RECLAMATION

*Managing Water in the West*

# Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project, New Mexico and Texas

## Final Environmental Impact Statement

**U.S. Department of the Interior**
**Bureau of Reclamation**
**Upper Colorado Region**
**Albuquerque Area Office, Albuquerque**

**September 30, 2016**

# MISSION STATEMENTS

**Protecting America's Great Outdoors and Powering Our Future**

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

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Cover photo – Elephant Butte Dam, Powerplant and Reservoir, New Mexico, (Kevin Doyle, EMPSi)

# Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project, New Mexico and Texas, Final Environmental Impact Statement

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|---|---|
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| Cooperating Agencies: | Federal:<br>U.S. Section, International Boundary and Water Commission<br>State:<br>Colorado Division of Water Resources<br>Elephant Butte Irrigation District of New Mexico<br>El Paso County Water Improvement District No.1<br>Texas Rio Grande Compact Commissioner |
| Abstract: | The proposed Federal action analyzed in this final environmental impact statement is to continue to implement the 2008 Operating Agreement for the Rio Grande Project and to implement long-term contracts for storage of San Juan-Chama Project water in Elephant Butte Reservoir. The Operating Agreement is a written agreement describing how Reclamation allocates, releases from storage, and delivers Rio Grande Project water to the Elephant Butte Irrigation District in New Mexico, the El Paso County Water Improvement District No. 1 in Texas, and to Mexico. |
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# Summary

The Bureau of Reclamation (Reclamation) has prepared this final environmental impact statement (FEIS) to analyze the environmental impacts of continuing to implement the Rio Grande Project Operating Agreement (OA) through 2050. The OA is a written agreement describing how Reclamation allocates, releases from storage, and delivers Rio Grande Project (RGP) water to diversion points (headings) of the Elephant Butte Irrigation District (EBID) in New Mexico, the El Paso County Water Improvement District No. 1 (EPCWID) in Texas, and the Republic of Mexico (herinafter Mexico). In addition, Reclamation will use this FEIS to evaluate the environmental effects of a proposal to renew a contract to store San Juan–Chama Project water in Elephant Butte Reservoir.

## Purpose and Need for Action

### Operating Agreement

The purpose for action is to meet contractual obligations to EBID and EPCWID and comply with applicable law governing water allocation, delivery, and accounting. These obligations are currently fulfilled under the 2008 OA (Appendix A). The need for action is to resolve the long and litigious history of the RGP and enter into mutually agreeable, operational criteria that comply with applicable law, court decrees, settlement agreements, and contracts. These include the 2008 Compromise and Settlement Agreement among Reclamation, EBID, and EPCWID and contracts between the U.S. and EBID and EPCWID.

### San Juan–Chama Project Storage

The purpose and need for a similar action is to respond to a request to renew a multiyear storage contract of San Juan–Chama Project water in Elephant Butte Reservoir in accordance with Public Laws 97-140 and 87-483.

## The Rio Grande Project and Geographic Scope

The study area for this FEIS is the RGP in southern New Mexico and far western Texas in the Rincon, Mesilla, and El Paso Valleys (Figure 1). The study area begins in the north with Elephant Butte Reservoir and extends southward and downstream along the Rio Grande to the El Paso-Hudspeth County line in Texas. The study area includes the service areas of the two irrigation districts and also includes deliveries to Mexico at the Acequia Madre at El Paso, Texas.

## Cooperating Agencies

Reclamation is the lead Federal agency in the preparation of this FEIS. Cooperating agencies include the U.S. Section of the International Boundary and Water Commission (USIBWC), the Colorado Division of Water Resources, EBID, EPCWID, and the Texas Rio Grande Compact Commissioner.

## Changes since the Draft EIS

Reclamation published a notice of availability of the draft EIS (DEIS) in the *Federal Register* (81 Fed. Reg. 14886) on March 18, 2016. Notice of the availability of the DEIS was published in newspapers, on Reclamation's internet web page, social media, and e-mail. Reclamation held two public hearings during the comment period to give the public an opportunity to learn more about the alternatives and impacts and to comment on the DEIS. After receiving multiple requests to extend the public comment period, the period was extended to June 8, 2016.

During this draft public comment period, Reclamation received 148 comments in 24 comment documents from Federal, state, and local agencies, and the public. Appendix E of this FEIS includes the comments received and responses. In assessing and considering these comments, Reclamation revised this FEIS. One of the comments pointed out an error in the hydrology model, so the FEIS includes some revised water resources data in Chapter 4 and Appendix C. Chapter 4 was reorganized by resource rather than by alternative to clarify the differences due to the alternatives versus climate change. Information for most resources was edited to better define and explain potential impacts, and cumulative actions and impacts were placed in a separate chapter. In response to comments, the No Action Alternative was changed from Alternative 1 to Alternative 5, as described below and in Chapter 2 and Appendix E. Alternative 1 has been selected as the agency's preferred alternative.

## Alternatives

The Council on Environmental Quality's (CEQ) regulations for implementing the National Environmental Policy Act (NEPA) require that all EISs include the alternative of no action. CEQ (1981; 46 Fed. Reg. 18026) says there are two distinct interpretations of no action. The first interpretation is "no change from current management direction" and is typically applied to management plans. CEQ explains that this interpretiation of no action involves continuing with the present course of action or management until the action is changed. The second interpretation of no action is where a proposed activity would not take place and the resulting environmental effects from taking no action would be compared with the effects of permitting the proposed activity or an alternative activity to go forward. This is typically applied to construction actions.

Following CEQ's first interpretation of no action, the DEIS identfied Alternative 1 as the No Action Alternative because it involves continuation of the OA and San Juan-Chama storage contracts. The DEIS considered four other alternatives that vary in inclusion or exclusion of the allocation and accounting procedures established by the OA, the diversion ratio adjustment and carryover accounting , and storing San Juan-Chama Project water in Elephant Butte Reservoir. In the DEIS and this FEIS, Alternative 5 is consistent with past management practices prior to the OA, but based on comments received on the DEIS (see Appendix E, "Alternatives, No Action Alternative"), for this FEIS, Reclamation relabeled Alternative 5 as the No Action Alternative, applying CEQ's second interpretation of no action.  The alternatives are summarized here and presented in detail in Chapter 2.

### Alternative 1: Continuation of OA and San Juan-Chama Storage Contract, Preferred Alternative

Alternative 1 is Reclamation's preferred alternative. Alternative 1 includes continued implementation through the year 2050 of the operating procedures defined in the OA and corresponding Rio Grande Project Water Operations and Accounting Manual (Operations

Manual). Under Alternative 1, RGP allocation and accounting procedures would continue to include the diversion ratio adjustment and carryover accounting established by the OA and Reclamation would renew a contract to store up to 50,000 acre-feet of San Juan–Chama Project water in Elephant Butte Reservoir.

### Alternative 2: No San Juan–Chama Project Storage

Alternative 2 is the same as Alternative 1 except that Reclamation would not store San Juan–Chama Project water in Elephant Butte Reservoir.

### Alternative 3: No Carryover Provision

Alternative 3 is the same as Alternative 1 except that carryover accounting established by the OA would be excluded from RGP allocation and accounting procedures.

### Alternative 4: No Diversion Ratio Adjustment

Alternative 4 is the same as Alternative 1 except that the diversion ratio adjustment established by the OA would be excluded from RGP allocation and accounting procedures.

### Alternative 5: Prior Operating Practices, No Action Alternative

Alternative 5 (No Action) would eliminate both carryover accounting and the diversion ratio adjustment from RGP allocation and accounting procedures.

### Selection of the Preferred Alternative

Based upon the analysis presented in this FEIS and after reviewing the comments and concerns of agencies, organizations and individuals (Appendix E), Reclamation's responsible official, the Regional Director of the Upper Colorado Region, selected Alternative 1 as the preferred alternative. At least 30 days after publishing a notice of availability of this FEIS, the Regional Director will sign a Record of Decision selecting an alternative and allowing implementation to proceed.

## Major Conclusions

Based on the analysis of impacts of these alternatives in Chapters 4 and 5, major conclusions of the FEIS are as follows:

- **EBID's Annual Allocated Water**. Alternatives 1 and 2 would provide an average of 213,110 acre-feet under the central tendency climatic scenario. Alternative 3 would provide an average of 264,752 acre-feet; Alternative 4 would provide 272,269 acre-feet. Alternative 5 (No Action) would provide 314,327 acre-feet to EBID.
- **EPCWID's Annual Allocated Water**. Alternatives 1 and 2 would provide an average of 224,049 acre-feet under the central tendency climatic scenario. Alternative 3 would provide an average of 267,973 acre-feet; Alternative 4 would provide 207,296 acre-feet. Alternative 5 (No Action) would provide 239,317 acre-feet to EPCWID.
- **Total Storage**. Alternative 1 would provide an average of 483,445 acre-feet of total storage under the central tendency climatic scenario. Alternative 2 would provide an average of 455,233 acre-feet; Alternative 3 would provide 493,743 acre-feet; Alternative 4 would provide 465,907 acre-feet; and Alternative 5 (No Action) would provide 483,425 acre-feet.
- **Elephant Butte Reservoir Elevation**. Under the central tendency climate scenario, the average Elephant Butte Reservoir elevations would be 4,326 to 4,327 feet under all alternatives except that Alternative 2 would average 4,319 feet due to not storing San Juan-Chama Project water. As shown in Section 4.3, the differences in elevation would be greater

(10 to 12 feet) due to the projected effects of future climate change than due to implementation of the alternatives.

- **Special Status Species**. Reclamation concluded that implementation of Alterantive 1 "may affect, and is likely to adversely affect" the Southwestern willow flycatcher (*Empidonax traillii extimus*) and Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*). A "may affect, and is likely to adversely modify**"** determination for flycatcher critical habitat and cuckoo proposed critical habitat is based on water resources modeling presented in Sections 4.13-4.14 that shows that reservoir filling would inundate this habitat. The U.S. Fish and Wildlife Service (Service) concurred with these findings in a biological opinion issued on May 25, 2016.
- **Regional Economic Impacts**. Under the central tendency climate scenario, the regional economic impacts in Doña Ana and Sierra Counties, New Mexico, where EBID is located, would decrease compared to Alternative 5 for all action alternatives. The regional economic impacts estimated for El Paso and Hudspeth Counties, Texas, where EPCWID is located, would increase for all action alternatives compared to Alternative 5. Changes (positive and negative) would be small compared to the entire regional economies of the New Mexico and Texas and there would be no high or disproportionate adverse impacts on environmental justice communities.

## Environmental Commitments

The EIS process will end with completion of a Record of Decision (ROD). The ROD shall explain the agency's decision and discuss plans for mitigating potential environmental effects and monitoring those commitments. Should Alternative 1 become the selected alternative, the following future commitments would be implemented.

- Under Alternative 1, Reclamation would continue to work with the USIBWC, EBID, and EPCWID to assess and determine the available supply, the release from storage, and delivery of RGP water.
- Under unforeseen or adverse conditions, Reclamation would continue to work with the USIBWC, EBID, and EPCWID under the parameters of the OA to resolve issues in an adaptive management framework.
- Reclamation has accepted the Service's biological opinion dated May 25, 2016 and would continue to monitor vegetation and listed species in coordination with the USIBWC.

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# Appendices

A. Operating Agreement
B. Operations Manual
C. Hydrology Technical Memorandum
D. Consultation and Coordination Correspondence
E. Comments-Responses

## Acronyms and Abbreviations

| Acronym | Full Phrase |
|---|---|
| ABCWUA | Albuquerque Bernalillo County Water Utility Authority |
| AFY | acre-feet per year |
| CEQ | Council on Environmental Quality |
| CFR | Code of Federal Regulations |
| CFS | cubic feet per second |
| Convention of 1906 | Convention between the United States and Mexico |
| CWA | Clean Water Act |
| DEIS | draft environmental impact statement |
| EA | environmental assessment |
| EBID | Elephant Butte Irrigation District |
| EIS | environmental impact statement |
| EPA | U.S. Environmental Protection Agency |
| EPCWID | El Paso County Water Improvement District Number 1 |
| ESA | Endangered Species Act |
| $ET_0$ | Evapotranspiration |
| FEIS | final environmental impact statement |
| Flycatcher | Southwestern willow flycatcher |
| Gwh | gigawatt-hour |
| HCCRD | Hudspeth County Conservation and Reclamation District No. 1 |
| IMPLAN | IMpact analysis for PLANning |
| ITA | Indian trust assets |
| MF-OWHM | MODFLOW (modular finite-difference flow model); One Water Hydrologic Model |
| M&I | Municipal and industrial water |
| NEPA | National Environmental Policy Act |
| NHPA | National Historic Preservation Act |
| NMDA | New Mexico Department of Agriculture |
| NMDGF | New Mexico Department of Game and Fish |
| NMED | New Mexico Environment Department |
| NMEMNRD | New Mexico Energy, Minerals, and Natural Resources Department |
| NMOSE | New Mexico Office of the State Engineer |
| NMRPTC | New Mexico Rare Plant Technical Council |
| NMSP | New Mexico State Parks |

| Acronym | Full Phrase |
|---|---|
| OA | Operating Agreement for the Rio Grande Project |
| Reclamation | United States Department of the Interior, Bureau of Reclamation |
| RGP | Rio Grande Project, New Mexico and Texas |
| RMBHM | Rincon and Mesilla Basin Hydrologic Model |
| SEA | supplemental environmental assessment |
| Service | United States Department of the Interior, Fish and Wildlife Service |
| TCEQ | Texas Commission on Environmental Quality |
| U.S. | United States |
| URGIA | Upper Rio Grande Impact Assessment |
| URGSim | Upper Rio Grande Simulation Model |
| URGWOM | Upper Rio Grande Water Operations Model |
| USC | United States Code |
| USDA | United States Department of Agriculture |
| USGS | United States Geological Survey |
| USIBWC | United States Section of the International Boundary and Water Commission |
| VIC | Variable Infiltration Capacity Hydrology Model |
| WWCRA | West Wide Climate Risk Assessment |

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# 1 Purpose of and Need for Action

## 1.1 Introduction

The Bureau of Reclamation (Reclamation) has prepared this FEIS to analyze the environmental effects of continuing to implement the OA for the RGP through the year 2050. The OA is a written agreement describing how Reclamation allocates, releases from storage, and delivers RGP water to two irrigation districts, the EBID and EPCWID, and to Mexico. In addition, Reclamation will use this FEIS to evaluate the environmental effects of a request to renew a multiyear contract for storing San Juan–Chama Project water in Elephant Butte Reservoir.

This FEIS has been prepared in compliance with NEPA, CEQ's NEPA implementing regulations (40 CFR 1500-1508), the U.S. Department of the Interior's NEPA regulations (43 CFR 46), and other relevant Federal and state laws, regulations, and policies.

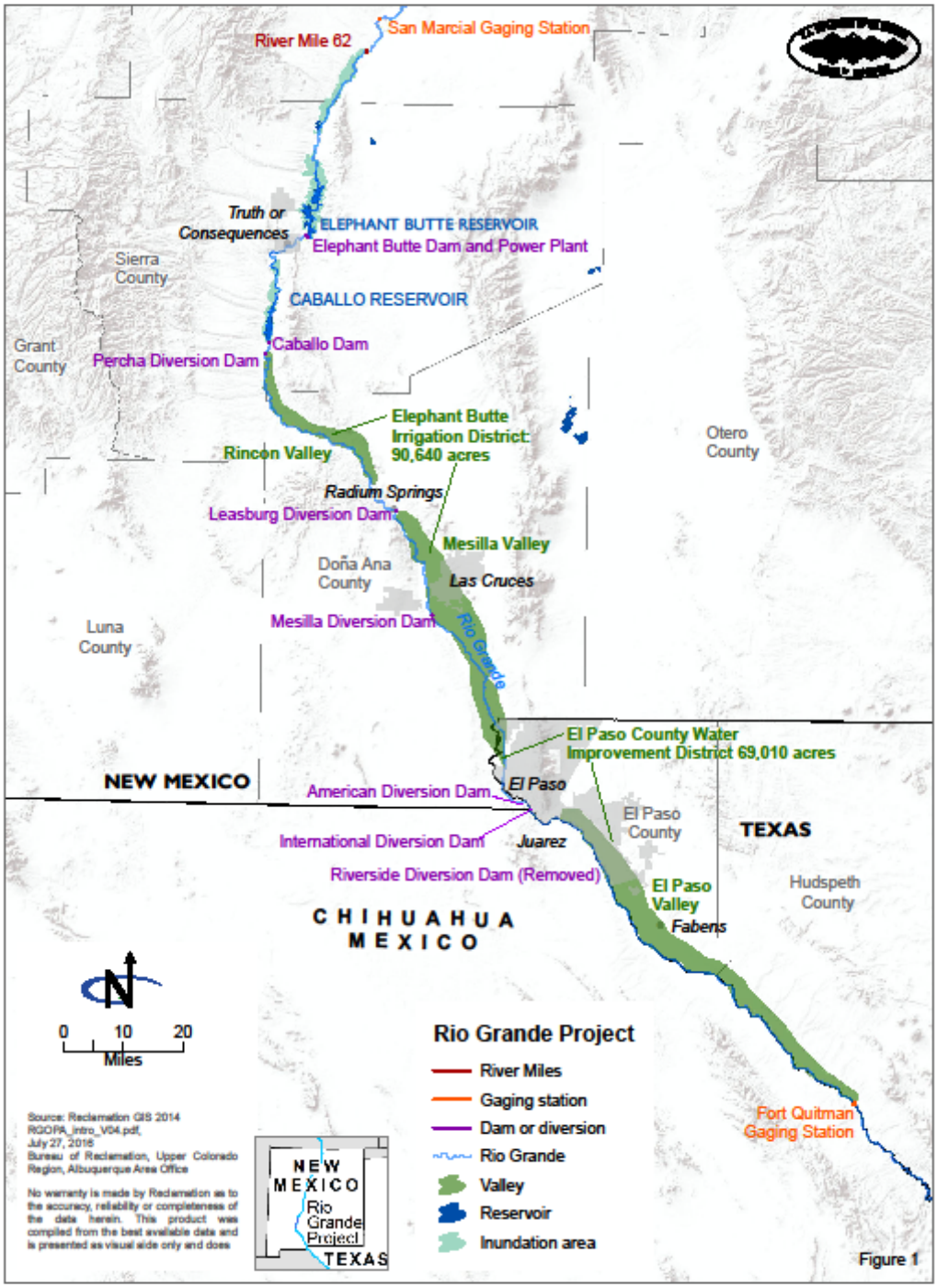
## 1.2 Rio Grande Project Operating Agreement

The OA is a written agreement describing how Reclamation allocates, releases from storage, and delivers RGP water to irrigation district diversion points (headings) of the EBID in New Mexico, EPCWID in Texas, and Mexico. The OA is Appendix A of this FEIS. It is described in Section 1.4.2.3 and in Chapter 2. The proposed action analyzed in this FEIS is continuing to implement the OA for the RGP for its remaining term, through 2050.

## 1.3 Rio Grande Project

The RGP is located in southern New Mexico and western Texas in the Rincon, Mesilla, and El Paso Valleys. Its facilities include the Elephant Butte and Caballo Dams and Reservoirs, a power generating plant, the Percha, Leasburg, Mesilla, American, and International Diversion Dams; 141 miles of canals, 462 miles of lateral ditches, and 457 miles of drains (Fig. 1). A sixth diversion dam, Riverside, was damaged by flood flows and was removed in 2003 to reduce flood hazards associated with further breaching.

Figure 1. Rio Grande Project in New Mexico and Texas.



Congress authorized the RGP under the authority of the Reclamation Act of 1902 and the Rio Grande Project Act of February 25, 1905, to serve lands in New Mexico and Texas. RGP water is made available to irrigate a variety of crops and for municipal and industrial (M&I) water uses. RGP water is also diverted to Mexico under the Convention between the United States and Mexico: Equitable Distribution of the Waters of the Rio Grande (Convention of 1906).

In 1907, Congress appropriated $1,000,000 to pay for the portion of the RGP necessary to provide storage of water for fulfillment of the Convention of 1906. As for funding the rest of the RGP, under the Reclamation Act of 1902, Congress intended that water projects would be self-supporting: each would generate sufficient revenue to cover the costs of construction, operation and maintenance, and the total estimated costs would be equitably borne by project beneficiaries. Therefore, EBID and EPCWID were required to enter into contracts with Reclamation under which they would cover these costs. The Reclamation Act of 1902 further states that the right to use RGP water "shall be appurtenant to the land irrigated and beneficial use shall be the basis, the measure, and the limit of the right" (32 Stat. 390; 43 USC Sections 372 and 383). The contracts among Reclamation, EBID and EPCWID establish the allocation of water between the two districts based on the irrigable acreage within each district.

A history of the RGP may be found in the *Rio Grande Project* (Autobee 1994) and Appendix C of Reclamation (2013a).

## 1.4 Background

### 1.4.1 Operations Overview

The RGP provides surface water for irrigation in southern New Mexico and for irrigation and M&I use in western Texas. It also provides for the delivery of surface water to Mexico under the Convention of 1906. The RGP also provides hydropower generation as a secondary function. Operation of the RGP involves four primary functions:

- Capture and storage of Rio Grande streamflow in Elephant Butte and Caballo Reservoirs
- Allocation of RGP water to EBID, EPCWID, and Mexico
- Release of RGP water to satisfy delivery orders from EBID, EPCWID, and the USIBWC on behalf of Mexico
- Diversion of RGP water from the Rio Grande and delivery of RGP water to headings and municipal water treatment facilities for beneficial use

The Rio Grande Compact contains a schedule for water that must be delivered to Elephant Butte Reservoir every year. In addition, Reclamation allows storage of San Juan–Chama Project water in Elephant Butte Reservoir currently under annual contracts with the Albuquerque-Bernalillo County Water Utility Authority (ABCWUA).

#### *1.4.1.1 Surface Water Supply*

At the beginning of the calendar year and prior to the onset of the irrigation season, Reclamation determines the total water in RGP storage. Total storage includes Rio Grande Compact deliveries, which are comprised of any accumulated inflows, less evaporative losses in Elephant Butte and Caballo Reservoirs. Reclamation then calculates the total usable RGP water by subtracting all non-RGP storage, including San Juan–Chama Project water and Rio Grande Compact credit water, from the total water in storage.

In years when the total usable RGP water at the beginning of the calendar year is not sufficient to provide a full allocation, Reclamation reevaluates RGP storage each month during the irrigation season until a final allocation is reached.

#### *1.4.1.2 Allocation of Rio Grande Project Water*

Reclamation allocates RGP water supplies such that the diversion allocations to EBID and EPCWID are proportionate to each district's respective acreages. EBID includes 90,640 acres authorized to receive RGP water in the Rincon and Mesilla Valleys of New Mexico. EPCWID includes 69,010 acres authorized to receive RGP water in the Mesilla and El Paso Valleys of Texas. Of the 159,650 acres, 57 percent of the acreage is in EBID and 43 percent is in EPCWID.

The annual diversion allocation is the quantity of RGP water that is allocated each year for delivery to EBID, EPCWID, and Mexico at their respective diversion headings. The annual diversion allocation is calculated based on the amount of RGP water in storage available for release and the estimated amount of water available for diversion at river headings accounting for canal bypass, drainage return flows, and other inflows or losses to the Rio Grande between Caballo Dam and International Dam.

In addition to their allocations of surface water from the RGP, irrigators within EBID and EPCWID have historically relied on groundwater pumping for supplemental irrigation. It is recognized that groundwater pumping in the Rincon and Mesilla Valleys depletes RGP surface water supplies by increasing seepage losses from the Rio Grande and decreasing groundwater discharge to the Rio Grande and to the network of drains that extends throughout the RGP. The magnitude of surface water depletions due to groundwater pumping is currently being studied. While groundwater is used for supplemental irrigation in both EBID and EPCWID, estimates of pumping for irrigation within EBID are an order of magnitude larger than corresponding estimates for EPCWID.

To determine how to provide each district with its annual diversion allocation, EBID and EPCWID do most of the water monitoring in the river and of water coming into the river from drains and other sources. These data are shared between parties and are used to schedule RGP orders, releases, and deliveries. Reclamation then executes the releases determined by the districts. Under the Convention of 1906, the U.S. is obligated to deliver 60,000 acre-feet of water annually in a full allocation year. In drought years when the full allocation is not available, the allocation to Mexico is reduced in the same proportion as water delivered to the districts.

#### *1.4.1.3 Release and Diversion of Rio Grande Project Water*

Reclamation delivers water to each district's diversion headings based on their water orders. Each district then distributes water through its conveyance system to its water users for irrigation or M&I use. The two districts use RGP water to irrigate a variety of crops, including lettuce, chilies, onions, cotton, sorghum, and pecans. Through contracts with EPCWID, El Paso Water[1] also receives RGP water. These contracts allow irrigation water to be converted to M&I uses. El Paso Water owns or leases farmland with first class water rights by which it is able to convert the associated irrigation water to M&I uses (Texas Water Development Board 2016).

Drainage and tailwater from RGP lands at the terminus of the RGP (the El Paso-Hudspeth County line) provides supplemental water to 18,000 acres in the Hudspeth County Conservation and

[1] El Paso Water is the new official name for what used to known as El Paso Water Utilities. See http://www.epwu.org/public_information/news_releases/nr_160630-01.html. They are a utility that delivers water to residents of the City of El Paso.

Reclamation District No. 1 (HCCRD) in Texas. Because HCCRD only receives seepage and drainage water through a contract with Reclamation by way of the EPCWID irrigation system and does not receive a direct allocation of RGP water, deliveries to HCCRD do not affect primary RGP operations.

The USIBWC carries out and schedules the deliveries at the request of Mexico. RGP water allocated to Mexico under the Convention of 1906 is officially delivered in the bed of the Rio Grande at the point adjacent to the head works of the Acequia Madre in Ciudad Juárez, about two miles downstream of the point where the river becomes the international border.

### 1.4.2 Historic Operations

#### *1.4.2.1 Project Initiation to 1979-1980*

From 1908 through 1979, Reclamation operated the RGP. Reclamation determined the annual allotment of RGP water per acre of authorized land and delivered the annual allotment to farm headgates and to the Acequia Madre for Mexico.

In 1937, Congress authorized the execution of amended repayment contracts with EBID and EPCWID. These contracts reduced the repayment obligations and established a corresponding right of use to a proportion of the annual water supply, based on an established irrigated acreage in each district: 57 percent to EBID and 43 percent to EPCWID, as explained in Section 1.4.1.2.

The districts' amended repayment contracts also required three changes to occur to historical operations. First, once the two districts paid the total reimbursable costs for the RGP, they were required to take over the day-to-day responsibility for operating and maintaining the irrigation delivery and drainage system. Second, once this transfer of operation and maintenance occurred, Reclamation and the two districts agreed to formalize a set of operating procedures that would govern the operations of transferred project works. Third, on transfer, Reclamation would no longer calculate, allocate, and deliver water to project land; instead, it would deliver an annual diversion allocation to each district's headings.

In 1979-1980, the two districts paid off their construction obligations to the U.S. In 1979, Reclamation contracted with EBID to assume responsibility for operating and maintaining the Percha, Leasburg, and Mesilla Diversion Dams in New Mexico. In 1980, Reclamation contracted with EPCWID to transfer operation and maintenance for the Riverside Diversion Dam (removed in 2003) and the distribution and downstream drainage system in Texas, which delivers tailwater to the HCCRD. Both contracts required Reclamation and the districts to create a mutually agreeable, "detailed operational plan…setting forth procedures for water delivery and accounting."

#### *1.4.2.2 Operations from 1980 to 2007*

Beginning in 1980, Reclamation determined annual diversion allocations to each district and delivered water to the authorized points of diversion. The districts were then responsible for conveying water from the point of diversion to individual farm gates. Until a mutually agreeable operations plan was in place, Reclamation imposed ad hoc operating procedures to govern operations. It modified these procedures as needed between 1980 and 2007. During that time, Reclamation calculated, allocated, and delivered each district's annual diversion allocation; however, it modified and optimized the methods, equations, and procedures according to real-time water conditions. The lack of an operations plan led to conflicts and litigation during this period.

#### *1.4.2.3 Operations from 2008 to Present*

In 2008, EBID, EPCWID, and Reclamation agreed to execute and implement the OA as a settlement of the litigation then pending and filed by both districts. The three parties are the signatories of the OA. The term of the resulting 2008 OA is from January 1, 2008, until December 31, 2050 (Appendix A).

As a part of the OA, the three parties prepared the RGP Water Accounting and Operations Manual (Reclamation 2012d) that contains more detailed information regarding the methods, equations, and procedures used to implement the OA. The Operations Manual is an addendum to the OA and is found in Appendix B. It is consistent with the OA and does not modify the provisions in the OA. The parties to OA consult with each other to review the Operations Manual. The most recent revision was in 2012.

##### 1.4.2.3.1 The OA, Operations Manual, and Diversion Ratio

The OA largely reflects historical operation of the RGP, with two key changes. First, the OA provides carryover accounting for any unused portion of the annual diversion allocations to EBID and EPCWID. Under historical operations prior to the OA, the unused portion of a district's annual allocation balance contributed to the total amount of usable water available for allocation to both districts during the following year. As a result, a portion of one district's unused allocation became part of the other district's annual allocation the following year. Under the OA, any unused portion of the annual diversion allocations to EBID and EPCWID, based on a regression line reflecting past delivery performance, referred to as the D-2 Curve, is carried over to that district's allocation balance the following year. The carryover provision of the OA is designed to encourage water conservation in the RGP by allowing each district to retain its unused allocation up to a specified limit.

Second, the OA adjusts the annual allocations to EBID and EPCWID to account for changes in RGP performance[2], as characterized by the diversion ratio. The diversion ratio is calculated as the sum of net allocation charges (i.e., sum of allocation charges minus allocation credits) to EBID, EPCWID, and Mexico divided by the total (cumulative) Project release from Caballo Dam over a specified period. The diversion ratio provision of the OA was developed to adjust the annual RGP allocations to the districts so as to provide RGP deliveries to EPCWID consistent with historical operations, prior to substantial increases in groundwater pumping within EBID and corresponding decreases in RGP performance. The annual RGP allocation to EBID is then adjusted to reflect current-year RGP performance as represented by the diversion ratio. When the diversion ratio is high, greater than one (>1.0), EBID generally receives an increase in allocation compared to historical RGP operations. When the diversion ratio is low, less than one (<1.0), EBID generally receives a decrease in RGP allocation compared to historical RGP operations.

While numerous factors affect RGP performance, recent changes in performance are predominantly driven by the actions of individual landowners within the EBID service area. These changes are:

- Crop selection and related effects on crop irrigation requirement
- Irrigation practices and related effects on farm irrigation efficiency

[2] By "performance", we mean historical performance of the RGP. While this may not have been called "diversion ratio" in the past, historically Reclamation calculated the amount of water that was delivered to lands in relation to the amount that was released from storage to determine if there was enough water to increase the allocation to lands and Mexico.

- Widespread use of groundwater for supplemental irrigation, as permitted and regulated by the State of New Mexico

The diversion ratio provision of the OA ensures that annual allocations and deliveries to EPCWID are consistent with historical performance. Moreover, it ensures that deviations in performance relative to historical conditions would be accounted for by adjusting the annual allocation to EBID.

Under the diversion ratio provision, the annual project allocation to EPCWID is equal to the district's historical diversion allocation, based on a regression line reflecting past delivery performance, as defined by the D-2 Curve (Appendix A, Section 2.5). The annual allocation to EBID is adjusted to reflect current year (actual) project performance, as reflected by the project diversion ratio. Again, when the diversion ratio is high relative to the baseline delivery performance defined by the D-2 Curve, EBID generally receives an increase in annual allocation compared to its diversion allocation under prior operating practices. When the diversion ratio is low relative to the D-2 Curve baseline, EBID generally receives a decrease in project allocation compared to prior operating practices.

#### 1.4.2.3.2 Principles Underlying the Operating Agreement

The provisions adopted in the OA for the RGP reflect Reclamation and the two districts' interest in equitable distribution of RGP water. These include Rio Grande surface waters and hydraulically connected groundwater in New Mexico and the portion of the Mesilla Valley in Texas. Implementing the OA fulfills contractual obligations among Reclamation and the two irrigation districts and resolves litigation in compliance with the legal settlement (Reclamation 2013a).

<u>Surface Water/Groundwater Interaction</u>

The interaction between the surface water and groundwater is a critical factor in understanding the OA. Previous studies (Conover 1954, Hanson et al. 2013, Haywood and Yager 2003, S.S. Papadopoulos & Associates, Inc. 2007 [henceforth SSPA 2007], Stringham et al. 2016) indicate a strong hydraulic connection between the Rio Grande and underlying groundwater aquifers in the areas served by the RGP, particularly in the Rincon and Mesilla Basins. Groundwater recharge via seepage and deep percolation of RGP water would continue under any alternative. In years when there is an increase in RGP allocation and delivery to EBID, there is a corresponding increase in recharge via seepage and deep percolation within EBID, as well as a decrease in demand for supplemental irrigation by groundwater pumping within EBID. Conversely, when there is a decrease in allocation, recharge and deep percolation decrease, demand for supplemental irrigation water increases, which may result in increased groundwater pumping within the district under permits issued by the State of New Mexico (Reclamation 2013a).

When groundwater elevations adjacent to the Rio Grande or a given drain segment are above the surface water elevation in the channel, the hydraulic gradient drives groundwater flows toward the channel (Fig. 2a). In this situation, groundwater discharge to the channel increases the available surface water supply. When groundwater elevations adjacent to the Rio Grande or a given drain segment are below the water elevation in the channel, the hydraulic gradient drives groundwater flow away from the river (Fig. 2b). In this situation, seepage from the channel into the underlying aquifer decreases the available surface water supply. In the event that groundwater elevations adjacent to a given channel segment fall substantially below the channel elevation, the channel may become hydraulically disconnected from the underlying aquifer (Fig. 2c). In this situation, seepage from the channel reaches a maximum rate and is no longer affected by fluctuations in groundwater elevation (Winter et al. 1998).

While numerous factors affect groundwater in the Rincon and Mesilla Valleys, groundwater pumping for supplemental irrigation is a primary driver of groundwater declines. In addition, irrigators within both the New Mexico and Texas portions of the RGP often supplement RGP surface water deliveries with groundwater from privately owned wells. Supplemental groundwater pumping is authorized and managed by the states, independently of the RGP and is currently the subject of litigation.

## D-1 and D-2 Curves

The RGP serves irrigated lands in the Rincon, Mesilla and El Paso Valleys, as well as providing water to the City of El Paso for M&I uses. EBID provides water to 90,640 acres in the Rincon and Mesilla Valleys of New Mexico. EPCWID provides water to 69,010 acres in the Mesilla and El Paso Valleys of Texas (Fig. 1). Groundwater pumping in the El Paso Valley portion of EPCWID does not affect RGP deliveries (Reclamation 2015c). This is because the effects of pumping occur downstream of RGP diversion points for the El Paso Valley portion of EPCWID.

The OA represents mutually agreeable procedures for water delivery and accounting by Reclamation to satisfy objections by both districts in how deliveries were provided starting in 1980. The D-1 and D-2 Curves used by Reclamation to determine annual RGP allocations represent the effects of inflows and losses within the RGP on historical RGP performance.

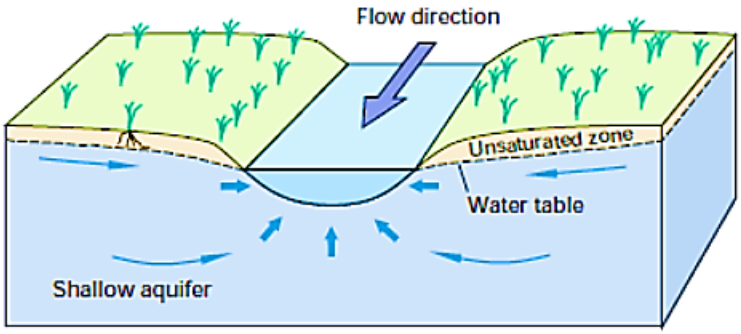
The D-1 and D-2 Curves were developed from operations data from 1951 to 1978. They reflect historical project performance during those years, including the effects of losses and inflows on project deliveries. The climatic and hydraulic conditions during these years ranged from low-flow drought conditions to high-flow full water supply. The D-1 Curve, used for making the allocation to Mexico, is a linear regression equation that represents the historical relationship between the total annual release from RGP storage and the total project delivery to lands within the U.S., plus delivery in the bed of the river at the point adjacent to the head works of the Acequia Madre. The D-2 Curve, used for making the water allocation to the districts, is a linear regression equation that represents the historical relationship between the total annual release from project storage and the total project delivery to canal headings on the Rio Grande. It includes delivery to all authorized points of diversion for EBID, EPCWID, and Mexico.

## Adaptive Management

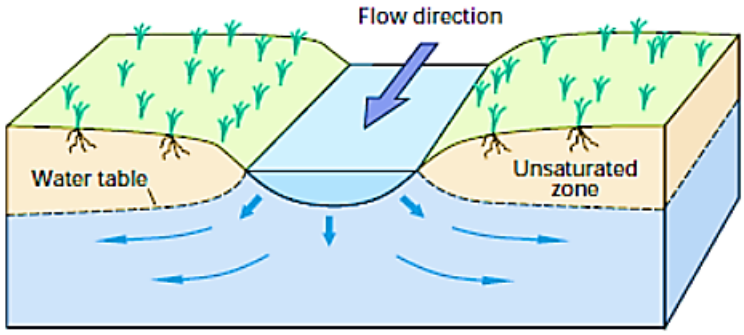
The OA and Operations Manual are intended to establish the overarching approach for management of the RGP, but it is recognized that they do not cover every possible contingency and may require adjustment. Under the principle of adaptive management (Holling 1978, Walters 1986), when unforeseen conditions or events occur in the future, the parties to the OA, consisting of Reclamation, EBID, and EPCWID, would consult and use their professional judgement and experience to adaptively manage the operations of the project.

Figure 2. Surface water and groundwater interaction; a gaining stream; b losing stream; c disconnected stream.

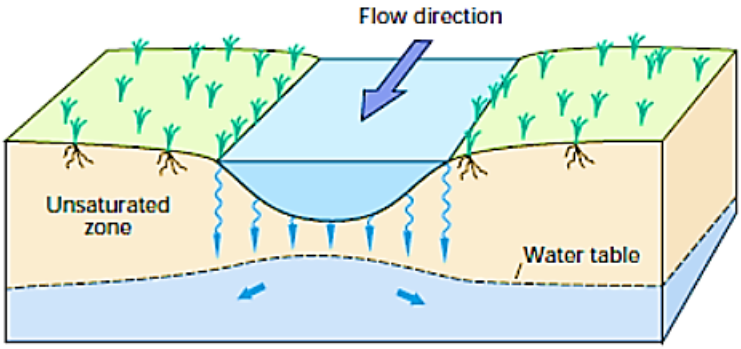
a. Gaining stream




b. Losing stream




c. Disconnected stream




Source: Winter et al. (1998).

### 1.4.3 San Juan-Chama Storage Contract

This FEIS evaluates the environmental effects of renewing multiyear contracts for storing San Juan–Chama Project water in Elephant Butte Reservoir, under the authority of Public Law 97-140 (95 Stat. 1718). The San Juan–Chama Project was authorized as a participating project of the Colorado River Storage Project Act in 1956. It consists of a system of diversion structures, trans-basin tunnels, and a storage reservoir to transfer water from the San Juan River in the Colorado River Basin to the Rio Chama in the Rio Grande Basin. San Juan–Chama Project repayment contractors receive their annual water allocations with no provisions for carryover; therefore, these contractors may benefit by storing unused annual allocations in Elephant Butte Reservoir for future use.

## 1.5 NEPA Analyses History

### 1.5.1 Operating Agreement

Two NEPA documents were prepared for the OA before this FEIS. In 2007, Reclamation prepared an environmental assessment (EA) to evaluate the effects of the OA through 2012. This EA committed Reclamation to gather data over the first five years of implementation to evaluate effects on the environment (Reclamation 2007).

In 2013, Reclamation supplemented the 2007 EA (SEA). This SEA was initially intended to analyze the potential impacts of implementing the OA through 2050. However, given the uncertainties of persisting drought and the need to improve analytical tools, Reclamation determined that analysis of a longer period would have been of limited use (Reclamation 2013a, b). In 2013, Reclamation began developing and refining modeling tools to thoroughly analyze the effects of implementing the OA through 2050, as documented in this FEIS.

### 1.5.2 San Juan–Chama Storage Contract

In 2010, Reclamation prepared an EA for a 40-year contract for storing ABCWUA's San Juan–Chama Project water in Elephant Butte Reservoir. The long-term contract was never implemented because information became available that rendered the associated Finding of No Significant Impact obsolete. Since 2010, Reclamation has been executing an annual contract with ABCWUA to store up to 50,000 acre-feet of San Juan–Chama Project water in Elephant Butte Reservoir, covered by categorical exclusions. Once stored, San Juan–Chama Project water is not included in the total RGP storage for purposes of allocations, but is maintained as a separate pool until exchanged upstream. The ABCWUA has proposed extending the contract to store San Juan-Chama Project water in Elephant Butte Reservoir through 2050.

## 1.6 Proposed Action

Reclamation is proposing to continue implementing the 2008 OA for the RGP for its remaining term, through 2050. In addition, it is proposing a similar action (as defined at 40 CFR 1508.25(a)(3)) of implementing long-term contracts for storing San Juan–Chama Project water in Elephant Butte Reservoir. The proposed action and alternatives are described in Chapter 2.

## 1.7 Purpose and Need for Action

### 1.7.1 Operating Agreement

The purpose for action is to meet contractual obligations to EBID and EPCWID and comply with applicable law governing RGP water allocation, delivery, and accounting. The purpose is also to provide a method to mitigate for the effects on the RGP of groundwater interaction in the Rincon and Mesilla Valleys. The need for action is to resolve the long and litigious history of the RGP by having mutually agreeable, detailed operational criteria.

### 1.7.2 San Juan–Chama Project Storage

The purpose and need for a similar action is to respond to a request to renew a multiyear storage contract of San Juan–Chama Project water in Elephant Butte Reservoir in accordance with the Act of December 29, 1981, Public Law 97-140. A similar action is defined by CEQ's regulations (40 CFR 1508.25(a)(3)) as actions that, when viewed with a proposal, have similarities such as common timing or geography that provide a basis for evaluation together. The analysis of a long-term contract for storing San Juan–Chama Project water in Elephant Butte Reservoir is a potentially similar action sharing common timing and geography with the OA. It is considered along with the proposed action of continuing to implement the 2008 OA.

## 1.8 Compliance with Other Authorities

In addition to meeting the requirements of NEPA, this FEIS documents compliance with other environmental laws and policies such as:

- Endangered Species Act (ESA)
- National Historic Preservation Act (NHPA)
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations
- Executive Order 13007, Indian Sacred Sites
- Executive Order 13112, Invasive Species
- Executive Order 13175, Tribal Consultation

## 1.9 Public Scoping

Public scoping began with publication of a notice of intent to prepare an EIS in the *Federal Register* (79 FR 2691) on January 15, 2014. The public was notified of the start of the NEPA review and scoping by:

- Placing newspaper advertisements in the *Santa Fe New Mexican* on January 27 and 28, 2014, the *Albuquerque Journal* on January 26, 2014, the *Las Cruces Sun News* on January 26, 2014, and the *El Paso Times* on January 26, 2014
- Announcing the public scoping meetings via Reclamation's social media sites and the project website (http://www.usbr.gov/uc/albuq/rm/RGP/)

Scoping meetings were held on both weekday and weekend dates and during both daytime and evening. Reclamation held three public scoping meetings at each of the following locations:

- Thursday, January 30, 2014, 3:00 p.m. to 5:00 p.m.—Reclamation, Albuquerque Area Office, 555 Broadway NE, Suite 100, Albuquerque, New Mexico
- Friday, January 31, 2014, 6:00 p.m. to 8:00 p.m.—Elephant Butte Irrigation District, 530 South Melendres Street, Las Cruces, New Mexico
- Saturday, February 1, 2014, 9:00 a.m. to 11:00 a.m.—Reclamation, El Paso Field Division, 10737 Gateway West, Suite 350, El Paso, Texas

Reclamation staff conducted the meetings, prepared the handouts, and answered questions. Persons attending the Albuquerque and Las Cruces meetings were primarily representatives of government agencies, but only Reclamation staff attended the meeting in El Paso. (Therefore, a hearing on the DEIS was not held in El Paso.)

Two comment letters were received during the scoping process, one from the New Mexico Interstate Stream Commission and the other from the City of Las Cruces. More information on the scoping process, including comments received, may be found in the NEPA Scoping Summary Report (Reclamation 2014c), which is also available on the project website (http://www.usbr.gov/uc/albuq/rm/RGP/). Reclamation took these comments into consideration in preparing this FEIS. In addition, comments received on the DEIS were considered in finalizing the FEIS.

## 1.10 Key Issues

Key issues or resources relevant to the analysis were identified based on the SEA (Reclamation 2013a), public comments and concerns raised during scoping, from internal scoping, and outreach to Federal, state, and local agencies and tribal governments; and legal, regulatory or policy requirements. The following issues or resources are analyzed in detail in this FEIS.

- Water Resources: total storage, Elephant Butte Reservoir elevations, allocation, releases, net diversion, farm surface water deliveries, farm groundwater deliveries, groundwater elevations, water quality
- Biological Resources: vegetation communities including wetlands, wildlife, aquatic species, and special status species and critical habitat
- Cultural Resources: historic properties, Indian sacred sites, and resources of tribal concern
- Socioeconomic Resources: Indian trust assets, recreation, hydropower, regional economic impacts and economic benefits, and environmental justice.

# 2 Alternatives

This chapter describes five alternatives analyzed in detail in this FEIS. This chapter also explains the criteria for selecting the preferred alternative and discusses alternatives that were considered, but not analyzed in detail.

## 2.1 Alternatives Development Process

Formulation of alternatives began in the fall of 2014 and continued through early 2015. Reclamation received suggestions for alternatives during scoping and these were considered during the alternatives development process. Additional alternatives were proposed during the public comment period for the FEIS in 2016.

A key step in the alternatives development process was a workshop held on November 4, 2014, at Reclamation's office in El Paso, Texas. Reclamation staff, contractors, and representatives of the cooperating agencies at that time: EBID, EPCWID, USIBWC, the City of Santa Fe, and the Rio Grande Compact Commission's Texas Commissioner—participated in the workshop in person or remotely. Workshop participants reviewed and discussed the purpose and need statement to assess where there was discretion for considering alternatives to current practices. The workshop included facilitated discussions of the alternatives. It also clarified the difference between annual implementation of the Operations Manual and the overall water supply allocation process described in the OA.

Reclamation reviewed the output of the screening exercise and outlined the elements of the alternatives to be carried forward for further review. Reclamation determined that the carryover provision and the diversion ratio adjustment were the basis of the settlement agreement and represented variables or elements for creating a reasonable range of alternatives. Reclamation also determined that due to similar geography and timing, the environmental effects of storing San Juan–Chama Project water in Elephant Butte Reservoir should be analyzed in the EIS.

## 2.2 Description of Alternatives

The alternatives were derived from the methods, equations, and procedures that Reclamation, EBID, and EPCWID use in determining the annual diversion allocation and water accounting for the RGP. As shown in Table 2-1, the alternatives vary in inclusion of the diversion ratio adjustment, carryover accounting, and the San Juan-Chama storage contract.

### 2.2.1 Operational Elements Common to All Alternatives

Some elements of project operations are common to all alternatives and would not vary. Reclamation would continue to store, allocate, release, and deliver RGP water for authorized uses in the U.S. and for delivery to Mexico under all alternatives. Reclamation would continue to determine annual allocations based on the usable water in RGP storage available for release during the current year. This includes usable water in storage at the start of the year. Added to this is any usable water that becomes available during the year as inflow to RGP storage or as relinquishment of Rio Grande Compact credit waters.

Under all alternatives, annual diversion allocations to EBID, EPCWID, and Mexico would continue to be based on two linear regression relationships between RGP releases and RGP deliveries, referred to as the D-1 and D-2 Curves, as described in Section 1.4.2.3.2 of Chapter 1. Reclamation and the USIBWC developed the D-1 Curve in 1980 to calculate the annual allocation to Mexico when less than a full supply is available. In accordance with the Convention of 1906, the annual RGP allocation to Mexico is 60,000 acre feet per year (AFY), except in years of extraordinary drought or serious accident to the U.S. irrigation system. The water for Mexico is officially delivered in the bed of the Rio Grande at the point adjacent to the head works of the Acequia Madre, in cooperation with the USIBWC.

The D-2 Curve represents the total (gross) amount of water available for diversion from the Rio Grande by EBID, EPCWID, and Mexico during the year under historical RGP performance conditions. The amount of water available for diversion in the U.S. by EBID and EPCWID would be determined by subtracting the annual allocation to Mexico from the total volume of water available for diversion during the year, as calculated by the D-2 Curve. EBID would then be allocated 88/155$^{ths}$ (57 percent) of the volume of water available for diversion and EPCWID would be allocated 67/155$^{ths}$ (43 percent).

The annual diversion allocations to EBID, EPCWID, and Mexico would continue to be based on the D-1 and D-2 Curves. RGP releases would continue to be scheduled and managed to meet delivery orders submitted by EBID, EPCWID, and USIBWC on behalf of Mexico.

### 2.2.2 Alternatives

Five alternatives are carried through detailed analysis in this FEIS. Table 0-1 highlights the differences among alternatives.

#### *Alternative 1—Continuation of OA and San Juan-Chama Storage Contract, Preferred Alternative*

- Continue to implement the diversion ratio adjustment provision of the OA in computing annual diversion allocations
- Continue to implement the carryover accounting provisions of the OA, which allows carryover of unused allotment balance from one year to the next
- Continue to store up to 50,000 acre-feet of San Juan–Chama Project water in Elephant Butte Reservoir

Alternative 1 is the continued implementation through 2050 of the operating procedures defined in the OA and Operations Manual, as amended for any given year. Under these operating procedures, the carryover accounting and diversion ratio provisions would continue. Reclamation would continue to implement a contract through 2050 with the ABCWUA to store up to 50,000 acre-feet of San Juan–Chama Project water in Elephant Butte Reservoir. Details of data, inputs, and calculations used in the allocation procedure are described in Table 4 of the OA (Appendix A). Additional details on allocation calculations are provided in the Operations Manual (Appendix B).

Under the OA, representatives of EBID, EPCWID, and Reclamation consult to establish the monthly and final water allocations for the year for each district and Mexico and review the Operations Manual. The manual was last updated in 2012 to clarify calculations used in the allocation procedure and to optimize operations (Reclamation 2012e).

### *Alternative 2—No San Juan–Chama Project Storage*

- Continue to implement the diversion ratio adjustment provision of the OA in computing annual diversion allocations
- Continue to implement the carryover accounting provisions of the OA, which allows carryover of unused allotment balance from one year to the next
- Do not store any San Juan–Chama Project water in Elephant Butte Reservoir

Alternative 2 is the same as Alternative 1, except Reclamation would not continue with contracts to store San Juan–Chama Project water in Elephant Butte Reservoir. Alternative 2 allows Reclamation to model and determine the effects of storing San Juan-Chama Project water in the RGP.

### *Alternative 3—No Carryover Provision*

- Continue to implement the diversion ratio adjustment provision of the OA in computing annual diversion allocations
- Do not implement the carryover accounting provisions of the OA
- Eliminate the carryover allocations and relinquish the unused allotment balance at the end of each calendar year
- Continue to store up to 50,000 acre-feet of San Juan–Chama Project water in Elephant Butte Reservoir

Alternative 3 is the same as Alternative 1, except Reclamation would not implement the carryover accounting provisions of the OA. Alternative 3 allows Reclamation to model and determine the effects of the carryover provision.

### *Alternative 4—No Diversion Ratio Adjustment*

- Do not implement the diversion ratio adjustment provision of the OA
- Compute annual diversion allocations based only on the D-1 and D-2 regression equations without adjusting for variations in RGP performance
- Continue to implement the carryover accounting provisions of the OA, which allows carryover of unused allotment balance from one year to the next
- Continue to store up to 50,000 acre-feet of San Juan–Chama Project water in Elephant Butte Reservoir

Alternative 4 is the same as Alternative 1, except Reclamation would not implement the diversion ratio adjustment provision of the OA. Alternative 4 allows Reclamation to model and determine the effects of the diversion ratio adjustment provision.

### *Alternative 5—Prior Operating Practices, No Action Alternative*

- Do not implement the diversion ratio adjustment provision of the OA
- Compute annual diversion allocations based only on D-1 and D-2 Curves regression equations that reflect historical conditions
- Do not implement the carryover accounting provisions of the OA
- Eliminate the provision for carryover allocations for each district
- Continue to store up to 50,000 acre-feet of San Juan–Chama Project water in Elephant Butte Reservoir

For this FEIS, Alternative 5 is the No Action Alternative. It allows a comparison through 2050 of operations under the OA and a simulation of procedures prior to the OA which did not apply the carryover allocation accounting for each district and diversion ratio adjustment provisions in the calculation of the allocation to EBID. Alternative 5 is the best possible representation of prior operating practices in a modeling context and is based on strict application of the D-1 and D-2 Curves.

Table 2-1 Key elements of alternatives

| Alternative | Continue Diversion Ratio Adjustment | Continue Carryover Accounting | Continue Storage of San Juan–Chama Project Water |
|---|---|---|---|
| 1 | ● | ● | ● |
| 2 | ● | ● | |
| 3 | ● | | ● |
| 4 | | ● | ● |
| 5 | | | ● |

Because they are not part of the OA, the alternatives do not include the following:

- Changes to the dams, storage facilities, the power generating plant, diversion facilities, and delivery points
- Negate obligations under the Convention of 1906 and the Rio Grande Compact or compliance with various court decrees, settlement agreements, and contracts
- Construction of new facilities or other actions that are physically different from or that exceed the bounds of historic operations within the RGP
- Changes to the basic operation of the dams and other RGP facilities
- Changes to the channel capacity

The alternatives analyzed in this FEIS vary in including or excluding the carryover provision, diversion ratio adjustment, and the San Juan-Chama storage contract. The range of alternatives is designed to determine whether these elements would result in environmental impacts when simulated using a hydrology model described in Section 4.1 of Chapter 4.

Continuing to implement the OA is part of the settlement of litigation between Reclamation and the two districts. Since 1979 and 1980, Reclamation, EBID, and EPCWID have had contractual obligations resulting from the transfer of the irrigation and drainage facilities from Reclamation to each district to agree on a detailed operational plan, setting forth procedures for allocation, delivery, and accounting of RGP water. This need was finally satisfied in 2008 when the three parties entered into the 2008 settlement agreement, which required implementing the OA and the Operations Manual (Reclamation 2014c). Alternative 1 represents the operational procedures in place since 2008 and an existing agreement among Reclamation and the districts to continue implementing the OA through 2050. Alternative 5 represents the No Action Alternative.

#### *2.2.2.1 Carryover Provision*

The carryover provision of the OA provides for carryover accounting for the unused allocation balances remaining on EBID's and EPCWID's respective RGP water accounts at the end of each year. If either district does not use all of its total diversion allocation during a given year, for purposes of modeling for this FEIS, the corresponding quantity of water that would have been

released from RGP storage to satisfy the unused portion of the district's allocation instead would remain in storage at the end of the year.

Each district may accrue and maintain carryover balance for any period of years up to 60 percent of its respective full annual allocation under the OA. EBID, therefore, may accrue carryover balance up to a limit of 305,918 acre-feet and EPCWID may accrue carryover balance up to 232,915 acre-feet. In the event that either district accrues carryover balance in excess of their respective limit, the excess balance would be transferred to the other district's RGP water account.

The carryover provision of the OA does not affect the procedure used to determine the annual RGP allocation to Mexico. In accordance with the Convention of 1906, the allocation to Mexico would be 60,000 AFY, except in years of extraordinary drought or serious accident to the U.S. irrigation system. During extraordinary droughts, the annual allocation to Mexico would be determined based on the total release from storage and annual delivery to lands within EBID and EPCWID, plus total deliveries to the heading of the Acequia Madre, as calculated using the D-1 Curve. (See Section 1.4.2.3.2.)

#### *2.2.2.2 Diversion Ratio Adjustment*

As described in Section 1.4.2.3, the diversion ratio represents the amount of diversion allocation that is used per unit release of RGP water from Caballo Dam. It is a measure of RGP performance in meeting delivery obligations to EBID, EPCWID, and Mexico. The OA provides the method for determining the initial annual diversion allocations to EBID and EPCWID. It also includes the methods for adjusting these allocations based on RGP performance, as measured by the diversion ratio, which is affected by groundwater levels, and return flows to the Rio Grande.

As described in Section 1.4.2.3.1, Reclamation uses the diversion ratio to adjust allocations to EBID and EPCWID to account for changes in RGP performance. This is done to account for the effects of groundwater and surface water conjunctive use by irrigators in the Rincon and Mesilla Basins, on current year RGP performance. The diversion ratio adjustment ensures that the annual RGP allocation to EPCWID is consistent with historical RGP performance, as characterized by the D-2 Curve. It also ensures that deviations in RGP performance are accounted for by adjusting the annual RGP allocation to EBID.

Calculating annual allocations to EBID and EPCWID under the OA involves additional adjustments under some conditions. A positive adjustment (increase) is applied to both districts' allocations when the usable water available for current-year allocation is greater than 600,000 acre-feet and current (actual) RGP performance exceeds the historical D-2 baseline. A negative adjustment (decrease) is applied to both districts' allocations during extreme droughts. These are defined as consecutive years where RGP releases are below 400,000 AFY.

The OA implemented a minor modification to the application of the D-2 Curve. The 763,842 acre-feet for a full allocation release was increased to 790,000 AFY as specified as the normal release in the Rio Grande Compact.

#### *2.2.2.3 San Juan–Chama Storage*

Alternatives 1, 3, 4, and 5 include storing San Juan–Chama Project water in Elephant Butte Reservoir. The ABCWUA is seeking to renew a multiyear contract for storage of up to 50,000 acre-feet of San Juan–Chama Project water in Elephant Butte Reservoir through 2050.

## 2.3 Alternatives Eliminated from Detailed Study

This section discusses alternatives that were considered but eliminated from detailed study and explains the reasons for their elimination.

### 2.3.1 Removing Credits and Charges and Using Actual Deliveries of Water in Accounting

The New Mexico Interstate Stream Commission submitted an alternative during scoping and again during the DEIS comment period requesting analysis of an alternative to remove credits and charges in water accounting for the RGP. Allocation charges reflect the volume of surface water diverted from the Rio Grande; allocation credits reflect the volume of water bypassed or returned to the Rio Grande and available for diversion at a downstream diversion point. In general, allocation charges are computed as the greater of the volume of water ordered for diversion at a specified diversion point and the volume of water actually diverted; alternatively, allocation credits are computed as the lesser of the volume of water ordered or bypassed at specified bypass points and the actual volume of water bypassed or returned to the Rio Grande. Depending on the allocation charges and credits on corresponding RGP water orders promotes efficient operation of the RGP by creating an incentive to divert all water ordered or available. This was not carried forward for several reasons. First, because it would remove the incentives for efficient operations which would increase water use throughout the project area and reduce the amount of allocation for EBID due to a reduction to the diversion ratio. Second, charges are a method of tracking allocation use. If charges were removed, then there would be no way to track the allocation used by each district. This would be contrary to contracts among Reclamation and the two districts. Largely because of the second reason, i.e., being contrary to contracts, it means this alternative would not meet the purpose and need for action.

### 2.3.2 Change the Rio Grande Compact Accounting Point to San Marcial

During scoping, a request was made to change the Rio Grande Compact accounting point back to San Marcial. This alternative was not carried forward because it does not meet the purpose of and need for the proposed action. Specifically, changing the Compact accounting point is beyond Reclamation’s authority. Such a change would require a resolution of the Rio Grande Compact Commission, such as the change that was made in 1948 which changed the accounting point from San Marcial Station to storage in Elephant Butte Reservoir.

### 2.3.2 Add Point of Diversion for La Mancha Wetlands

During the comment period, the Southwest Environmental Center request a new diversion point on the river to divert surface water to the La Mancha wetlands. This alternative was not carried forward because it does not meet the purpose of and need for action. It is also beyond Reclamation's authority to grant this request. New diversions on the river would require coordination with the USIBWC, EBID, and others.

### 2.3.3 Change Carryover Accounting to Reflect Actual Conservation

Reclamation considered a suggestion to analyze changing carryover accounting to reflect conservation. Conservation is not how carryover is determined. Accumulation of carryover in each district’s account is not only dependent on conservation, but it is a summation of the water allotted at the point of diversion against the water diverted and charged against their account.

### 2.3.4 Changes in Drought Factor and Evaporation Calculations

Reclamation considered alternative elements to address how evaporation losses are calculated and potentially adjusting the drought factor. These elements were not carried forward as part of the

final alternatives because they are potential adjustments that could be made by revising the Operations Manual.

### 2.3.5 Climate Change and Compact Modeling and Analysis Assumptions

Reclamation received requests for new alternatives to account for changes in RGP efficiency caused by climate change and alternatives looking at Rio Grande Compact credit water accounting. These requests are not true alternatives, but are modeling and analysis assumptions or parameters contributing to the effects analysis in Chapters 4 and 5.

### 2.3.6 Impairment from Groundwater Pumping

A proposal was submitted to consider taking action if impairment from groundwater pumping depletes the RGP water supply. Actions which Reclamation may take outside the OA are outside the scope of the proposed action and are too speculative to attempt to analyze in this FEIS.

### 2.3.7 Mimic Natural Hydrograph

During the public comment period on the DEIS, two comments were made requesting new alternatives of modifying releases to mimic the natural flow regime, with higher water released in spring and lower water released in summer and fall to benefit native plants and wildlife. The alternative to release water for such purposes is beyond Reclamation's authority and does not meet the purpose and need for action for this FEIS.

### 2.3.8 Mitigation Measure to Revegetate

A request was made during the public comment period on the DEIS to add a mitigation measure of planting cottonwoods and willows in the reservoir pool following reservoir drawdowns. Reclamation considered this request, but given the cycles of filling and drawdown of the reservoirs, there would be natural regeneration occurring and such proposed revegetation would not be required. However, Reclamation has committed to monitor vegetation changes and meet with the Service to assess the habitat (cottonwoods, willows, and tamarisk) available for the Southwestern willow flycatcher and the Yellow-billed cuckoo. Revegetation would be considered in the future as needed to comply with the ESA.

### 2.3.9 San Juan–Chama Storage Alternative Contract Options

During scoping, Reclamation considered various alternatives for differing amounts or durations of storage of San Juan–Chama Project water in Elephant Butte Reservoir. While working on the DEIS, the ABCWUA requested renewal of a long-term contract for storing up to 50,000 acre-feet. Analysis under Alternative 2 allows comparison of the effects of this proposed San Juan–Chama Project storage.

During the public comment period on the DEIS, Reclamation received several comments suggesting expansion of the geographic scope of analysis to analyze the effect of future exchanges of San Juan-Chama Project water upstream. The modelling approach used to evaluate the San Juan-Chama Project storage provides a reasonable analysis of environmental effects within the scope of this FEIS. Any environmental effects related to San Juan-Chama Project water above Elephant Butte Reservoir or exchanges are out-of-scope for this FEIS. Any environmental effects related to San Juan-Chama water flowing downstream or exchanges upstream are out-of-scope for this FEIS, but will be analyzed when such actions are ripe for analysis. This FEIS analyzes the effects of storage of San Juan-Chama water and the resulting higher water elevations in Elephant Butte Reservoir as a result of ABCWUA's proposed contract.

### 2.3.10 Store Project Water in Higher Elevation Reservoirs Upstream

An environmental organization requested evaluation of an alternative of storing water in upstream reservoirs that have lower evaporation rates and could offer benefits to riparian and riverine habitats. The Rio Grande Compact (Article IV) requires New Mexico to deliver water to Elephant Butte Reservoir. The Compact contemplates storage of water in upstream reservoirs and actually requires such storage of water in upstream reservoirs to the extent of any accumulated debit in Compact deliveries, consistent with the physical limitations of such reservoirs. Article VII, however, generally prohibits increases in storage in upstream reservoirs constructed after 1929 when there is less than 400,000 acre feet of water stored in Elephant Butte Reservoir. Upstream storage does not meet the purpose and need for action and this would require a Compact amendment. Therefore, this is not analyzed in this FEIS.

## 2.4 Comparison of Alternatives and Selection of Preferred Alternative

Table 2-1 illustrates the differences among alternatives. The preferred alternative is Alternative 1. It incorporates carryover accounting, the diversion ratio provision, and the storage of San Juan-Chama water in Elephant Butte Reservoir. The preferred alternative is the alternative Reclamation believes would fulfill its statutory mission and responsibilities, considering environmental, technical, economic, and other factors described in Chapters 4 and 5, and best meets the purpose and need for action. See Chapters 4 and 5 for comparisons of effects of the alternatives.

# 3 Affected Environment

This chapter describes the water resources, biological, cultural, and socioeconomic resources that would be affected by implementation of the alternatives presented in Chapter 2 or whose review is required by law, regulation, or policy.

## 3.1 Resources Considered

Resources or resource topics analyzed and not analyzed in this FEIS are presented in Table 3-1. The resources considered but not analyzed may not be present in the study area or they may not be relevant to the scope of the Federal action. In other cases, any potential to affect the resource may be negligible or speculative. This determination is based on scoping, input from cooperating agencies, prior NEPA review (Section 1.5), and the experience of interdisciplinary team members.

Table 3-1 Resources and issues analyzed in the FEIS

| Resource | Relevance | Agency Determination |
|---|---|---|
| Aesthetics | Not included | This resource issue is not relevant to the scope of the action. |
| Agriculture, Farmlands | Included | Socioeconomic analysis includes economic benefits and impacts related to agriculture, but Farmland Protection Policy Act compliance is not required because of the assumption of a constant cropping pattern and no change in farm numbers or acreage. Contract freeze RGP acreage at 159,650 acres. Furthermore, RGP delivers water to the headings and not individual farms. |
| Air quality | Not included | There would be no effects to air quality related to the alternatives and no compliance with the Federal Clean Air Act is required. |
| Biological resources | Included | Aquatic species, vegetation and wetlands, and wildlife and special status species, and invasive species are relevant to the scope of the action and are included in the FEIS. |
| Climate change | Included | The alternatives would not affect climate change, but climate change would affect other resources and is included in the water resources modelling presented in Chapter 4. |
| Cultural resources | Included | Historic properties, Indian sacred sites, and resources of tribal concern are relevant to the scope of the action. |
| Environ-mental justice | Included | This is relevant to the scope of the Federal action based on the presence of minority and low-income communities in the study area per Executive Order 12898. |
| Geology, soils, paleontology | Not included | There would be no effects on geology and soils related to the alternatives. Although paleontological resources have been found within Elephant Butte Reservoir, there is negligible potential to affect paleontological resources based on the scope of the action. |
| Indian trust assets | Included | There are no Indian trust assets in the project area; however, Secretarial Order 3335 and Reclamation policy require description of this resource. |

| | | |
|---|---|---|
| Noise | Not included | There are no effects on noise related to the action. |
| Hydro-power, Energy | Included | CEQ regulations at 40 CFR 1502.16 require consideration of energy requirements of alternatives. Hydropower is relevant due to generation at the Elephant Butte Powerplant. |
| Recreation | Included | Relevant due to public recreational opportunities provided by RGP reservoirs, state parks, and the river. |
| Socio-economics | Included | Relevant to the scope of the Federal action due to potential economic benefits and regional economic indicators. |
| Solid and hazardous waste | Not included | There would be no generation of solid or hazardous wastes related to the action. |
| Traffic | Not included | There would be no effects on traffic or transportation related to the action. |
| Water resources | Included | Surface water and groundwater are relevant to the scope of the action. |
| Water quality | Included | Water quality is relevant to the scope of the action. |

## 3.2 Geographic Scope

Geographic areas of analysis vary by resource or resource issue. For all resources, the geographic area of analysis begins with Elephant Butte Reservoir in the north and extends downstream along the Rio Grande to the El Paso-Hudspeth County line. Reservoirs located upstream of Elephant Butte Reservoir are operated independently of the RGP and any environmental effects related to operations of these reservoirs or the effects of San Juan-Chama water flowing downstream to Elephant Butte Reservoir have either been analyzed in prior NEPA reviews or would be analyzed in the future depending on the alternative selected and when such actions would be ripe for analysis.

The El Paso-Hudspeth County line forms the southern boundary for the analysis because it marks the downstream end of RGP facilities and effects of the alternatives are not measurable beyond this line.

Implementation of the alternatives would not involve constructing new facilities or other actions that are physically different from or that exceed the bounds of historical operations of the RGP. The alternatives would not change the structure of the storage or diversion dams nor change obligations under the Convention of 1906, the Rio Grande Compact, or compliance with various court decrees, settlement agreements, and contracts.

### 3.2.1 Rio Grande Project

As shown in Fig. 1, the RGP is located in southern New Mexico and western Texas. The constructed features of the RGP are the Elephant Butte and Caballo Dams and Reservoirs, six diversion dams, 139 miles of canals, 457 miles of laterals, 465 miles of drains, and a hydroelectric powerplant. Reclamation and multiple entities own and operate the facilities and distribution infrastructure of the RGP.

As described in Section 1.4.1.2, Reclamation allocates RGP water proportionate to the districts' respective acreages. EBID includes 90,640 acres authorized to receive RGP water in the Rincon and Mesilla Valleys of New Mexico. EPCWID includes 69,010 acres authorized to receive RGP water in the Mesilla and El Paso Valleys of Texas. RGP water allocated to Mexico under the

Convention of 1906 is delivered in the bed of the Rio Grande at the point adjacent to the head works of the Acequia Madre in Cuidad Juárez, Mexico.

The HCCRD, below the RGP boundary in Texas, uses excess flows from the RGP. Under a Warren Act contract between HCCRD and Reclamation, HCCRD has used drainage and wastewater from the RGP since 1925. The contract extends only to the return water; it does not obligate the RGP or Reclamation to deliver specific amounts of water.

## 3.3 Water Resources

This section summarizes existing water resources, including surface water, groundwater, and water quality. The study area includes Elephant Butte and Caballo Reservoirs, the Rio Grande between the reservoirs, and the Rio Grande below Caballo Reservoir to diversion points to EBID and EPCWID lands, and Mexico.

### 3.3.1 Regulatory Framework

The legal and regulatory framework governing surface water in the study area is complex. Important authorities and agreements are:

- Reclamation Act of 1902 and the Rio Grande Project Act of 1905
- 1906 Convention between the U.S. and Mexico.
- Rio Grande Compact of 1939
- Public Law 97-140, 95 Stat. 1717, Section 5(c) (authority for storage of San Juan-Chama water in Elephant Butte Reservoir)
- Public Law 102-575, Title XXXIII—Elephant Butte Irrigation District, New Mexico, Section 3301 Transfer (authority for transfer to the two districts title to easements, ditches, laterals, canals, drains, and other rights-of-way)
- Court Order No. CIV-90-95-HB/WWD of 1996 (Court order to keep Caballo Reservoir storage level below 50,000 acre-feet from October 1 to January 21 annually under most conditions)

### 3.3.2 Data Sources

Water resources data were compiled primarily from Reclamation sources (e.g. Reclamation 2013a; Appendix F).

### 3.3.3 Elephant Butte and Caballo Reservoirs Storage

Reclamation stores RGP water in Elephant Butte and Caballo Reservoirs. Elephant Butte Reservoir has a capacity of 2,024,586 acre-feet, all of which is conservation storage for later release for authorized project purposes (Reclamation 2008b). Caballo Reservoir has a total capacity of 324,934 acre-feet, which includes 224,934 acre-feet of conservation storage and 100,000 acre-feet of flood control space (Reclamation 2008b). Total conservation storage within the RGP is 2,249,520 acre-feet.

In a typical year, storage in Elephant Butte Reservoir increases in the spring due to snowmelt and decreases during the irrigation season (generally March to October), although its contents can swing dramatically due to variations in runoff from summer monsoons. Storage in Caballo Reservoir generally increases from January through March, decreases from March through April,

increases from May through June, decreases from June through October, and increases from October through December (Reclamation 2013a).

### 3.3.4 Releases and Rio Grande below Caballo Dam

The study area for releases from the dams includes the Rio Grande below Elephant Butte Dam and the Rio Grande below Caballo Dam to the El Paso-Hudspeth County line in Texas. This marks the geographic end of the RGP facilities.

EBID, EPCWID, and USIBWC on behalf of Mexico, place orders with Reclamation for releases from storage to meet their delivery requirements at authorized points of diversion. Orders are placed daily during the irrigation season. If the districts cannot agree on the volume or timing of releases, Reclamation makes the final determination. Reclamation releases water from RGP storage for diversion by Mexico. Reclamation determines the amount and schedule of release for Mexico to meet the delivery schedule set by Mexico at its point of delivery.

Historically, the Rio Grande between the reservoirs and below Caballo Dam dries during the non-irrigation season when no surface water is released. Portions may remain wet due to rain and snowfall, groundwater, or municipal discharges. The annual flow below Caballo Dam was constant from 1960 to 2013 with the exception of a few wet and dry periods. The most significant dry period occurred during the mid-1960s, while the two wettest periods occurred during the mid-1980s and mid-1990s. In a typical year, flow below Caballo Dam is low in January, gradually increases until March, decreases during April and May, peaks in July, and decreases until December.

## 3.4 Groundwater

In addition to the background information in Chapter 1, this section summarizes existing conditions for groundwater in the Rincon Valley of New Mexico, the Mesilla Valley of New Mexico and Texas, and the El Paso Valley of Texas. The Mesilla Valley extends from Radium Springs, New Mexico, to the El Paso Narrows in El Paso, Texas, near the New Mexico-Texas-Mexico border. El Paso Valley is the low-lying area containing the Rio Grande channel, from south of the El Paso Narrows to near Fabens, Texas.

### 3.4.1 Regulatory Framework

Groundwater in New Mexico is regulated by the New Mexico Office of the State Engineer (NMOSE). In 1980, NMOSE recognized the Lower Rio Grande Underground Basin and imposed a permit system on well drilling. Before this declaration, there were no restrictions on well drilling in this area. The volume of groundwater that may be pumped under pre-basin groundwater rights[3] is currently being determined through a basin adjudication process by the State of New Mexico.

Groundwater within Texas is managed and regulated by local or regional groundwater conservation districts, if present.[4] The portion of the study area in Texas is governed by the rule of capture and a landowner needs no authorization or permit to pump.

[3] That is, under water rights established by groundwater use prior to the basin being declared.
[4] No Texas groundwater conservation districts currently exist in the RGP study area (Texas Water Development Board 2016).

### 3.4.2 Data Sources

Groundwater information was reviewed from Conover (1954), Frenzel (1992), Frenzel and Kaehler (1992), Reclamation (2013a, 2015c), and Stringham et al. (2016). Groundwater data also came from the following sources:

- Groundwater elevation data by the USGS using records extracted for individual groundwater measurement sites from a geo-database compendium (Burley 2010).
- Groundwater recharge data estimated by assessing deep percolation of irrigation water, channel seepage from the Rio Grande and RGP conveyance facilities, and mountain-front and slope-front recharge from surrounding areas. Values have been extracted from the final model input files for the NMOSE and collaborators' groundwater model of the Rincon and Mesilla Basins (SSPA 2007).
- Groundwater pumping for irrigation in the Rincon and Mesilla Basins has been estimated based on the Lower Rio Grande Groundwater Flow Model. While metering of groundwater pumping has occurred since the 1980s and has been required since 2009, comprehensive metering records of groundwater pumping for irrigation in the Rincon and Mesilla Basins are unavailable.

### 3.4.3 Existing Groundwater Conditions

As described in Chapter 1, adapting to and managing for the impact on the RGP supply caused by groundwater pumping by irrigators in the RGP service area was a purpose of the OA.

#### *3.4.3.1 Aquifers*

As described in Section 1.4.2.3.2, the shallow unconfined aquifer systems in the Rincon and Mesilla Valleys are hydraulically connected to the Rio Grande; therefore, groundwater pumping from these aquifers in New Mexico and Texas has the potential to affect RGP supply and deliveries. The unconfined aquifer system in the El Paso Valley is also hydraulically connected to the Rio Grande. However, most of the RGP diversions and return flows occur upstream of the portion of this aquifer system that is affected by groundwater pumping and are not substantially affected by fluctuations in groundwater conditions in the El Paso Valley (Reclamation 2013a; Appendix F).

#### *3.4.3.2 Groundwater Recharge and Demand*

Groundwater use and recharge are currently affected by factors including drought, increasing demands, and changing farm irrigation efficiencies (Stringham et al. 2016). In the Lower Rio Grande Underground Water Basin (NMOSE 2015), including the Rincon and Mesilla Valleys of New Mexico, groundwater use has recently been estimated to range from 50,000 to 100,000 AFY in years of full RGP surface water supply and from 200,000 to 300,000 AFY in years of low RGP supply. Groundwater use for supplemental irrigation depends on irrigated acreage, crop distribution, and weather conditions during the growing season in addition to RGP supply (Barroll 2005, Reclamation 2013a). Average seasonal groundwater pumping is greater from March through October than from November to February, which reflects the use of the groundwater for supplemental irrigation. Pumping has varied over time with the volume in years of extremely heavy pumping up to six times that of years with the lowest pumping. Accurate estimates of historical and current groundwater pumping for supplemental irrigation of RGP lands in the Texas portion of the Mesilla Valley and in the El Paso Valley of Texas are not available at this time. Water quality considerations and other factors limit the groundwater use on RGP lands in the El Paso Valley of Texas, which overlies the Hueco Bolson groundwater aquifer.

In general, an increase in RGP allocation and surface water diversions to either district is expected to increase groundwater recharge from canal seepage and deep percolation of irrigation water in that district, along with a corresponding decrease in groundwater demand for supplemental irrigation. Conversely, a decrease in RGP allocation and diversions to either district is expected to decrease groundwater recharge in the district and increase groundwater demand for supplemental irrigation.

Previous analysis in the SEA determined that it was not possible to quantify the total change in groundwater recharge and demand from 2008 to 2012 nor the portion of that total change that would be attributable to the OA. An order of magnitude estimate suggests that incremental changes in groundwater recharge and groundwater demand for supplemental irrigation in the Rincon and Mesilla Valleys during this period were small compared to the total recharge and pumping in the region (Reclamation 2013a; Appendix F).

Groundwater pumping is not an authorized function of the RGP and is not directly a part of RGP operations. However, it is worth noting that groundwater pumping from aquifers hydraulically connected to the Rio Grande, or to the network of canals, laterals, ditches, drains, and wasteways used to convey RGP deliveries and return flows, is likely to affect RGP supplies and deliveries through the interaction of the groundwater and surface water systems. In addition, groundwater demand for supplemental irrigation depends in part on the availability of surface water from the RGP. Previous studies have indicated that seepage from the Rio Grande and deep percolation of irrigation water from RGP lands to the underlying aquifer system are a primary source of groundwater recharge to the shallow unconfined aquifers of the Lower Rio Grande Underground Water Basin (Hanson et al. 2013, Haywood and Yager 2003, SSPA 2007, Stringham et al. 2016).

#### *3.4.3.3 Groundwater Trends*

Analysis based on historical measurements of groundwater elevations from monitoring wells in the RGP and surrounding areas of the Rincon and Mesilla Valleys demonstrates widespread and statistically significant negative trends in groundwater elevation from 1980 to the present. Analysis of previous decades suggest that this trend is confined to the past decade, indicating that sustained groundwater pumping in excess of recharge (i.e., groundwater mining) was not prevalent in the RGP or adjacent lands before the current drought (Reclamation 2013a; Appendix F).

Other groundwater trends are:

- Trends in groundwater elevation are predominantly negative, although some wells exhibit neither negative nor positive trends over the same period. Trends in groundwater elevation at each measurement site reflect conditions near that site.
- Full allocations each year in the early 1990s to early 2000s lessened concerns about allocations and no substantial changes in RGP operations, district operations, or groundwater use for supplemental irrigation in the RGP or adjacent areas of the Rincon or Mesilla Valleys occurred between the late 1990s and early 2000s.
- Efforts to increase irrigation efficiency and to reduce distribution losses, including lining and piping portions of the distribution system, may have contributed to recent groundwater declines in some portion of the Mesilla Valley by reducing recharge from deep percolation of irrigation and canal seepage. It is likely that recent groundwater declines are associated with the severe and sustained drought conditions that have affected the RGP since 2003 (Reclamation 2013a, Appendix F).

The analysis presented in the SEA (Reclamation 2013a, Appendix F) indicates a statistically significant positive correlation between groundwater elevation and annual flow below Caballo Dam, as well as the total annual RGP diversions under both wet and dry conditions. These results are intuitively consistent with conjunctive use of surface water and groundwater in the RGP. During periods of high surface water availability, streambed recharge from the Rio Grande to the underlying aquifer increases and groundwater pumping decreases, resulting in higher groundwater elevations. Conversely, during periods of low surface water availability, streambed recharge decreases and pumping increases, resulting in declining groundwater levels. Results suggest a strong connection between surface water and groundwater resources in areas served by the RGP, particularly in the Rincon and Mesilla Basins, as indicated by numerous previous studies (Deb et al. 2012, Reclamation 2013a; Appendix F, Stringham et al. 2016).

## 3.5 Water Quality

This section summarizes existing water quality between Elephant Butte Reservoir and the Rio Grande at the El Paso-Hudspeth County line.

### 3.5.1 Regulatory Framework

The legal and regulatory framework for water quality includes:

- Federal Water Pollution Control Act or Clean Water Act (CWA; 33 USC Section 1251 et seq.)
- Public Health Service Act, Safe Drinking Water Act (Title XIV of the Public Health Service Act; Public Law 107-377)
- New Mexico Administrative Code 20.6.4
- Texas Administrative Code Title 30, Chapter 307

Under the CWA, water quality is managed by the New Mexico Environment Department (NMED) and Texas Commission on Environmental Quality (TCEQ). These state agencies have developed water quality standards based on designated uses for which the body of water is suitable. Both state agencies divide the Rio Grande into water quality segments for which standards must be met.

### 3.5.2 Data Sources

Water quality data are from Hogan (2013), New Mexico Environment Department (NMED 2016), Reclamation (2013a; SEA Appendix H), Texas Commission on Environmental Quality (TCEQ 2016), and the U.S. Environmental Protection Agency (EPA 2015a, b).

### 3.5.3 Existing Reservoir Water Quality Conditions

The NMED Surface Water Quality Bureau (2016:175-176) reports that water quality in Elephant Butte Reservoir (HUC 13020211) has improved recently and the reservoir has been taken off the state's impaired list, but there is still a fish consumption advisory due to mercury in fish tissue. Caballo Reservoir (HUC: 13030101) is impaired due to mercury in fish tissue and high levels of nutrients. Fish consumption advisories are in place (NMED 2016:176).

### 3.5.4 Existing Rio Grande Water Quality

The Rio Grande between Elephant Butte and Caballo Reservoirs has historically been impaired by low dissolved oxygen levels and excessive nutrients, but in 2016, no impairments were found (NMED 2016:177-178). However, the state plans to reassess the dissolved oxygen levels. The

NMED (2016:178) has listed the Rio Grande in the HUC: 13030102, El Paso-Las Cruces reach, as impaired due to exceedances of the *E. coli* criterion.

The TCEQ (2016) lists the Rio Grande River (Basin 23; AUID 2312-2) as impaired for aquatic life from the Texas-New Mexico border to International Dam due to depressed dissolved oxygen levels and a toxic substance (methylene chloride) in sediment. For general uses, total dissolved solids and nutrients exceed standards. In addition, groundwater quality may be a concern within the districts' service areas.

The Rio Grande is impaired for primary contact recreational use from Percha Dam to the Texas boundary due to exceedance of the *E. coli* bacteria standard. The Rio Grande downstream of the New Mexico border is impaired due to excessive *E. coli* and high salinity or total dissolved solids. At El Paso, the average total dissolved solids is about 750 mg/L, and at Fort Quitman it commonly is in excess of 2,000 mg/L and up to an average of 3,200 mg/L during the irrigation season (Hogan 2013, Phillips et al. 2003, Stringham et al. 2016). Total dissolved solids are typically elevated in the winter when flows are lower and are reduced in the summer when higher flows dilute concentrations (Michelsen et al. 2009).

## 3.6 Vegetation Communities, Wetlands and Special Status Plant Species

This section describes vegetation communities including wetlands and special status plant species within the Elephant Butte and Caballo Reservoir pools and along riverbanks between the reservoirs and down to the El Paso-Hudspeth County line. "Special-status species" includes species given varying levels of protection with the highest level of protection given to species listed or proposed for listing as endangered or threatened under the ESA.

### 3.6.1 Regulatory Framework

A number of laws, regulations, and policies apply to vegetation communities and plant species. These include:

- ESA
- CWA Section 404
- Executive Order 11990, Protection of Wetlands
- New Mexico Energy, Minerals, and Natural Resources Department (NMEMNRD) Forestry Division (NMEMNRD 2015) Section 75-6-1 NMSA 1978
- Texas Parks and Wildlife Department Code Chapter 88 and Sections 69.01 through 69.9 of the Texas Administrative Code

### 3.6.2 Data Sources

Data sources for vegetation in the study area include the U.S. Geological Survey's (USGS) Southwest Regional Gap Analysis (USGS 2011), the New Mexico Rare Plant Technical Council (NMRPTC 2015), New Mexico State Parks' (NMSP) management plans (NMSP 2000, 2006), endangered plant information from the New Mexico Energy, Minerals, and Natural Resources Forestry Division (NMEMNRD 2015), and the Service's National Wetland Inventory, and publications such as Muldavin et al. (2000).

Field surveys and aerial photography conducted by Reclamation (2003a, 2012b), USIBWC (various), and others (e.g. Sogge et al. 1997) to document habitat for the endangered Southwestern willow flycatcher (*Empidonax traillii extimus*, flycatcher) also provide data about vegetation communities in the five county biological resources study area.

### 3.6.3 Existing Vegetation Conditions

The study area is in the Chihauhuan Desert on the ecotone[5] between Desert Scrub and Desert Grassland (Brown 1982, Dick-Peddie 1993). Riparian-wetland vegetation borders the study area along the shoreline of the reservoirs and the floodplain of the Rio Grande. Within the study area, the location and distribution of individual plant species depends on the soil, elevation, degree of slope, and proximity to water, etc.

The Southwest Regional Gap Analysis Project (USGS 2011) provides land cover data for the study area, classified according to the National Vegetation Classification System. Following this system, vegetation within the full-pool footprint of Elephant Butte Reservoir and its delta include the following:

- Western Great Plains Riparian Woodland and Shrubland
- North American Arid West Emergent Marsh
- North American Warm Desert Playa
- North American Warm Desert Wash
- North American Warm Desert Riparian Woodland and Shrubland

Since 1995, Elephant Butte Reservoir has receded more than 24 miles downstream, exposing thousands of acres of bare soil (Fig. 3). This area is dominated by Goodding's willow (*Salix gooddingii*), interspersed with broadleaf cattails (*Typha latifolia* L.), and marsh grasses (Muldavin et al. 2000). To the east, opposite the Low Flow Conveyance Channel outfall, dense monotypic stands of nonnative tamarisk or saltcedar (*Tamarix* spp.) are dominant (Reclamation 2012a).

Scant riparian development exists along the floodplain of the Rio Grande between Elephant Butte and Caballo Reservoirs. Vegetation in this reach is typically limited to a narrow band of tamarisk with a few overstory cottonwoods (*Populus fremontii*) (Reclamation 2012a).

Where the Rio Grande broadens into the upper delta of Caballo Reservoir, several patches of tamarisk and overstory cottonwoods and a variety of herbaceous and grass species persist (Reclamation 2012a). The broadening of the floodplain and Caballo Reservoir account for the relatively high water table that supports this vegetation.

Little vegetation is found in and around Caballo Reservoir due to annual mowing and management (Reclamation 2012a). However, a 40-acre parcel has been fenced to exclude livestock. This parcel, known as the Las Palomas site, supports a mosaic of native riparian and wetland vegetation that provides wildlife habitat. Downstream of the Las Palomas site, several large patches of native willows (*Salix* spp.) have developed in the bottom of the reservoir pool. Several of these patches are comparable to the high-quality wildlife habitat in the Elephant Butte Reservoir and consist of young to middle-aged coyote willow (*Salix exigua*) and Goodding's willow. These patches are classified as North American Arid West Emergent Marsh, North American Warm Desert Playa, and North American Warm Desert Riparian Woodland and Shrubland.

[5] A transitional area between two biological communities

Downstream of Percha Dam (2.0 miles below Caballo Dam) to the American Dam at El Paso, the affected environment is the floodway managed by the USIBWC. The floodway ranges in width from approximately 50 to 2,100 feet for over 100 miles. In most of the floodway there is little to no vegetation, but portions of it are described by USIBWC (2003, 2009b) as a combination of farmland and North American Arid West Emergent Marsh and North American Warm Desert Riparian Woodland and Shrubland.

Through the years, the USIBWC has managed vegetation to reduce erosion potential, remove potential obstructions that could reduce flood containment capacity, help stabilize stream banks, control weeds and brush including saltcedar, and provide wildlife habitat at suitable locations. The USIBWC's Record of Decision for River Management Alternatives for the Rio Grande Canalization Project (USIBWC 2009a) calls for enhancing native vegetation within the floodway by reducing mowing and revegetation.

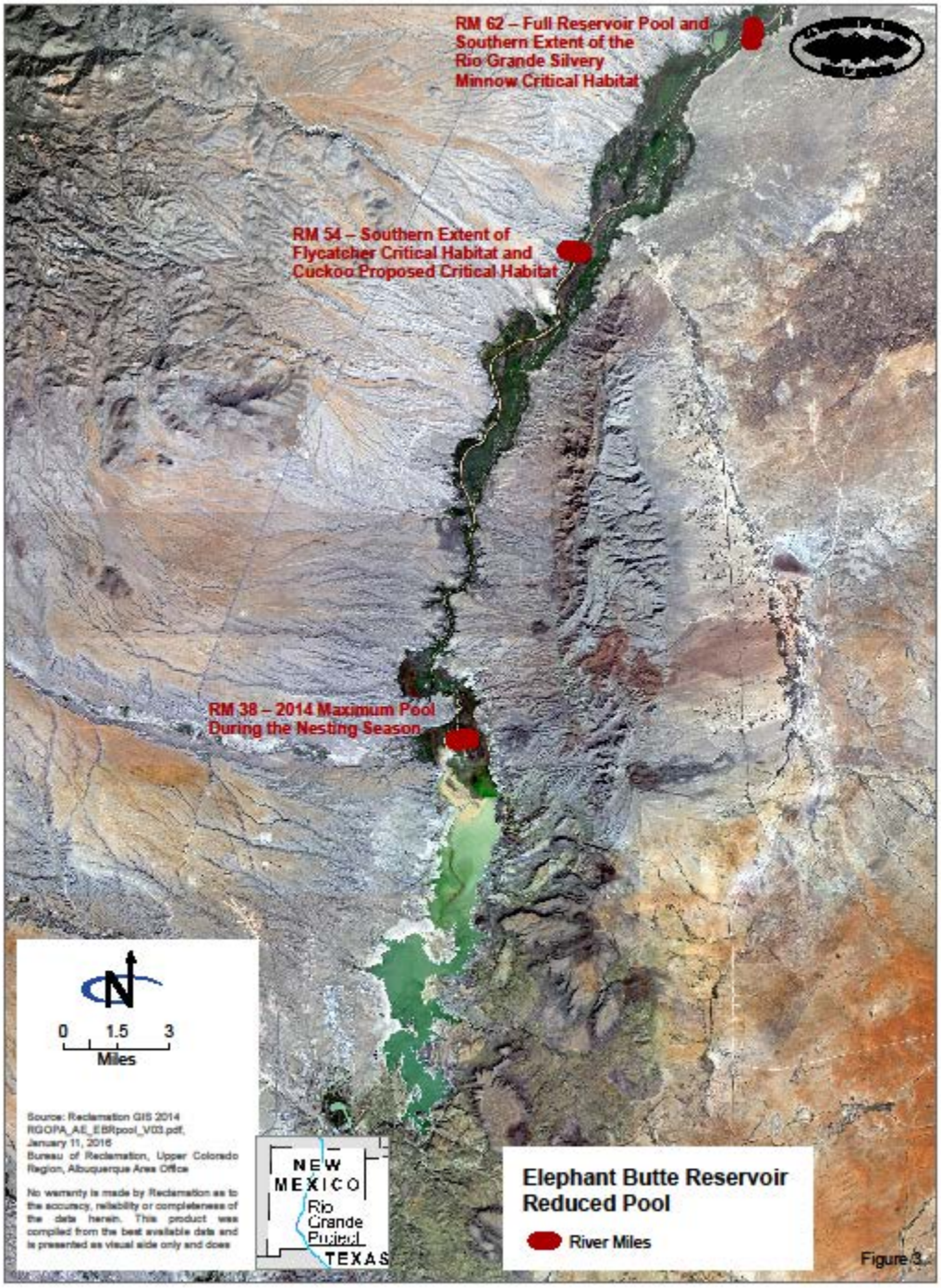
### 3.6.4 Vegetation Trends

The recession of Elephant Butte Reservoir over the last decade has allowed the development of a mosaic of native and nonnative vegetation (Fig. 3, Reclamation 2012a). Downstream, at the sediment delta of Caballo Reservoir, several patches of tamarisk and overstory cottonwoods and a variety of herbaceous and grass species have grown, including the densely vegetated Las Palomas site referenced in Section 3.6.3 (Reclamation 2012a). These vegetated patches within the full pool footprint of both reservoirs are dynamic due to both natural succession and to changes brought about by fluctuating reservoir levels.

While defoliation of tamarisk due to the tamarisk leaf beetle (*Diorhadba* spp.), has yet to occur in the study area, it is likely that individual trees and patches of dense, monotypic tamarisk will become defoliated as the beetle expands over time.

Below Caballo Reservoir, there is minimal native vegetation along the Rio Grande. The river is channelized to accommodate agricultural and urban land uses, but additional acres adjacent to the river has recently been allocated for riparian restoration and managed grasslands. Approximately 350 additional acres may be designated as no-mow zones in future years to accommodate new conditions, such as increased flycatcher habitat buffer areas or new restoration sites (USIBWC 2014b).

Figure 3. Elephant Butte Reservoir reduced pool, 2014



### 3.6.5 Special Status Plant Species

There are 13 Federal- or state-listed special status plant species in the five counties in the biological resources study area, but based on habitat requirements and soil associations, only the Pecos sunflower (*Helianthus paradoxus*) and Wright's marsh thistle (*Cirsium wrightii*) have any potential to occur in the study area. To date, no occurrences of either species have been reported. These species are discussed in more detail below.

#### *3.6.5.1 Pecos sunflower (Helianthus paradoxus)*

The Pecos sunflower is a wetland species that requires saturated saline soils of desert wetlands. It is usually associated with desert springs (cienegas) or the wetlands created from modifying desert springs at 3,300 to 6,600 feet of elevation. Some activities that degrade or destroy wetlands and therefore threaten Pecos sunflower are channel incision that reduces water tables, groundwater depletion, water diversions, filling, and saltcedar invasion. Livestock will eat Pecos sunflower, especially the flower heads, when other green forage is scarce. Disturbance may facilitate hybridization (NMRPTC 2015).

#### *3.6.5.2 Wright's marsh thistle (Cirsium wrightii)*

Wright's marsh thistle grows in wet, alkaline soils in spring seeps and marshy edges of streams and ponds at elevations of 3,450 to 8,500 feet. Desert springs (cienegas) are susceptible to drying up or being diverted. Populations in the City of Roswell, Chavez County, at Lake Valley, Sierra County, and at the San Bernardino Cienega in Arizona appear to be extirpated. Introducing insects as biological control for weedy thistles may pose a grave hazard for non-weedy thistle species. The effects of fire and livestock grazing on this species have not been studied (NMRPTC 2015).

## 3.7 Wildlife and Special Status Wildlife Species

This section summarizes existing conditions for terrestrial wildlife and special status wildlife species, including consideration of birds, mammals, reptiles, amphibians, arthropods, and gastropods. For this FEIS, special status species are those protected by the laws listed below.

### 3.7.1 Regulatory Framework

The primary laws protecting wildlife are:

- ESA
- Bald and Golden Eagle Protection Act (16 USC, Sections 668-668d)
- Migratory Bird Treaty Act of 1918 (16 USC, Sections 703-712), as amended
- New Mexico Wildlife Conservation Act (17-2-40.1 NMSA 1978)
- Texas Parks and Wildlife Department Code, Chapters 67 and 68, and Texas Administrative Code, Sections 65.171-65.176, of Title 31

### 3.7.2 Data Sources

Data sources for wildlife in the study area are based on descriptions of the vegetation communities in Section 3.6, plus data provided by the Service on special status species in the five counties: Doña Ana, Sierra, and Socorro Counties, New Mexico, and El Paso and Hudspeth Counties, Texas. Wildlife data from New Mexico State Parks' (NMSP) management plans (2000, 2006) are incorporated by reference. Reclamation also reviewed the Service's online Critical Habitat Portal (Service 2014a) and *Federal Register* notices for designated critical habitat for special status species. The New Mexico Department of Game and Fish's (NMDGF) online

database, the Biota Information System of New Mexico, was reviewed for Federal and state threatened, endangered, and species of concern (NMDGF 2015a). Also, reviewed were data from the New Mexico natural heritage program sensitive species by county database (NMDGF 2015a) and the Texas natural diversity database and rare, threatened, and endangered species of Texas by county database maintained by Texas Parks and Wildlife Division (TPW 2016).

The New Mexico Ornithological Society has an online database of bird sightings throughout the state (New Mexico Ornithological Society 2015), and there are several available lists showing documented bird species for these counties that were reviewed. Publications of the Service listing species, designating critical habitat, recovery or management plans, and biological opinions were reviewed and data from these publications are incorporated by reference (e.g. Service various).

### 3.7.3 Existing Wildlife Conditions

This section provides a general overview of the wildlife and bird species and their habitats that could be in the study area, with an emphasis on special status species. As with vegetation, the potentially affected habitat focused on potential inundation areas associated with reservoir pools and the effects of the frequency, timing, and extremes in reservoir elevation changes over the long term.

The vegetation in and around the two reservoirs and along the floodplain of the Rio Grande provides habitat for a diversity of wildlife species (USIBWC 2001; Reclamation 2002, 2003b). Common wildlife at both Elephant Butte and Caballo Reservoirs are mule deer, coyote, rabbits, pocket gopher, ground squirrel, chipmunk, raccoon (NMSP 2000, 2006). NMSP (2000, 2006) has documented more than 250 species of birds in and around the reservoirs, with common species including woodpecker, egret, killdeer, quail, great blue heron, and shorebirds.

The reservoirs and shorelines support many species of reptiles, amphibians, and invertebrates. Among the invertebrates, currently no tamarisk leaf beetles (*Diorhadba* spp.) have been documented in the study area, but the beetle has been dispersing in Texas and New Mexico since at least 2010. *Diorhabda* has been known to defoliate over 90 percent of tamarisk at some sites, with possible tamarisk mortality after 3-5 years of repeated defoliation. The defoliation of tamarisk could affect the use of the study area by birds including the endangered flycatcher, as described below.

Downstream of Caballo Reservoir, typical wildlife includes the black-tailed jackrabbit, desert cottontail, cotton rat, ground squirrel, mourning dove, meadowlark, kestrel, red-tail hawk, skunk, burrowing owl, several species of waterfowl, other migratory birds, and non-game animals (USIBWC 2007, 2014a).

Riparian areas constitute less than one percent of the land area in the arid Southwest, yet provide habitat to a greater number of wildlife species than any other ecological community in the region. These areas are also critical corridors for migratory species, especially migratory birds. When analyzing the river portion of the study area from Caballo Reservoir to El Paso, USIBWC assessed the quality of wildlife habitat in the area as below average to poor (USIBWC 2003).

Some riverine wetlands in the river channel offer high-quality habitat, but these are small and far apart. Wildlife habitat along the river, from the Elephant Butte Dam to El Paso, has been impacted by agricultural and urban development. In general, the remaining high-value wildlife habitat is associated with the Elephant Butte and Caballo Reservoirs and a riparian strip next to the Rio Grande. The dynamic nature of flooding and drying at the upper portions of the Elephant Butte Reservoir has allowed large areas of riparian vegetation to establish itself, which provides

important wildlife habitat. Smaller patches of similar vegetation have developed on the drought-exposed bed of Caballo Reservoir.

### 3.7.4 Special Status Wildlife Species

The endangered flycatcher and the threatened Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*; cuckoo) are seasonally present within the study area/action area. Reclamation also considered potential for the endangered New Mexico meadow jumping mouse (*Zapus hudsonius luteus*; mouse), the endangered Interior least tern (*Sterna antillarum*), and the threatened piping plover (*Charadruis melodus*; plover) in the action area. For the mouse (see Section 3.7.4.3), the Service (2014c, 2013c) indicates it could be present in Socorro County, New Mexico, but surveys for the species, as well as examination of its potential habitat based on vegetation communities, indicate this species is not present in the action area. While migrating individual Interior least tern and plover could occur during transitory stopover periods, no habitat for these species has been found along the riverine portion of the action area.

#### *3.7.4.1 Southwestern Willow Flycatcher*

The flycatcher is a small perching bird (order Passeriformes), about six inches long, with a life span of generally one to three years; some live four to seven years (Langridge and Sogge 1997, Netter et al. 1998, Paxton et al. 1997). They winter in neotropical areas of southern Mexico and Central America and begin to arrive at New Mexico breeding sites in early May. Flycatcher habitat along the Rio Grande has two primary functions: habitat for breeding and feeding during the breeding season and stopover habitat while migrating.

The flycatcher was originally listed as endangered due to loss of habitat, brood parasitism, and lack of adequate protective regulations (Service 1995). The greatest ongoing threats to flycatchers in the Rio Grande are the decline in the quality of critical nesting habitat related to drought and loss of dense riparian vegetation, invasion of the saltcedar leaf beetle (*Diorhabda* spp.), and nest predation by brown-headed cowbird (*Molothrus ater*).

The Service published the final rule designating critical habitat for the flycatcher in 2013 and included about 14.4 kilometers (9.0 miles) of the upper part of Elephant Butte Reservoir in the Middle Rio Grande Management Unit (Service 2013a:380).

Regarding the sediment delta at the north of Elephant Butte Reservoir, the Service reported that:

> "Over time, as the lake at Elephant Butte has declined, there has been an increase of willows and other trees in the delta of Elephant Butte Reservoir, and also an increase in flycatcher territories within the reservoir pool and north of the reservoir pool where the habitat is supported by the low-flow conveyance channel. The area within and north of Elephant Butte Reservoir supports the largest known population of flycatchers in the range of the subspecies." [Service 2013a:365]

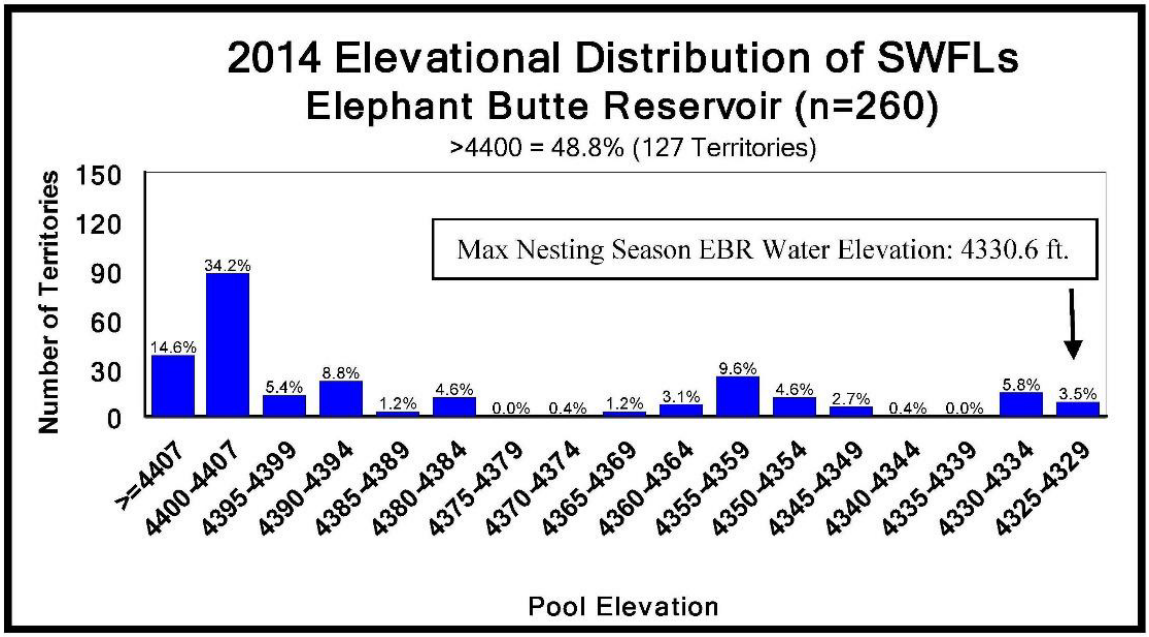
The final rule also found that the southerly margin of Elephant Butte Reservoir contains some elements of flycatcher habitat (Service 2013a:380). However, the Service determined that this southern segment in the active conservation pool of the Elephant Butte Reservoir is not necessary for the conservation of flycatcher and it was not designated as critical habitat (Service 2013a:349).

##### 3.7.4.1.1 Presence

The upper or northern part of Elephant Butte Reservoir is located in the Service's Middle Rio Grande Management Unit. Patches of vegetation at the northernmost extent within the historic

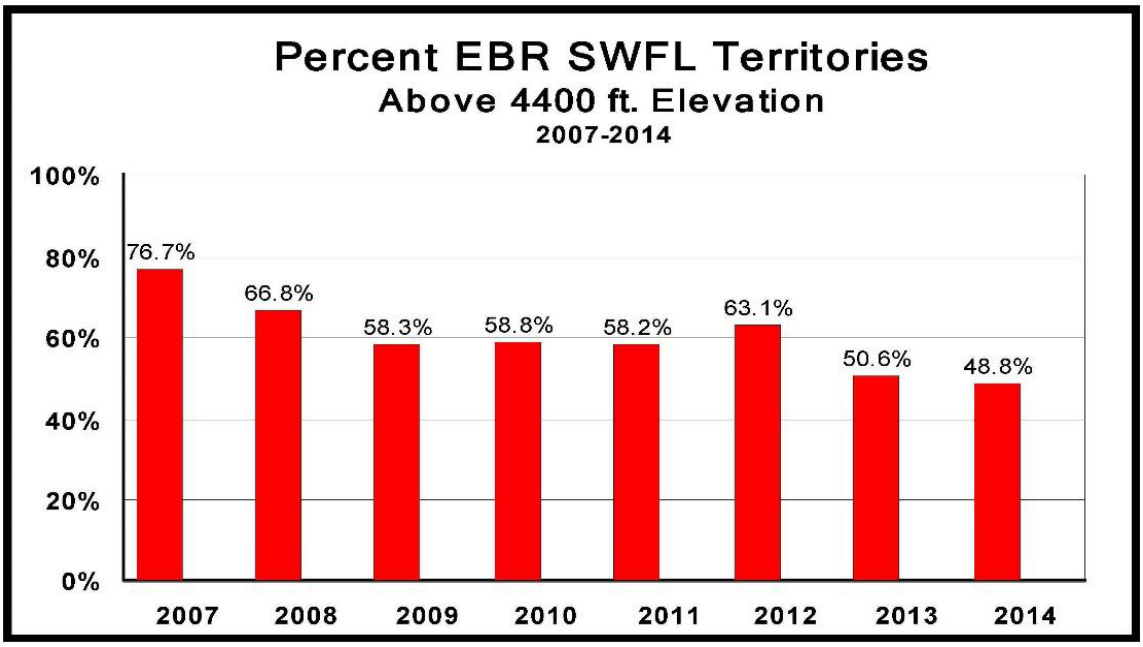
reservoir (considered south of River Mile 62) became suitable for flycatchers in the mid-1990s. Flycatcher habitat is dynamic system, with the birds requiring dense patches of vegetation with tall trees. High-quality flycatcher habitat within the reservoir that has developed is a result of more recent reservoir recession that continues to improve and is providing new habitat for nesting and migrant flycatchers (Reclamation 2015a).

Figure 4. Elevational distribution of Southwestern Willow Flycatcher territories within Elephant Butte Reservoir, 2014, with maximum water levels.




Source: Reclamation (2015d).

Figure 5. Percentage of Southwestern Willow Flycatcher territories above the high pool of Elephant Butte Reservoir, 2007-2014.




Source: Reclamation (2015d).

During the 2014 surveys, 598 resident flycatchers were documented throughout the Middle Rio Grande Management Unit, which included resident birds forming 234 pairs and establishing 364 territories (Reclamation 2015a). Consistent with previous years, the San Marcial reach was the most productive, with 307 territories and 205 pairs. The 2014 surveys showed a second consecutive year of increased territory numbers after a large drop in 2012. The 2014 monitoring included nesting success rates, productivity, and brown-headed cowbird (*Molothrus ater*) parasitism. The San Marcial reach was again most productive, with 255 nests and 151 flycatcher fledglings. Overall, nesting success for all of the Middle Rio Grande Management Unit was the lowest observed in the past 16 years of monitoring, with most failures due to depredation (Reclamation 2015a).

Figure 4 presents the distribution of flycatchers by elevation in Elephant Butte Reservoir during 2014. Because the elevation of the full reservoir is approximately 4,400 feet, the reservoir is important in providing flycatcher habitat**.** Figure 5 shows the percent of flycatcher territories above the high reservoir pool from 2007 to 2014.

#### *3.7.4.2 Yellow-Billed Cuckoo*

Cuckoos are insect specialists but also prey on small vertebrates, such as tree frogs and lizards; they are also known to be nest parasites of other bird species, including flycatchers. In the arid west, cuckoos are usually found in cottonwood-willow riparian associations along watercourses. The cuckoo requires large tracts of willow-cottonwood or mesquite (*Prosopis* spp.) forest or woodland for its nesting season habitat. Hydrologic conditions at cuckoo breeding sites can vary between years. This year-to-year change in hydrology can affect food availability and habitat suitability for cuckoos. Extended inundation reduces habitat suitability because the larvae of

sphinx moths pupate, and the eggs of katydids are laid underground; prolonged flooding kills the larvae and eggs (Service 2014b), thus removing important food sources.

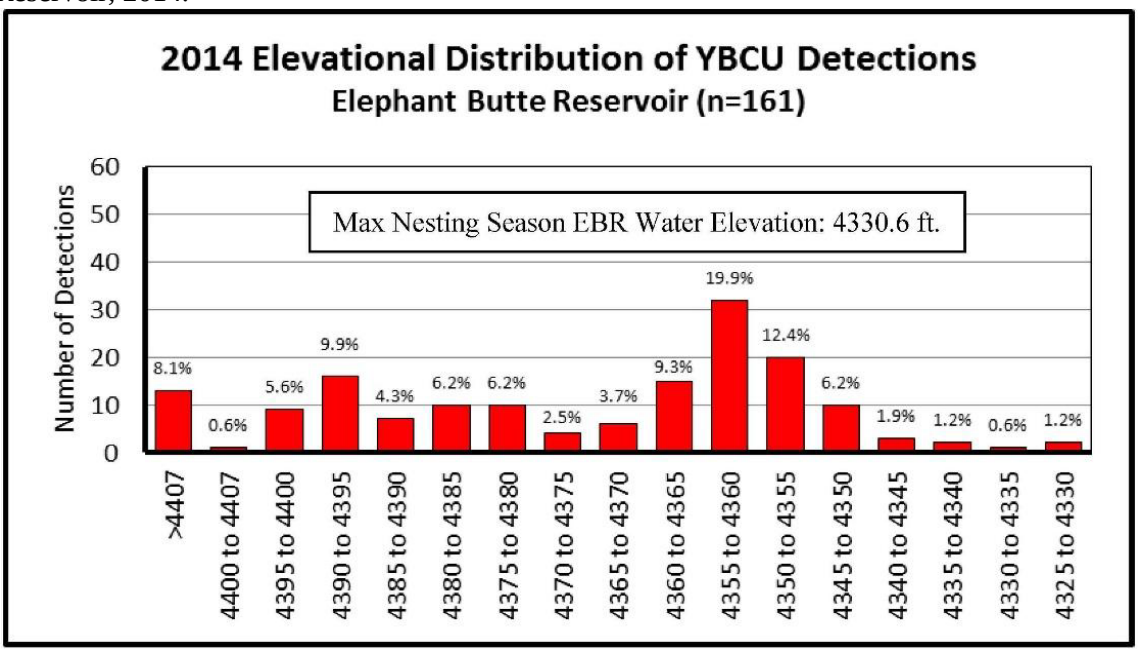
The cuckoo was listed as threatened due to the "habitat loss associated with [man-made] features that alter watercourse hydrology so that the natural processes that sustained riparian habitat in western North America are greatly diminished" (Service 2013b:59992). In addition to habitat loss, reduction of prey insect abundance due to the use of pesticides has been identified as a major threat to the cuckoo (Service 2014e).

In 2014, the Service proposed designating critical habitat for the cuckoo, which included the Middle Rio Grande Unit NM-8 (Service 2014b). It is 61,959 acres in extent and is an approximately 170-mile-long continuous segment of the Rio Grande, from the Elephant Butte Reservoir in Sierra County at approximately River Mile 54, upstream through Socorro, Valencia, and Bernalillo Counties to below Cochiti Dam in Cochiti Pueblo in Sandoval County, New Mexico. This unit is consistently occupied by a large number of breeding cuckoos and currently is the largest breeding group of the species north of Mexico. The site also provides a movement corridor for cuckoos moving farther north. Tamarisk, a nonnative species that reduces habitat quality for cuckoos, is a major component of habitat in this unit. The Service has not yet finalized critical habitat designation for the species, including identifying actual boundaries at Elephant Butte Reservoir.

#### 3.7.4.2.1 Presence

In Reclamation's 2013 survey of cuckoos from State Highway 60 downstream to the Elephant Butte Reservoir, the San Marcial Reach (River Mile 68.5 to 38.5) had the most cuckoo habitat of any of surveyed reaches (Reclamation 2014b). In 2013, the exposed pool of the Elephant Butte Reservoir constituted 86 percent of all cuckoo detections and 86 percent of all territories found within the San Marcial Reach. This subset of San Marcial also contained 48 percent of all cuckoo detections and 50 percent of all territories found in the entire Middle Rio Grande study area. The biological assessment (Reclamation 2015d) includes more information on the cuckoo and its distribution in the study area. The distribution of cuckoos by elevation in Elephant Butte Reservoir during the 2014 surveys is provided in Fig. 6.

Figure 6. Elevational distribution of Yellow-billed Cuckoo detections within Elephant Butte Reservoir, 2014.




Source: Reclamation (2015d).

### *3.7.4.3 New Mexico Meadow Jumping Mouse*

There have been relatively few studies of this endangered mouse and its natural life history. The mouse is unique in that it hibernates about eight to nine months out of the year, longer than most mammals, and it is active for only three to four months during the summer. Within this short time frame, it must breed, give birth, raise young, and store up sufficient fat reserves to survive the next year's hibernation period. As a result, if resources are not available in a single season, populations may be greatly impacted. In addition, New Mexico meadow jumping mice live three years or less and have one small litter annually, with seven or fewer young, so the species has limited capacity for high population growth rates due to this low fecundity.

According to the Service (2013c), the New Mexico meadow jumping mouse has specialized habitat requirements in that it appears to only utilize two riparian community types: 1) persistent emergent herbaceous wetlands (beaked sedge and reed canarygrass); and 2) scrub-shrub wetlands found in riparian areas along perennial streams that are composed of willows and alders. It especially uses microhabitats or patches or stringers of tall dense sedges on moist soil along the edge of permanent water. Habitat requirements are characterized by tall (averaging at least 24 inches) dense herbaceous riparian vegetation, composed primarily of sedges and forbs. This suitable habitat is found only when wetland vegetation achieves full growth potential associated with perennial flowing water

The mouse was originally listed as endangered due to the "present or threatened destruction, modification, or curtailment of its habitat or range; the inadequacy of existing regulatory mechanisms; and the natural and manmade factors affecting its continued existence" (Service 2014c:33120). In addition, isolated populations make natural recolonization of impacted areas highly unlikely or impossible in most areas (Service 2014c). Because the species occurs only in areas that are water saturated, populations have a high potential for extirpation when habitat dries due to ground and surface water depletion, draining of wetlands, or drought.

In April 2014, the Service reopened comment on proposed designated critical habitat for the mouse along the Rio Grande Valley (Service 2014d). Areas proposed for critical habitat for the mouse in this unit incorporate the Bosque del Apache National Wildlife Refuge, which is the only habitat believed to be occupied by the subspecies in the Middle Rio Grande with the capability to support its breeding and reproduction. Final designation of critical habitat has not yet occurred.

#### 3.7.4.3.1 Presence

Based on work conducted in support of delta channel maintenance (Reclamation 2013c), the New Mexico meadow jumping mouse is not expected to occur in the study area. Frey and Kopp (2014) completed a preliminary assessment of mouse habitat down to River Mile 38 using GIS-based vegetation mapping and field evaluations of irrigation drains and the Low Flow Conveyance Channel. Mapping did identify potentially suitable habitat (herbaceous and regenerating willow) next to the Low Flow Conveyance Channel. Because of the quality of available data, this was a conservative effort that overestimated the amount of habitat. Further assessment and surveys have not found potentially suitable mouse habitat (Frey and Kopp 2014).

## 3.8 Aquatic Resources and Special Status Fish Species

This section summarizes existing conditions for aquatic habitats, the fish community, and special status fish species in this potentially affected environment. The area of analysis includes the full-pool of Elephant Butte and Caballo Reservoirs, the Rio Grande between the reservoirs, and the Rio Grande downstream of Caballo Dam to diversion facilities for the irrigation districts and the American Diversion Dam. Hydrological modeling simulates reservoir filling and drying affecting aquatic habitats along the Elephant Butte Reservoir delta reach, from River Mile 62 to River Miles 38 to 36, and the Elephant Butte and Caballo Reservoirs. Such habitat changes can affect the numbers and life stage of fish.

### 3.8.1 Regulatory Framework

The same laws applicable to wildlife apply to aquatic species.

### 3.8.2 Data Sources

No original aquatic resource or fish data were collected for the FEIS. Data used to describe existing conditions for aquatic resources and special status fish species in the study/action area include Reclamation sampling surveys for the endangered Rio Grande silvery minnow and habitat, including maps. Additional data were derived from NMDGF reports on sport and game fish species (NMDGF 2015b). Aquatic resource conditions are described through 2014, which marked the baseline for consultation with the Service.

### 3.8.3 Existing Fisheries Conditions

Beyond the irrigation season, except for relatively limited durations of stormflow input from the watershed, the Rio Grande channel between the reservoirs and downstream of Caballo Dam has long periods of low to no flows. The reaches of the Rio Grande below the reservoirs do not develop a sustainable or transient fishery or aquatic community, precluding needs for aquatic life assessment. Consequently, fisheries and other aquatic life resources of concern included in this assessment are limited to those in the delta reach inflows through the full-pool footprints and within the changing wetted perimeters of the two reservoirs.

#### 3.8.3.1 Elephant Butte Reservoir Headwaters

With the drawdown of the water surface elevation since 1995, more than 24 miles of channel formed through the delta reach at Elephant Butte Reservoir, from River Mile 62 to River Miles 38 to 36. Reclamation surveyed fish populations in this channel from 2010 through 2012 (Table 3-2). In 2010, minnows were the most abundant fish collected from this temporary delta channel. They were captured in a variety of habitat types at the four survey sites selected, based on accessibility between River Miles 45.8 and 51.3.

Table 3-2 Fish species collected during September sampling in the temporary channel in Elephant Butte Reservoir, 2010-2012

| | 2010 | | 2011 | | 2012 | |
|---|---|---|---|---|---|---|
| Species | No. | Number per 100 $m^2$ | No. | Number per 100 $m^2$ | No. | Number per 100 $m^2$ |
| Rio Grande silvery minnow | 233 | 24.07 | 65 | 2.83 | 0 | 0 |
| Red shiner | 78 | 6.68 | 219 | 9.53 | 1044 | 29.74 |
| Western mosquitofish | 41 | 3.70 | 26 | 1.13 | 1287 | 36.66 |
| Channel catfish | 24 | 1.93 | 55 | 2.39 | 11 | 0.31 |
| Flathead chub | 2 | 0.30 | 3 | 0.13 | 2 | 0.06 |
| Threadfin shad | 1 | 0.09 | 0 | 0 | 0 | 0 |
| Yellow bullhead | 1 | 0.08 | 0 | 0 | 0 | 0 |
| River carpsucker | 0 | 0 | 7 | 0.30 | 0 | 0 |
| Common carp | 0 | 0 | 0 | 0 | 2 | 0.06 |
| Logperch | 0 | 0 | 0 | 0 | 2 | 0.06 |
| Fathead minnow | 0 | 0 | 0 | 0 | 1 | 0.03 |

Source: Reclamation 2013a; Key $m^2$ = square meters

In 2011, silvery minnow was the second most abundant fish collected; however, overall fish densities were much lower than those observed in 2010. In October 2012, Reclamation sampled four sites from River Miles 46 to 52 and captured seven fish species. No silvery minnows were captured during any of the 2012 field season. Sampling at two sites produced no fish and there were no dry sites. Western mosquitofish were the most abundant, followed by red shiners. Red shiners were distributed evenly across the sites and mosquitofish were slightly more abundant at the downstream sites.

#### 3.8.3.2 Elephant Butte Reservoir

Elephant Butte Reservoir is New Mexico's largest lake and most popular state park for recreation. The fish community is monitored annually, in the spring and fall. The most recent available spring fish electroshocking survey reports provide information for the years 2007 through 2010 and fall experimental gill net surveys for 2007 to 2011 (NNDGF 2012). Ten fish species were reported in these surveys, as follows:

- Smallmouth bass (*Micropterus dolomieu*)
- Largemouth bass (*M. salmoides*)
- Bluegill (*Lepomis macrochirus*)
- Longear sunfish (*Lepomis megalotis*)
- Green sunfish (*L. cyanellus*)
- White crappie (*Pomoxis annularis*)

- Black crappie (*P. nigromaculatus*)
- White bass (*Morone chrysops*)
- Striped bass (*M. saxatilis*)
- Walleye (*Sander vitreus*)

Although based on a relatively small sample size, the collection data for smallmouth bass indicated a relative imbalance, dominated by older, larger fish (NNDGF 2012). The condition was most likely the result of "poor habitat, due to fluctuating water levels during the spring spawn, poor spawning substrate, water clarity, and inadequate forage fish" (NMDGF 2012). In contrast, collection data for largemouth bass indicated that their population had shifted to larger, healthier fish until 2010, when this trend reversed. It appeared that natural recruitment was very low (NMDGF 2012).

Capture rates for other centrarchids (white bass, crappie, sunfish, striped bass, and walleye) were low. Catch data for populations for these fish was inconsistent between years, most likely due to sample bias, inappropriate habitat in the survey sites, and relatively low densities of many of these fish. Overall, Reclamation concluded that habitat quality undoubtedly restricted the abundance of centrarchids at Elephant Butte Reservoir, with the lack of suitable spawning habitat and escape cover attributable to the age of the lake and water use practices (NMDGF 2012).

The fall gill net surveys, conducted during November from 2007 to 2011, found the number of fish captured remained stable (NMDGF 2012). However, gizzard shad, normally the most commonly captured and abundant forage fish, showed a substantial population decrease through the survey period, and with an increase in size, makes the population potentially less available as forage. Blue catfish became the most abundant fish in the reservoir based on percent captured data, with their abundance more than doubling from 2009 to 2011. The relative abundance of both striped bass and white bass declined appreciably throughout the survey period.

Table 3-3 Fish in Elephant Butte Reservoir, 2014

| Name | Number | % Caught | % Biomass |
|---|---|---|---|
| Blue catfish | 597 | 52.09 | 27.08 |
| Gizzard shad | 207 | 18.06 | 9.38 |
| Smallmouth buffalo | 98 | 8.55 | 42.05 |
| Channel catfish | 48 | 4.19 | 1.26 |
| Common carp | 29 | 2.53 | 6.01 |
| Walleye | 23 | 2.01 | 4.95 |
| White bass | 18 | 12.04 | 7.34 |
| Striped bass | 1 | 0.09 | 1.71 |
| Largemouth bass | 1 | 0.09 | 0.18 |
| Freshwater drum | 1 | 0.09 | 0.03 |
| Longear sunfish | 1 | 0.09 | 0.01 |
| Bluegill | 1 | 0.09 | 0.01 |
| Threadfin shad | 1 | 0.09 | 0.01 |

Source: Mammoser (2015).

Table 3-3 provides data from the 2014 fall fish community gill net survey in Elephant Butte Reservoir. Blue catfish, gizzard shad, white bass, smallmouth buffalo, channel catfish, common carp, and walleye comprised most of the surveyed fish community; all other species accounted for less than 2 percent of the fish caught (Mammoser 2015).

From a fish community perspective, Elephant Butte Reservoir suffers from age and management practices that have been, and will continue to be, detrimental to some species while benefitting others" (New Mexico Department of Game and Fish [NMDGF] 2012). Present day management of the fishery populations is viewed to be affected by yearly fluctuating water levels due to irrigation demands and poor habitat created by severe drought conditions; centrarchid populations (e.g., bass and sunfish) are much below state management objectives (NMDGF 2011).

The lack of submerged vegetation in the reservoir has limited the recruitment and survivorship of bass. The absence of vegetation to help filter suspended particulates, reduce the water's turbidity, and stabilize the lake's banks negatively affects many fish species, including white, largemouth, and smallmouth bass, which tend to avoid turbid areas. In contrast, other fish species, like blue catfish, can tolerate increased turbidity, with populations quadrupling in Elephant Butte Reservoir in recent years, while channel catfish populations have markedly declined.

#### *3.8.3.3 Caballo Reservoir*

Caballo Reservoir fishery data come from experimental gill net surveys in mid-November 2008 (NMDGF 2012). At that time due to very low water levels in the reservoir, only three randomly selected sites were sampled. Catfish and walleye were the main game species captured, representing most of the community in percent captured and percent of biomass. Walleye, catfish, and white bass are the primary species targeted by anglers in the reservoir.

Gizzard shad represented 17.5 percent of the fish captured in 2008, a percent similar to those captured in 2006. The capture data indicate a well-balanced population with moderate recruitment (NMDGF 2012). Walleye represented 27 percent of the 2008 fish captured. Walleye fry have been stocked in Caballo Reservoir every year since 2007. While their capture number was lower than in 2004 and 2006, their population remained abundant. Their population size reduction was attributed to the decrease in lake levels and the increase in the percent catch of blue catfish. Blue catfish capture numbers increased in 2008 from previous surveys in 2004 and 2006, and they had become the dominant game fish in 2008. The report suggested that water level effects on habitat conditions likely dictate which species are more prevalent each year.

### 3.8.4 Special Status Species, Rio Grande Silvery Minnow

The Rio Grande silvery minnow is the only ESA-listed fish species present in the study area. The Rio Grande silvery minnow was listed as endangered in 1994 (Service 1994, 59 Fed. Reg. 36988). Silvery minnows are pelagic spawners,[6] producing numerous semi-buoyant, non-adhesive eggs. Most spawning typically has been observed in the spring, from late April through June, accompanying the period of snowmelt runoff (Reclamation 2012c). Spawning also has been observed during runoff following summer monsoons. Both juvenile and adult minnows primarily use meso-habitats with moderate depths (15 to 40 centimeters), low water velocities (4 to 9 centimeters per second), and silt/sand substrates. During the winter, these minnows become less active and seek habitats with cover, such as debris piles and other areas with low water velocities.

During spring sampling, large concentrations of reproductively mature silvery minnows are often collected on inundated lateral overbank habitats (Hatch and Gonzales 2008). Further study is

[6] They lay their eggs in open water

needed to determine whether minnows exhibit preferential use of lateral habitat (including overbank) for spawning. Surveys of inundated overbank habitats often have captured large numbers of gravid females and ripe male minnows (Gonzales and Hatch 2009).

#### *3.8.4.1 Threats*

According to the Service (2010, 75 Fed. Reg. 7625 and 1994:36988), decline of the fish is due to destruction and modification of its habitat due to dewatering and diversion of water, water impoundment (including Elephant Butte and Caballo Dams), and modification of the river (channelization). Competition and predation by non-native species, water quality degradation, and other factors have contributed to its status as endangered.

Silvery minnow populations remain at risk in the Rio Grande due to:

- Channel drying and the lack of suitable perennial refugia habitat during the irrigation season and periods of drought, leading to complete desiccation of potential habitat for minnows
- The lack of abundant feeding habitat consisting of channel flows less than a half a foot per second, and high flow velocities suspending and scouring away potential benthic and other attached food supplies for minnows, decreasing survival
- Floodplain habitats that fail to connect and inundate during spawn-stimulating flows, stranding minnow eggs and developing fry in high-velocity channel flows that have long been known to produce very high to total mortality of eggs and developing fry in small-bodied fish species (Harvey 1987)

#### *3.8.4.2 Critical Habitat*

The Service (2003, 68 Fed. Reg. 8087) designated critical habitat for the Rio Grande silvery minnow from the San Acacia Diversion Dam to the headwaters of Elephant Butte Reservoir at River Mile 62. The lateral extent of critical habitat was defined as areas bounded by levees, or in areas without levees, 300 feet of riparian zone adjacent to each side of the river (Service 2003:8119). Areas other than the Rio Grande, including the study area, were excluded from the designation of critical habitat for silvery minnow under Section 4(b)(2) of the ESA.

#### *3.8.4.3 Presence*

Historically, silvery minnows were distributed throughout most of the Rio Grande, from near the Gulf of Mexico to the upper reaches of both the Pecos River and the Rio Grande, reaching into the Rio Chama. The only reach in the FEIS study area where silvery minnows currently occur is in the channel through the Elephant Butte delta reach from River Mile 62, extending south to the active pool at approximately River Miles 38 to 36; i.e., at the headwaters of Elephant Butte Reservoir.

## 3.9 Invasive Species

An invasive species as defined by Executive Order 13112 is a species that is non-native or alien to the ecosystem and whose introduction is likely to cause economic or environmental harm or harm to human health.

### 3.9.1 Regulatory Framework

Authorities for combating the introduction or spread of invasive species are:

- Executive Order 13112
- New Mexico Noxious Weed Control Act

- New Mexico Aquatic Invasive Species Control Act
- Texas Agricultural Code Chapter 71, Subchapters D and T

### 3.9.2 Existing Invasive Species Conditions

According to the NMDA (2009) and U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (2015), invasive species within the project area are mostly noxious weeds, or plants that are not native, that are targeted for management and control, and that have a negative impact on the economy or the environment. The New Mexico State Noxious Weed List suggests the potential presence of the following noxious weeds:

- Five Class A species—camelthorn (*Alhagi maurorum*), hoary cress/whitetop (*Cardaria* spp.), parrot feather watermilfoil (*Myriophyllum aquaticum*), ravennagrass (*Saccharum ravennae*), and Scotch cottonthistle (*Onopordum acanthium*)
- Five Class B species—African rue (*Peganum harmala*), Malta starthistle (*Centaurea melitensis*), perennial pepperweed (*Lepidium latifolium*), Russian knapweed (*Acroptilon repens*), and tree of heaven (*Ailanthus altissima*)
- Six Class C species—cheatgrass (*Bromus tectorum*), field bindweed (*Convolvulus arvensis*), jointed goatgrass (*Aegilops cylindrical*), Russian olive (*Elaeagnus angustifolia*), saltcedar (*Tamarix* spp.), and Siberian elm (*Ulmus pumila*)
- Four watch list species—crimson fountaingrass (*Pennisetum setaceum*), giant cane (*Arundo donax*), Sahara mustard (*Brassica tournefortii*), and spiny cocklebur (*Xanthium spinosum*)

In Texas, noxious weeds identified as particularly worrisome invasive species in the Trans-Pecos ecoregion and study area are camelthorn (*Alhagi maurorum*), field bindweed (*Convolvulus arvensis*), giant reed (*Arundo donax*), Japanese dodder (*Cuscuta japonica*), and tamarisk or saltcedar (*Tamarix ramosissima*).

As mentioned in Section 3.6.4, the release of tamarisk leaf beetle (*Diorhadba* spp.) at locations along the Rio Grande in Texas is expected to result in the defoliation of saltcedar as the beetles arrive in Elephant Butte and Caballo Reservoirs.

Quagga mussels (*Dreissena bugensis)* were discovered in Nevada in 2007 and have subsequently spread throughout the west. Zebra mussels (*Dreissena polymorpha*) were documented in California in 2008 and they have also been spreading throughout Western waters. NMDGF has recently adopted new rules to combat the spread of invasive mussels and other aquatic invasive species. In Texas, six lakes are infested with zebra mussels. At this time, Elephant Butte and Caballo Reservoirs are mussel-free.

## 3.10 Cultural Resources

Cultural resources refer to historic and prehistoric buildings, structures, sites, objects, districts, Indian sacred sites, and resources of tribal concern. Historic properties are the subset of cultural resources listed on or eligible for listing on the National Register of Historic Places. The study area or area of potential effects for cultural resources includes Elephant Butte and Caballo Dams and Reservoirs, the Rio Grande floodplain between the two reservoirs, and the Rio Grande below Caballo Dam to the El Paso-Hudspeth County line.

### 3.10.1 Regulatory Framework

The principal Federal law addressing cultural resources is the NHPA (54 USC 306108), formerly known as Section 106. Its implementing regulations are found at 36 CFR 800. These require Federal agencies to take into account the effects of their actions on historic properties and to allow the Advisory Council on Historic Preservation an opportunity to comment. Executive Order 13007 requires consultation with Indian tribes regarding Indian sacred sites. The executive memorandum from the White House of April 29, 1994, requires government-to-government consultation on issues of tribal concern that may include cultural resources.

### 3.10.2 Existing Conditions

Listed historic properties in the area of potential effects of this undertaking include Elephant Butte Dam, the diversion dams, and the Franklin Canal. Other historic properties are the Garfield Lateral (LA-111726), Pittsburg Placer Mine (LA-13557), a Mogollon pithouse site (LA-2806), and an Apache battle site (LA-132559). Class III surveys of the Elephant Butte and Caballo Reservoirs were conducted in 1998 and 1999 and there are archaeological resources in the reservoir pools (Reclamation 2013a).

As part of the tribal consultation supporting the SEA, the Mescalero Apache Tribe expressed concerns with native plants growing along the irrigation canals in the service areas of EBID and EPCWID. The Mescalero Tribe collects plant material for cultural purposes.

For this undertaking, Reclamation consulted with the New Mexico State Historic Preservation Officer and they concurred with Reclamation's determination of "no historic properties affected" (Appendix D). In addition, Reclamation consulted with the Mescalero Apache Tribe and Ysleta del Sur, but they did not identify any resources or issues of concern.

## 3.11 Indian Trust Assets

Indian trust assets (ITAs) are legal interests in property held in trust by the U.S. for Federally-recognized Indian tribes or individual Indians.

### 3.11.1 Regulatory Framework

Management of ITAs is based on the several policies:

- Secretarial Order No. 3175, Departmental Responsibilities for Indian Trust Resources
- Secretarial Order No. 3206, American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the ESA
- Secretarial Order No. 3215, Principles for the Discharge of the Secretary's Trust Responsibility
- Departmental Manual 512 DM Chapter 2, Departmental Responsibilities for Indian Trust Resources
- Indian Policy of Reclamation

### 3.11.2 Data Sources

No ITAs have been identified in the project area through consultation with Indian tribes or the Bureau of Indian Affairs.

## 3.12 Socioeconomics

The study area for socioeconomics includes Doña Ana and Sierra Counties, New Mexico, and El Paso and Hudspeth Counties, Texas. A small portion of Elephant Butte Reservoir is in Socorro County; however, no RGP-irrigated lands are in this county so it is not included in the socioeconomic study area. Recreation facilities associated with Elephant Butte Reservoir are in Sierra County.

### 3.12.1 Regulatory Framework

The NEPA and its implementing regulations are the authorities requiring analysis of socioeconomics.

### 3.12.2 Data Sources

Data sources include the U.S. Department of Commerce, Bureau of Economic Analysis (2014, 2015)), U.S. Department of Labor (2015), Census of Agriculture (USDA 2014), U.S. Department of Commerce Bureau of Economic Analysis (2015), and IMPLAN (2013).

### 3.12.3 Existing Conditions, Farm Employment and Income

Indicators include employment, labor income, and output. According to the U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Accounts (2014), during the years from 1970 to 2014, farm employment in the four counties shrank from 5,230 to 4,792 jobs, an 8.4 percent decrease, while non-farm employment grew from 174,608 to 510,948 jobs, a 192.6 percent increase. In 2014, Hudspeth County, Texas had the largest percent of total farm employment (11.9 percent), and El Paso County, Texas had the smallest (0.23 percent).

From 1970 to 2014, farm earnings grew from $141.0 million to $171.6 million, a 21.6 percent increase, while non-farm earnings grew from $7,114.2 million to $22,993.0 million, a 223.2 percent increase. In 2014, Hudspeth County, Texas had the largest percent of total earnings from farm earnings (11.52 percent), and El Paso County had the smallest (0.04 percent).

From 1970 to 2014, net income, including corporate farms, grew from $77.6 million to $84.2 million, an 8.5 percent increase. During this period, cash receipts from crops grew from $214.3 million to $301.7 million, a 40.8 percent increase.

### 3.12.4 Existing Conditions, Industry Output

Industry output or sales represent the value of goods and services produced by businesses within a sector of the economy. The New Mexico study area (Doña Ana and Sierra Counties) had $12.1 billion in industry output. The Texas study area (El Paso and Hudspeth Counties) had $2.866.6 billion in industry output. The service sectors make up the largest percentage of industry sales in both study areas. Non-service-related industries make up the second largest portion of total output. Agriculture makes up 4.4 percent and 0.9 percent of total output in the New Mexico and Texas study areas, respectively. Table 3-4 summarizes the percent of output by industry.

Table 3-4 Percent of total output by industry

| | Doña Ana and Sierra Counties, New Mexico | El Paso and Hudspeth Counties, Texas |
|---|---|---|
| **Non-Service Industries** | **28.8%** | **44.2%** |
| Agriculture, Forestry, Fishing, and Hunting | 4.4% | 0.9% |
| Mining | 0.3% | 5.8% |
| Utilities | 2.9% | 2.3% |
| Construction | 7.4% | 6.1% |
| Manufacturing | 13.8% | 29.1% |
| **Service Industries** | **54.1%** | **49.6%** |
| Wholesale trade | 2.4% | 5.4% |
| Retail trade | 5.3% | 4.2% |
| Transportation and warehousing | 2.7% | 3.5% |
| Information | 2.9% | 3.6% |
| Finance and insurance | 3.7% | 5.6% |
| Real estate and rental | 10.6% | 7.7% |
| Professional, scientific, and technical services | 7.1% | 5.8% |
| Management of companies | 0.1% | 0.9% |
| Administrative and waste services | 2.4% | 2.4% |
| Educational services | 0.4% | 0.5% |
| Health and social services | 9.3% | 4.8% |
| Arts, entertainment, and recreation | 0.9% | 0.5% |
| Accommodation and food services | 3.8% | 2.5% |
| Other services | 2.6% | 2.2% |
| **Government** | **17.1%** | **6.2%** |
| Government and other | 17.1% | 6.2% |

Source: IMPLAN (2013).

Table 3-5 Farmland by type by county, 2012

| Farmland | Doña Ana | Sierra | El Paso | Hudspeth |
|---|---|---|---|---|
| Number of farms | 2,184 | 256 | 657 | 167 |
| Land in farms (acres) | 659,970 | 1,250,136 | 209,393 | 2,251,109 |
| Average farm size (acres) | 302 | 4,883 | 319 | 13,480 |
| Approximate land area (acres) | 2,437,000 | 2,674,533 | 648,206 | 2,925,329 |
| Approximate percent of land area in farms | 27.1 | 46.7 | 32.3 | 77 |

Source: U.S. Department of Agriculture, National Agricultural Statistics Service, Census of Agriculture (2014b).

Table 3-6 Number of farms by type and county, 2012

| Farms by type | Doña Ana | Sierra | El Paso | Hudspeth |
|---|---|---|---|---|
| All Farms | 2184 | 256 | 657 | 167 |
| Oilseed & grain | 14 | 0 | 1 | 0 |
| Vegetable & melon | 64 | 9 | 0 | 4 |
| Fruit & nut tree | 1310 | 24 | 193 | 0 |
| Greenhouse, nursery | 29 | 0 | 2 | 3 |
| Other crop | 356 | 67 | 225 | 52 |
| Beef cattle ranch, farm | 123 | 110 | 57 | 74 |
| Animal, all types | 288 | 46 | 179 | 34 |
| Percent of Total | | | | |
| Oilseed & grain | 0.6% | 0.0% | 0.2% | 0.0% |
| Vegetable & melon | 2.9% | 3.5% | 0.0% | 2.4% |
| Fruit & nut tree | 60.0% | 9.4% | 29.4% | 0.0% |
| Greenhouse, nursery | 1.3% | 0.0% | 0.3% | 1.8% |
| Other crop | 16.3% | 26.2% | 34.2% | 31.1% |
| Beef cattle ranch, farm | 5.6% | 43.0% | 8.7% | 44.3% |
| Animal, all types | 13.2% | 18.0% | 27.2% | 20.4% |

Source: U.S. Department of Agriculture, National Agricultural Statistics Service, Census of Agriculture (2014b).

### 3.12.6 Agricultural Conditions, Farmland and Type

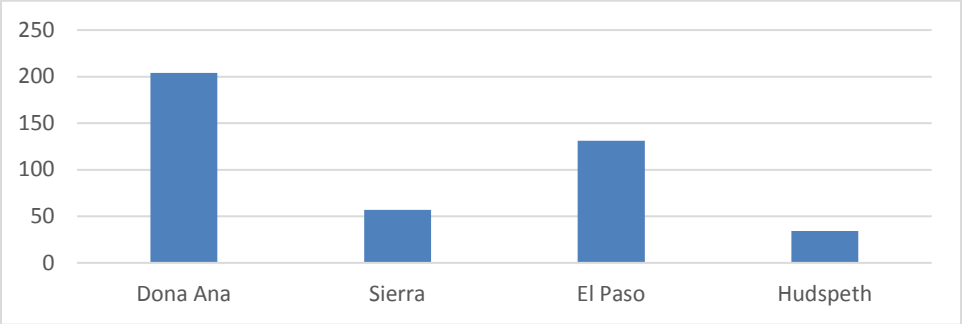
Table 3-5 presents statistics for agricultural conditions in the four-county study area in 2012. As shown, Hudspeth County had the largest percent of land area in farms (77 percent) while Doña Ana County had the smallest (27.1 percent). In the four-county study area, some 50.3 percent of the land was in farms in 2012. Table 3-6 presents the number and percentage of farms by type. As shown, in 2012, Hudspeth County has the smallest number or percent of oilseed and grain farming and the largest percent of beef cattle ranching and farming (44.3 percent) and Dona Ana County had the smallest percent in beef cattle ranching and farming (5.6 percent).

### 3.12.7 Population Growth and Income

According to the U.S. Department of Commerce, Bureau of Economic Analysis (2015) and as shown in Fig. 7, between 1970 and 2014, Doña Ana County, New Mexico had the largest percent change in population (204 percent) and Hudspeth County, Texas has the smallest (34 percent). During this period, the population of the four county study area increased by 141 percent and the population of the U.S. increased by 56 percent.

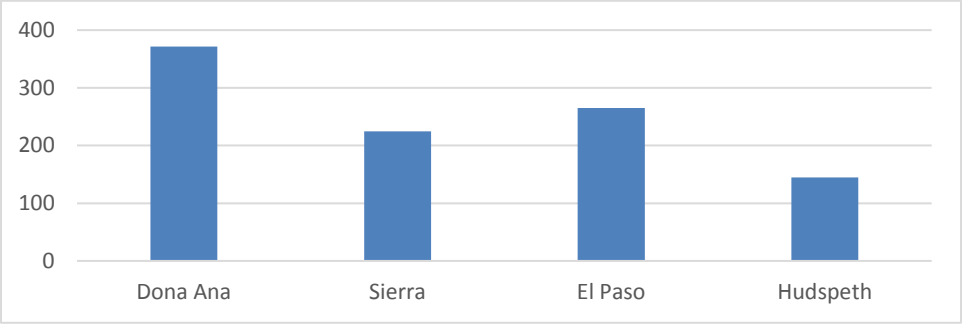
As shown in Fig. 8, between 1970 and 2014, Doña Ana County, New Mexico had the largest percent change in personal income (372 percent) and Hudspeth County, Texas had the smallest (145 percent). During this period, the change in personal income in the four county study area was 281 percent and the change in the U.S. was 182 percent.

Figure 7. Percent change in population by county, 1970 – 2014.




Source: U.S. Department of Commerce, Bureau of Economic Analysis (2015)

Figure 8. Percent change in personal income, percent change, 1970 – 2014.




Source: U.S. Department of Commerce, Bureau of Economic Analysis (2015)

## 3.13 Hydropower

### 3.13.1 Regulatory Framework

Energy requirements and conservation potential are required analyses under the CEQ's regulations at 40 CFR 1502.16.

### 3.13.2 Data Sources and Existing Conditions

The hydroelectric plant at Elephant Butte Dam generates power that is dependent on flow volume and head. Power production does not occur during the winter when RGP releases do not occur; hydropower calculations are based on the calculated average elevation from March to October only.

The Elephant Butte Powerplant has a rated head of 140 feet and is assumed to operate with 90 percent efficiency. Energy generation is calculated from reservoir elevation, with the rated head achieved at the maximum elevation over the study period and the potential energy conversion of 1.024 kilowatt-hours per acre-foot per foot of head. Calculated production based on the average March to October monthly elevation and release data for 2014 is 3 percent below the actual powerplant production of 13.4 gigawatts per hour (Gwh) reported by Reclamation (2015b).

## 3.14 Recreation

### 3.14.1 Regulatory Framework

The NEPA and its implementing regulations are the primary authorities requiring analysis of economic resources, including contributions of the travel and tourism sector to the regional economy.

### 3.14.2 Data Sources

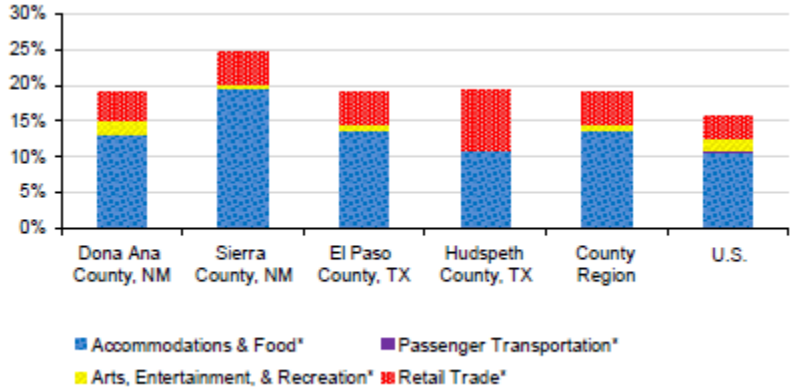
Data on recreation, or travel and tourism, are from the U.S. Department of Commerce, Census Bureau (2015b).

### 3.14.3 Existing Conditions

In 1998, travel and tourism represented 16 percent of total employment in the four counties. By 2013, travel and tourism represented 19 percent of total employment. From 1998 to 2013, travel and tourism employment grew from 36,584 to 51,346 jobs, a 40.4 percent increase (U.S. Department of Commerce, Census Bureau 2015b).

In 2014, Fig. 9 shows that Sierra County, New Mexico had the largest percent of total jobs in industries that include travel and tourism. In 2014, accommodations and food was the largest component of travel and tourism-related employment (13.6 percent of total jobs) in the four county study area.

Figure 9. Travel and tourism industries by county (percent of total private employment), 2014.




Source: U.S. Department of Commerce, Census Bureau (2015b)

## 3.15 Environmental Justice

### 3.15.1 Regulatory Framework

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, directs Federal agencies to identify and address disproportionately high and adverse effects of its programs and activities on minority and low-income populations.

### 3.15.2 Data Sources

Guidelines provided by the CEQ (1997) and the Federal Interagency Working Group (2016) indicate minority communities may be defined where minorities comprise more than 50 percent of the population. Minorities include people who self-identify as Hispanic, Black or African-American, American Indian, Asian, Native Hawaiian, or some other race alone or combined. In this FEIS, the study area is the four counties, Doña Ana, Sierra, El Paso, and Hudspeth. The CEQ and Federal Interagency Working Group (2016) guidelines indicate that low-income communities may be defined following the Office of Management and Budget's Directive 14 poverty thresholds which vary by family size.

### 3.15.3 Low-income Populations

Table 3-7 presents the number and percent of people living in poverty during the 2010-2014 period. While none of the counties had half of their population living below the poverty threshold, based on a comparison of the percent of individuals living below the poverty threshold to the total county percentage (24.3 percent), Doña Ana County had slightly more persons living in poverty (27.8 percent), while Hudspeth County had the highest estimated percent of persons living below the poverty threshold (43.2 percent).

For families, 20.6 percent of the County families were living below the poverty threshold. Doña Ana County had slightly more than that (21.8 percent) and Hudspeth County had the highest estimated percent of families living below the poverty threshold (33.8 percent). These statistics define Doña Ana and Hudspeth Counties as environmental justice communities based on their comparatively high percentages of low-income persons or families.

Table 3-7 Poverty by county, 2010-2014

| | Doña Ana | Sierra | El Paso | Hudspeth |
|---|---|---|---|---|
| People | 207701 | 11486 | 809165 | 3017 |
| Families | 51778 | 2467 | 194230 | 742 |
| People below poverty | 57837 | 2037 | 189586 | 1303 |
| Families below poverty | 11304 | 235 | 39622 | 251 |
| Percent of Total | | | | |
| People below poverty | 27.8 | 17.7 | 23.4 | 4302 |
| Families below poverty | 21.8 | 9.6 | 20.4 | 33.8 |

Source: U.S. Department of Commerce, Census Bureau, American Community Survey Office. (2015a). Key: Calculated using average ACS annual surveys during 2010-2014.

### 3.15.4 Minority Populations

In the 2009-2014 period, Table 3-8 shows Doña Ana, El Paso, and Hudspeth Counties had more than 50 percent of the population self-identifying as Hispanic or Latino. Hispanic or Latino refers to a cultural identification, not a race. In the 2009-2014 period, El Paso County, Texas had the highest estimated percent of the population that self-identify as Hispanic or Latino of any race (81.4 percent). This makes these three counties environmental justice communities.

Table 3-8 Minority populations by county, 2009- 2014

| | Doña Ana | Sierra | El Paso | Hudspeth |
|---|---|---|---|---|
| Total Population | 212,942 | 11,774 | 823,862 | 3,344 |
| Hispanic of any race | 141,087 | 3,394 | 670,946 | 2,634 |
| White alone | 62,649 | 7,929 | 110,287 | 671 |
| Black alone | 3,223 | 26 | 24,393 | 23 |
| American Indian alone | 1,702 | 120 | 2,177 | 0 |
| Asian alone | 2,291 | 113 | 8,331 | 16 |
| Pacific Islander alone | 12 | 0 | 1,014 | 0 |
| Some other race | 154 | 366 | 697 | 0 |
| Two or more races | 1,824 | 192 | 6,017 | 0 |
| | | | | |
| Percent of Total | | | | |
| Hispanic of any race | 66.3 | 28.8 | 81.4 | 78.8 |
| White alone | 29.4 | 67.3 | 13.4 | 20.1 |
| Black alone | 1.5 | 0.2 | 3 | 0.7 |
| American Indian alone | 0.8 | 1 | 0.3 | 0 |
| Asian alone | 1.1 | 1 | 1 | 0.5 |
| Pacific Islander alone | 0 | 0 | 0.1 | 0 |
| Some other race | 0.1 | 0 | 0.1 | 0 |
| Two or more races | 0.9 | 1.6 | 0.7 | 0 |

Source: U.S. Department of Commerce, Census Bureau, American Community Survey Office (2015a.)

# 4 Environmental Consequences

This FEIS is not intended to review the existence of the RGP or its historical operations; the focus is on how the alternatives described in Chapter 2 might change the water resources, biological, cultural, and socioeconomic resources in the study area. The temporal scope of the analysis and the proposed action extends to 2050. As such, the analyses in this chapter are based on modeling of RGP operations under each alternative through 2050 using an integrated hydrologic and water operations model. Model results are subsequently used as inputs to the evaluation of potential changes to other resources. Modeling of future RGP operations incorporates assumptions regarding future climatic and hydrologic conditions, cropping and irrigation practices, and M&I water demands. This chapter begins with a summary of the hydrologic model developed to assess the effects of the alternatives on water resources.

## 4.1 Water Resource Modeling Methods and Assumptions

Analyses of potential environmental consequences presented in this chapter are based on simulations of future RGP operations through the year 2050, including the storage, release, and delivery of surface water for beneficial use to EBID, EPCWID, and to Mexico under the Convention of 1906. These simulations were carried out using the Rincon and Mesilla Basins Hydrologic Model (RMBHM), as described in this section and Appendix C.

As discussed in Chapter 1, previous studies indicate a strong interaction between the Rio Grande and underlying groundwater aquifers, particularly in the Rincon and Mesilla basins (Conover 1954, Hanson et al. 2013, Haywood and Yager 2003, SSPA 2007). Groundwater pumping in the Rincon and Mesilla Basins results in depletion (capture) of surface-water supplies, including increased seepage losses from the Rio Grande as well as decreased drainage and return flows from irrigated lands. Depletion of RGP surface-water supplies, in turn, increases the amount of water that must be released from storage to meet delivery orders from EBID, EPCWID, and Mexico, and ultimately reduce the amount of RGP surface water that can be delivered to project diversion points (headings). Conversely, RGP operations affect the timing, distribution, and volume of groundwater recharge that occurs as seepage from the Rio Grande and unlined canals and laterals and as deep percolation of applied irrigation water. Simulation of future RGP operations therefore requires an integrated modeling approach capable of representing RGP operations, groundwater demand and use, and groundwater/surface-water interactions between Caballo Dam and the RGP's downstream-most diversion point at International Dam.

The RMBHM was developed by Reclamation in collaboration with USGS to allow for simulation of RGP operations under the five alternatives described in Chapter 2, while accounting for the role of groundwater/surface-water interactions on RGP operations and surface-water and groundwater resources. The RMBHM builds on previous hydrologic models of the Rincon and Mesilla Basins (SSPA 2007) and the USGS (Hanson et al. 2013). The RMBHM uses the One-Water Hydrologic Flow Model (MF-OWHM; Hanson et al. 2013), an integrated hydrologic modeling software based on the USGS Modular Groundwater Model, MODFLOW. To simulate RGP operations under each alternative, the MF-OWHM was enhanced with additional software features. These features, developed and implemented by Reclamation in collaboration with the USGS (Ferguson et al. 2014), allow for dynamic simulation of storage, allocation, release, and diversion of RGP surface water supplies according to specified allocation and accounting procedures.

The RMBHM is used to simulate RGP operations and corresponding surface-water and groundwater resources under each alternative, including surface water storage in Elephant Butte and Caballo Reservoirs; allocations to EBID, EPCWID, and Mexico; releases from Caballo Dam; and diversions to EBID, EPCWID, and Mexico at their respective diversion points (headings). A spreadsheet post-processing tool was subsequently used to calculate the maximum volume of San Juan–Chama Project water in Elephant Butte Reservoir under each alternative on a monthly basis. All alternatives were simulated under a common set of future climatic and hydrologic conditions. Model results were post-processed and compiled to facilitate comparison of RGP operations and surface water and groundwater resources under the alternatives.

Details of the RMBHM are provided in Appendix C, Hydrology Technical Memo. Model configuration and inputs to RMBHM for the FEIS are summarized below, along with verification of RMBHM with respect to simulation of historical RGP operations. Assumptions regarding future climatic and hydrologic conditions, cropping and irrigation practices, and municipal and industrial water demands and uses are also summarized below.

### 4.1.1 Model Configuration

Model configuration refers to the extent and discretization of the simulated area (spatial domain) and simulation period (temporal domain), as well as the specified physical and hydraulic properties (constant parameters) of the Rincon and Mesilla Basins. The spatial domain of RMBHM extends from Caballo Dam at the northern end of the Rincon Valley to below American Dam at the southern end of the Mesilla Valley. The spatial domain is discretized using a uniform horizontal grid, with each grid cell encompassing 0.25 miles by 0.25 miles (1320 feet by 1320 feet, equal to 40 acres), and five vertical layers of varying thickness. The spatial domain and discretization used by RMBHM are identical to previous models (SSPA 2007) and USGS (Hanson et al. 2013).

For the FEIS, the temporal domain of RMBHM extends from the start of the 2007-2008 non-irrigation season (November 1, 2007) through the end of the 2050 irrigation season (October 31, 2050). There are 43 years in the simulation. Each simulated year is divided into a non-irrigation season from November through February (120.25 days) and an irrigation season from March through October (245 days). Each season is simulated using approximately monthly time step, with four time-steps of equal length during each non-irrigation season and eight time-steps of equal length during each irrigation season. Model results are output for 516 approximately monthly time steps. Representation of the simulation period based on irrigation and non-irrigation seasons is consistent with previous models (SSPA 2007) and USGS (Hanson et al. 2013); however, previous models used four time steps of varying length for each season rather than the monthly time steps used by RMBHM.

RMBHM requires constant parameters representing physical and hydraulic properties throughout its spatial domain, including subsurface properties (e.g., aquifer hydraulic conductivity, specific storage, and yield), channel properties (e.g., hydraulic conductivity of channel beds, channel slope and geometry, and channel roughness), and vegetation-related parameters (e.g., soil properties, root profiles). RMBHM also requires parameters related to irrigation practices, including on-farm irrigation efficiency. The majority of constant parameters used in RMBHM are identical to those used in the previous model by USGS (Hanson et al. 2013). Parameters related to subsurface and channel bed hydraulic conductivities, aquifer specific storage and specific yield, capillary fringe depth, and on-farm irrigation efficiency were adjusted on a trial-and-error basis during model evaluation to provide better agreement between simulated and observed reservoir storage, releases, and diversions as summarized in Appendix C.

### 4.1.2 Model Inputs

Model inputs refer to specified time-varying values representing hydrologic, climatic, and anthropogenic stressors to the surface-water and groundwater systems over the simulated area. Hydrologic stressors in RMBHM include surface water inflows to RGP storage. Climatic stressors include reservoir precipitation and evaporation rates and climate factors affecting irrigation demands (e.g., precipitation and temperature). Anthropogenic stressors include human factors affecting irrigation demands (e.g., cropping patterns and irrigated acreage), as well as on-farm irrigation efficiency of agricultural lands, M&I groundwater pumping rates and locations, and discharge of treated effluent from municipal wastewater treatment facilities.

In addition to hydrologic, climatic, and anthropogenic stressors, the storage and relinquishment of Rio Grande Compact credit water in Elephant Butte Reservoir is represented as a time-varying input. The amount of water available for allocation and release by the RGP is equal to the total RGP storage less any non-project water in storage, including Rio Grande Compact credit water. The amount of credit water in Elephant Butte Reservoir at any given time is determined according to Rio Grande Compact accounting procedures, which are not represented in RMBHM. The volume of compact credit water in Elephant Butte Reservoir must therefore be specified for each time step as an input to RMBHM. Certain provisions of the Rio Grande Compact may affect reservoir storage and releases upstream of Elephant Butte Reservoir—and thus inflows to Elephant Butte Reservoir—when RGP storage falls below a specified threshold. RMBHM does not consider the potential feedbacks under the Rio Grande Compact between RGP operations, storage in Elephant Butte Reservoir, and reservoir operations upstream of Elephant Butte Reservoir.

The simulation period for the FEIS extends through November 1, 2050. Model inputs are therefore based on projected future conditions, rather than observed historical conditions. It is not possible to reliably predict the year-to-year and month-to-month evolution of climate and hydrologic conditions through the end of the simulation period, such as the timing, duration, and severity of wet and dry periods. Similarly, it is not possible to reliably predict future cropping and irrigation practices or changes in future municipal, industrial and domestic (collectively referred to as M&I) water demands. Therefore, model inputs for the FEIS were based on a combination of recent historical conditions and projections of effects of future climate change.

Model inputs representing hydrologic and climate stressors over the simulation period were obtained from previous analyses carried out by Reclamation and others as part of the West Wide Climate Risk Assessment (WWCRA; Reclamation 2011a, 2011b) and Upper Rio Grande Impact Assessment (URGIA; Reclamation 2013d). Projections of monthly precipitation and temperature throughout the simulation area were obtained from downscaled projections of future climate developed as part of WWCRA (see Reclamation 2011a, 2011b). Projections of monthly inflows to Elephant Butte Reservoir and monthly reservoir precipitation and evaporation were obtained from simulations carried out for URGIA with the Upper Rio Grande Simulation Model (URGSim; Roach 2007). Analyses of future climate change and its impacts on surface water supplies and management in the upper Rio Grande Basin carried out by WWCRA and URGIA are based on a set of 112 projections of future climate conditions. Three sets of model inputs were developed to represent the range of projected climate and hydrologic conditions over the simulation period, including one representing the drier end of the projected range, one representing the wetter end, and one representing the central tendency (median). Climate projections consistently indicate drier conditions over the Rio Grande Basin over the simulation period; as a result, the average annual inflow to Elephant Butte Reservoir over the simulation period is less than the observed average annual inflow over the past several decades, even under the scenario representing the wetter end of the projected range of future conditions. Additional

details regarding model inputs representing future climate and hydrologic conditions are provided in Appendix C and references therein.

Model inputs representing future M&I water uses were based on recent estimates of M&I groundwater pumping within the simulated area. All M&I demand within the simulated area is met by groundwater. Estimates of M&I groundwater pumping exist through 2004 (SSPA 2007) and were subsequently updated through 2009 by USGS (Hanson et al. 2013). For the FEIS, model inputs representing future M&I groundwater pumping were developed based on average annual M&I pumping over the period 2000-2009. See Section 4.1.4 for additional discussion of assumptions regarding future M&I water uses.

Lastly, model inputs representing future irrigation demands throughout the simulated area were developed based on recent estimates of consumptive irrigation requirements[7] for the water year 2000 irrigation season, adjusted based on projected changes in reference evapotranspiration ($ET_0$) and effective precipitation. Projected changes in $ET_0$ and effective precipitation were calculated from projected monthly precipitation and temperature from the three climate projections selected for the FEIS. Additional details regarding model inputs representing future irrigation demands are provided in Appendix C. See Section 4.1.4 for additional discussion of assumptions regarding future irrigation demands.

### 4.1.3 Model Evaluation

The suitability of RMBHM for simulating RGP operations and their interaction with surface-water and groundwater resources in the Rincon and Mesilla Valleys was evaluated by simulating RGP operations under historical hydrology, climate, and cropping conditions for the period 1960-2009 and comparing simulation results to observed historical operations during this period. Historical hydrology and climate conditions were represented through time-varying model inputs, including historical inflows to Elephant Butte Reservoir, historical reservoir precipitation and evaporation rates, and historical crop irrigation requirement computed based on historical meteorology, crop distribution, and irrigated acreage data. For evaluation purposes, historical project operations were represented by implementing a consistent set of project allocation and accounting procedures representative of historical operations for the period 1990-2006. It should be noted that RMBHM uses a fixed set of operating rules over the duration of the evaluation period (1960-2009), whereas actual operating procedures varied over this period. Simulated operations are therefore not expected to perfectly match historical operations.

Model results were compared to historical records of project storage, releases, diversions, and flow in the Rio Grande below Caballo Dam and at El Paso, and to previous estimates of project surface-water deliveries and groundwater deliveries for supplemental irrigation in the Rincon and Mesilla Valleys. Project operations simulated by RMBHM closely match historical operations. As illustrated in Fig. 10, simulated total project storage is well correlated with observed historical storage ($R^2 = 0.94$) and exhibits little systematic bias. Similarly, Fig. 11 shows that simulated annual releases from Caballo Dam also agree well with observed historical releases. The simulated average annual project release is within one percent of the historical average, and the simulated average annual total project diversion from the Rio Grande is within five percent of the historical average. Simulated surface-water and groundwater deliveries to irrigated lands in the Rincon and Mesilla valleys also agree well with previous estimates (SSPA 2007). Strong agreement of RMBHM with historical records and previous modeling studies suggests that RMBHM accurately represents the key operational and hydrologic factors that drive surface-

[7] The quantity of irrigation water, exclusive of precipitation, stored soil moisture, or groundwater that is required consumptively for crop production.

water and groundwater management and use in the Rincon and Mesilla Basins. See Appendix C for additional details.

Figure 10. Observed and simulated monthly total project storage in Elephant Butte and Caballo Reservoirs (acre-feet), 1960-2010.

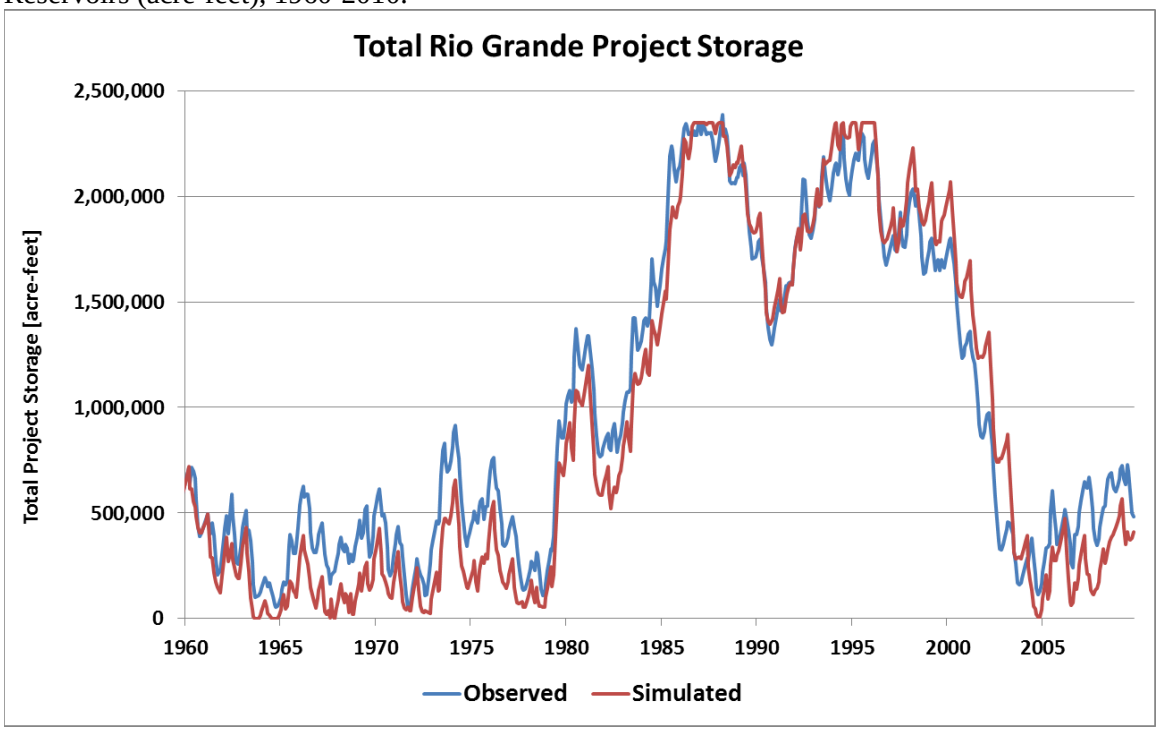
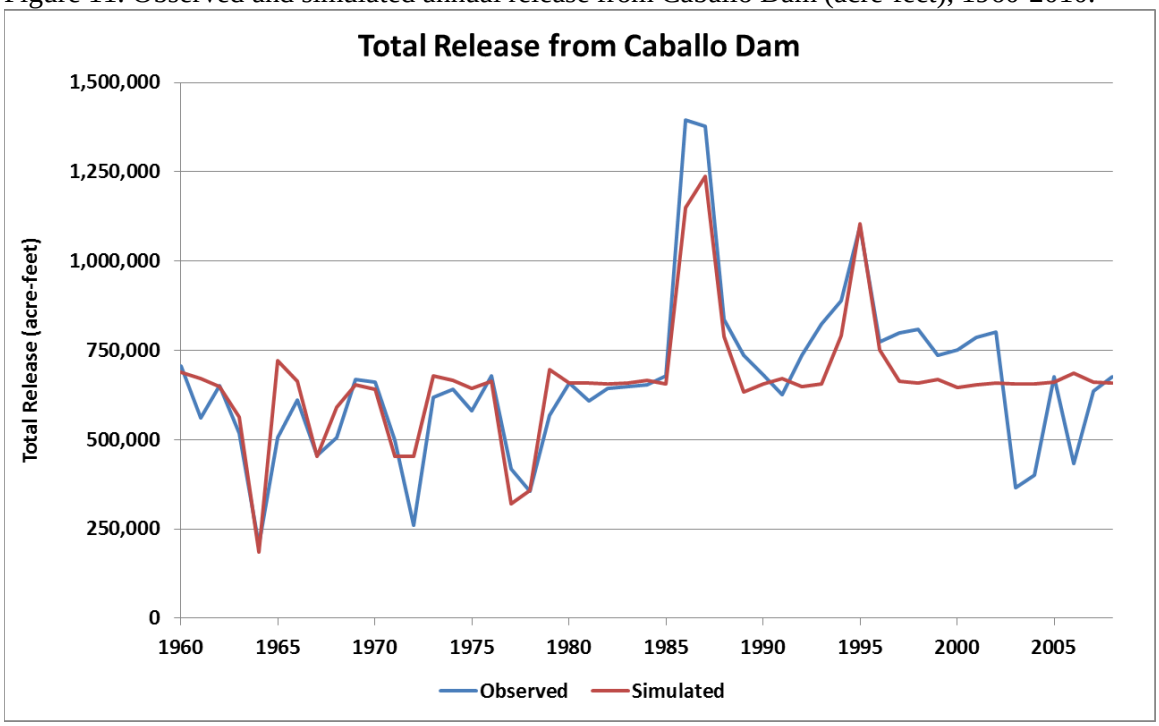



Figure 11. Observed and simulated annual release from Caballo Dam (acre-feet), 1960-2010.



### 4.1.4 Simulation of Alternatives

Each alternative evaluated in this FEIS was simulated by modifying the portion of the RMBHM source code that computes allocations to EBID, EPCWID, and Mexico, including calculation of annual allocations as well as carryover allocations where applicable. All other aspects of the RMBHM source code, configuration, and inputs are identical across all alternatives. Modifications implemented to simulate each alternative are summarized in Table 4-1. Additional discussion of modeling methods and assumptions is provided in Appendix C.

### 4.1.5 Modeling Assumptions

The simulation period for the FEIS extends through November 1, 2050. As discussed in Section 4.1.2, it is not possible to reliably predict the evolution of climate and hydrologic conditions, cropping and irrigation practices, M&I water uses, and other stressors through the end of the simulation period. Simulation of future RGP operations therefore requires reasonable assumptions regarding future conditions within the simulated area.

Modeling assumptions were consistent across all alternatives. Key assumptions used in developing model inputs representing future climate and hydrologic conditions, crop irrigation requirements, and M&I water use in Rincon and Mesilla Valleys are summarized below. Additional modeling assumptions are discussed in Appendix C.

Table 4-1 Simulation of FEIS alternatives using RMBHM

| Alter-native | Alternative Name | Alternative Description | Summary of Modifications to RMBHM |
|---|---|---|---|
| 1 | Preferred Alternative, Continuation of OA and San Juan–Chama Project Storage | Continue to implement the OA and continue to store up to 50,000 acre-feet of San Juan–Chama Project (SJCP) water in Elephant Butte Reservoir. | Calculation of annual allocations to EBID and EPCWID incorporate diversion ratio adjustment. Calculation of total allocations to EBID and EPCWID incorporate carryover accounting. Calculation of maximum SJCP storage calculated via post-processing. |
| 2 | No San Juan–Chama Project Storage | Continue to implement the OA but do not store SJCP water in Elephant Butte Reservoir. | Same as Alternative 1, except that SJCP storage is equal to zero (eliminates SJCP storage). |
| 3 | No Carryover | Implement only 1 of the 2 components of the OA and continue to store up to 50,000 acre-feet of SJCP water in Elephant Butte Reservoir. | Same as Alternative 1, except that RMBHM source code modified to exclude carryover accounting from calculation of total allocations to EBID and EPCWID. |
| 4 | No Diversion Ratio Adjustment | Implement only 1 of the 2 components of the OA and continue to store up to 50,000 | Same as Alternative 1, except that RMBHM source code modified to exclude the diversion ratio adjustment |

| Alter-native | Alternative Name | Alternative Description | Summary of Modifications to RMBHM |
|---|---|---|---|
| | | acre-feet of SJCP water in Elephant Butte Reservoir. | from calculation of annual allocations to EBID and EPCWID. |
| 5 | No Action Alternative, Prior Operating Practices | Revert to operations before the OA (as summarized for the modeling) into the future. | Same as Alternative 1, except that RMBHM source code modified to exclude the diversion ratio adjustment from calculation of annual allocations to EBID and EPCWID and to exclude carryover accounting from calculation of total allocations to EBID and EPCWID. |

#### *4.1.5.1 Climate and Hydrology Inputs*

As summarized in Section 4.1.2, model inputs representing future climate and hydrologic conditions were obtained from previous analyses of projected climate and hydrologic conditions (Reclamation 2011a, b; 2013c). Previous analyses consider the range of projected climate change over the Rio Grande basin from its headwaters to Elephant Butte Reservoir and corresponding changes in surface water supplies and management. Projected climate conditions were developed based on an ensemble of 112 statistically downscaled climate projections. Projected surface water supplies and management were then developed by using the Variable Infiltration Capacity (VIC) hydrology model to simulate changes in runoff and streamflow and the Upper Rio Grande Simulation Model (URGSim) to simulate corresponding changes in surface water management and use. In addition to reservoir operations, URGSim represents interstate water delivery obligations and accounting under the Rio Grande Compact. While there is considerable uncertainty regarding future climate and hydrologic conditions and water management in the simulated area, the projections developed by WWCRA and URGIA constitute the best available information on future inflows to Elephant Butte Reservoir and Compact credit water in Elephant Butte Reservoir over the simulation period.

It should be noted that under Article VII of the Rio Grande Compact, the volume of water in RGP storage could influence the operation of upstream reservoirs and thus the inflow to Elephant Butte Reservoir. RMBHM, which was developed for this FEIS, does not simulate this interaction between RGP storage and inflow to Elephant Butte Reservoir under the Compact. As discussed in Section 3.2, interactions between RGP operations and water management and use upstream of Elephant Butte Reservoir are beyond the scope of this analysis. Furthermore, despite the availability of existing models representing surface-water management and use upstream of Elephant Butte Reservoir (e.g., URGWOM and URGSim), modifying these models to interact with RMBHM would require very significant technical efforts, including substantial involvement from the agencies who lead development of these models. Reclamation, in consultation with the cooperating agencies, determined that such efforts are not necessary to accurately evaluate potential changes to resources resulting from implementation of the five alternatives.

#### *4.1.5.2 Crop Irrigation Requirement Inputs*

Model inputs representing future irrigation demands throughout the simulated area were developed based on estimates of crop irrigation requirement for the water year 2000 irrigation

season. Crop irrigation requirements for each year of the simulation period were calculated by adjusting the year 2000 crop irrigation requirements to reflect projected changes in annual reference evapotranspiration ($ET_0$) and effective precipitation, where changes in $ET_0$ and effective precipitation were derived from projected monthly precipitation and temperature from the three climate projections selected for the FEIS. This approach implicitly assumes that irrigated acreage and cropping patterns over the duration of the simulation period remain consistent with water year 2000.

Previous studies have assumed that any shortage in RGP surface water supply relative to crop irrigation requirements in Rincon and Mesilla Valleys is made up for by the use of groundwater for supplemental irrigation (e.g., Appendix F of SSPA 2007). Under this assumption, widespread use of groundwater to supplement RGP surface water supplies precludes the need to fallow land or shift to lower water-use crop during periods of low surface water supply. Analysis of irrigated acreage in Rincon and Mesilla Valleys over the past several decades shows no relationship between irrigated acreage and RGP surface water supply. Similarly, year-to-year fluctuations in cropping patterns (percent of acreage in a given crop) exhibit no relationship with RGP surface water supply. Historical cropping and acreage data thus support the assumption that cropping decisions are primarily influenced by market drivers, rather than by RGP surface water supplies. As a result, it is not possible to reliably predict future changes in cropping patterns and irrigated acreage based on simulated changes in RGP supplies.

#### *4.1.5.3 M&I Groundwater Pumping Inputs*

While plans of the cities of Las Cruces and El Paso are discussed in Chapter 5 as cumulative actions with potential cumulative impacts, there is considerable uncertainty regarding future M&I water demands and use in the study area. As noted in Chapter 5 (Section 5.3.10), future M&I water demands or use will depend on population growth, economic development, and other factors or actions that are not reasonably foreseeable. Given the large uncertainties related to M&I water demands and use through the year 2050, model inputs representing groundwater pumping for M&I use were developed based on estimates of M&I groundwater pumping for the period 2000-2009. This assumption is consistent with the fact that despite significant population and economic growth over the past two decades, water conservation programs have reduced per capita water demands and resulted in little change in actual M&I water use over this period (Hanson et al. 2013, McCoy et al. 2007, SSPA 2007). This assumption is also supported by the possibility that any further increases in pumping could be offset by fallowing of agricultural land or other conservation measures.

### 4.1.6 Analysis and Presentation of Model Results in FEIS

Potential environmental consequences of each alternative are evaluated based on simulations of future RGP operations and corresponding surface-water and groundwater resources. RMBHM was used to simulate the effects of the alternatives over the 43-year simulation period (November 2007 to October 2050), including year-to-year fluctuations in hydrology and climate and resulting fluctuations in water supplies, demands, and operations. Detailed results are in Appendix C, Hydrology Technical Memorandum.

Sections 4.2 to 4.11 summarize data from Appendix C, presenting averages for each simulated water resource variable (RGP allocations, releases, diversions, deliveries, etc.). Tables 4-2 to 4-13 are organized such that each column presents a single alternative and each row presents a single climate scenario with three climate scenarios presented to characterize uncertainties in future RGP operations and surface water and groundwater resources. Differences between alternatives may be evaluated by comparing columns in these tables. Differences due to potential climate change may be evaluated by comparing row. In addition, effects of climate change may be

evaluated as the difference in a given water resource variable or indicator between historical (observed) climate conditions and projected future climate conditions.

The three climate scenarios considered in the FEIS—the drier scenario (P25), central tendency or median scenario (P50), and wetter scenario (P75)—are all based on the best available projections of future climate and hydrologic conditions in the Rio Grande Basin and are each considered equally likely projections of future conditions. To assess impacts on special status species in Elephant Butte Reservoir, Reclamation used the wetter climate scenario. The wetter scenario represents a conservative worst case for the species and their habitat in the reservoir pool due to the impact of fluctuations of the water surface elevation and area, but the drier scenario would be the worst case for biological resources downstream of Caballo Dam.

## 4.2 Reservoir Storage

Total storage is the total volume of water (acre-feet) in Elephant Butte and Caballo Reservoirs at the end of each month. Project storage is the total volume of RGP water[8] in the reservoirs at the end of each month, excluding Rio Grande Compact credit water and San Juan–Chama Project water. Table 4-2 presents average monthly total storage by alternative and climate scenario. Table 4-3 presents average monthly storage in Elephant Butte Reservoir and Table 4-4 presents average monthly storage in Caballo Reservoir.

As shown, the FEIS alternatives are not likely to have a strong effect on reservoir storage. Differences in average monthly storage among the alternatives range from 38,421 to 44,360 acre-feet, while differences among future climate scenarios range from 175,224 to 193,452 feet. In other words, uncertainties in future climate conditions are significantly greater than the effect of implementing one or another alternative.

Table 4-2 Average monthly total storage (acre-feet) by alternative and climate scenario

| | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| Drier | 311,875 | 279,081 | 317,502 | 281,367 | 293,084 |
| Central | 483,445 | 455,233 | 493,743 | 465,907 | 483,425 |
| Wetter | 487,099 | 462,627 | 506,987 | 464,527 | 486,536 |

[8] Project storage is the combined capacity of Elephant Butte Reservoir and all other reservoirs actually available for the storage of usable water below Elephant Butte and above the first diversion to lands of the RGP, but not more than a total of 2,638,860 acre-feet (http://www.wrri.nmsu.edu/wrdis/compacts/Rio-Grande-Compact.pdf).

Table 4-3 Average monthly Elephant Butte Reservoir storage (acre-feet) by alternative and climate scenario

| | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| Drier | 293,148 | 259,152 | 298,307 | 264,678 | 275,596 |
| Central | 449,822 | 419,547 | 458,839 | 433,580 | 449,601 |
| Wetter | 447,860 | 421,558 | 465,693 | 426,740 | 446,448 |

Table 4-4 Average monthly Caballo Reservoir storage (acre-feet) by alternative and climate scenario

| | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| Drier | 18,727 | 19,929 | 19,195 | 16,689 | 17,488 |
| Central | 33,624 | 35,686 | 34,904 | 32,327 | 33,825 |
| Wetter | 39,238 | 41,068 | 41,294 | 37,786 | 40,088 |

### 4.2.1 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Under Alternative 1, Table 4-2 shows the average monthly total storage would be 483,445 acre-feet under the central tendency future climatic scenario. Alternative 1 would be almost identical to Alternative 5 (No Action) under central tendency or wetter conditions, but under drier conditions, the average monthly storage under Alternative 1 would be 18,791 acre-feet higher than Alternative 5 (No Action).

### 4.2.2 Alternative 2: No San Juan–Chama Project Storage

Under Alternative 2, the average monthly total storage would be 455,233 acre-feet under the central tendency climatic scenario. Alternative 2 would be 14,002 acre-feet, 28,192 acre-feet, or 23,909 acre-feet below Alternative 5 (No Action) under drier, central tendency, or wetter climatic conditions respectively.

### 4.2.3 Alternative 3: No Carryover Provision

Under Alternative 3, the average monthly total storage would be 493,743 acre-feet under the central tendency climate scenario. Alternative 3 would be 24,418 acre-feet, 10,318 acre-feet, or 20,451 acre-feet higher than Alternative 5 (No Action) under drier, central tendency, or wetter conditions respectively.

### 4.2.4 Alternative 4: No Diversion Ratio Adjustment

Under Alternative 4, the average monthly total storage would be 465,907 acre-feet under the central tendency climate scenario. Alternative 4 would be 11,716 acre-feet, 17,518 acre-feet, or 22,009 acre-feet below Alternative 5 (No Action) under drier, central tendency, or wetter conditions respectively.

### 4.2.5 Alternative 5: Prior Operating Practices, No Action Alternative

Under Alternative 5 (No Action), the average monthly total storage would be 483,425 acre-feet under the central tendency climate scenario. It would range from 311,875 to 447,099 acre-feet under drier to wetter climates.

## 4.3 Elephant Butte Reservoir Elevation

Because of the biological importance of the elevation of the water surface in Elephant Butte Reservoir, Table 4-5 provides the simulated average monthly water surface elevation in feet above sea level. As shown, the simulated maximum difference in average Elephant Butte Reservoir water surface elevation among the five alternatives is 7 to 9 feet, while the simulated maximum difference among the three future climate scenarios is 10 to 12 feet.

Table 4-5 Average monthly Elephant Butte Reservoir elevation (feet above sea level) by alternative and climate scenario

| | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| Drier | 4,316 | 4,307 | 4,316 | 4,313 | 4,315 |
| Central | 4,326 | 4,319 | 4,327 | 4,325 | 4,326 |
| Wetter | 4,325 | 4,319 | 4,327 | 4,324 | 4,325 |

### 4.3.1 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Under Alternative 1, Table 4-5 shows the average monthly elevation of the water surface in Elephant Butte Reservoir would be 4,326 feet above sea level under the central tendency climatic scenario. Alternative 1 would be almost identical to Alternative 5 (No Action) under all climatic scenarios.

### 4.3.2 Alternative 2: No San Juan–Chama Project Storage

Under Alternative 2, the average monthly elevation would be 4,319 feet under the central tendency climatic scenario. Alternative 2 would be an average of 7 feet lower than Alternative 5 under central tendency climatic conditions or 8 feet under drier conditions. There would be no difference from Alternative 5 under wetter conditions.

### 4.3.3 Alternative 3: No Carryover Provision

Under Alternative 3, the average monthly elevation would be 4,327 feet under the central tendency climatic scenario. Alternative 3 would be 1 to 2 feet higher than Alternative 5 (No Action) under all climate scenarios.

### 4.3.4 Alternative 4: No Diversion Ratio Adjustment

Under Alternative 4, the average monthly elevation would be 4,325 feet under the central tendency climatic scenario. Alternative 4 would be 1 to 2 feet lower than Alternative 5 (No Action) under all climate scenarios.

### 4.3.5 Alternative 5: Prior Operating Practices, No Action Alternative

Under Alternative 5, the average monthly elevation would be 4,326 feet under the central tendency climatic scenario, 4,315 feet under the drier climate scenario and 4,325 under the wetter climate scenario.

## 4.4 Annual Allocation to EBID and EPCWID

Table 4-6 shows the simulated average annual allocations in acre-feet to the two districts by alternative and climate scenario. The maximum difference to EBID among the alternatives would be 91,665 acre-feet under drier conditions, 101,217 under central tendency conditions, and 90,915 acre-feet under wetter conditions. The maximum difference to EPCWID among the alternatives would be 64,668 acre-feet under drier conditions, 60,677 acre-feet under central tendency conditions, and 59,925 acre-feet under wetter conditions.

Table 4-6 Average annual allocation (acre-feet) to districts by alternative and climate scenario

| District & | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| EBID | | | | | |
| Drier | 176,988 | 176,988 | 207,180 | 230,319 | 268,652 |
| Central | 213,110 | 213,110 | 264,752 | 272,269 | 314,327 |
| Wetter | 271,315 | 271,315 | 298,875 | 320,104 | 362,229 |
| EPCWID | | | | | |
| Drier | 196,833 | 196,833 | 240,025 | 175,357 | 204,542 |
| Central | 224,049 | 224,049 | 267,973 | 207,296 | 239,317 |
| Wetter | 258,768 | 258,768 | 303,640 | 243,716 | 275,788 |

### 4.4.1 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Under Alternative 1, the mean annual allocation to EBID would be 213,110 acre-feet under the central tendency climatic scenario. The mean annual allocation to EPCWID would be 224,049 acre-feet under the central tendency climatic scenario.

### 4.4.2 Alternative 2: No San Juan–Chama Project Storage

As shown in Table 4-6, Alternative 2 would be the same as Alternative 1.

### 4.4.3 Alternative 3: No Carryover Provision

Under Alternative 3, the mean annual allocation to EBID would be 264,752 acre-feet under the central tendency climatic scenario and 267,973 acre-feet to EPCWID.

### 4.4.4 Alternative 4: No Diversion Ratio Adjustment

Under Alternative 4, the mean annual allocation to EBID would be 272,269 acre-feet under the central tendency climatic scenario and 207,296 acre-feet to EPCWID .

### 4.4.5 Alternative 5: Prior Operating Practices, No Action Alternative

Under Alternative 5 (No Action), the mean annual allocation to EBID would be 314,327 acre-feet under the central tendency climatic scenario. The mean annual allocation to EPCWID would be 239,317 acre-feet under the central tendency climatic scenario.

## 4.5 Total Allocation to EBID and EPCWID

Table 4-7 shows the simulated average total allocation in acre-feet to the two districts by alternative and climate scenario. The total allocation to each district is calculated as the sum of its annual allocation and carryover allocation. The maximum difference to EBID among the alternatives would be 63,354 acre-feet under wetter conditions, 59,177 acre-feet under central tendency conditions, and 61,472 acre-feet under wetter conditions. The maximum difference to EPCWID among the alternatives would be 97,650 acre-feet under central tendency conditions, 97,352 acre-feet under wetter conditions, and 80,013 acre-feet under drier conditions.

Table 4-7 Average total allocation (acre-feet) to districts by alternative and climate scenario

| District & | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| EBID | | | | | |
| Drier | 222,539 | 222,539 | 207,180 | 278,015 | 268,652 |
| Central | 255,150 | 255,150 | 264,752 | 321,955 | 314,327 |
| Wetter | 335,499 | 335,499 | 298,875 | 410,996 | 362,229 |
| EPCWID | | | | | |
| Drier | 284,556 | 284,556 | 240,025 | 260,666 | 204,542 |
| Central | 336,967 | 336,967 | 267,973 | 310,152 | 239,317 |
| Wetter | 373,140 | 373,140 | 303,640 | 356,520 | 275,788 |

### 4.5.1 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Under Alternative 1, the mean total allocation to EBID would be 255,150 acre-feet under the central tendency climatic scenario. The mean total allocation to EPCWID would be 336,967 acre-feet under the central tendency climatic scenario. The mean total allocation to EBID would range from 222,539 acre-feet under the drier climate scenario to 335,499 acre-feet under the wetter scenario. The mean total allocation to EPCWID would range from 204,542 acre-feet under the drier scenario to 275,788 acre-feet under the wetter climate scenario.

### 4.5.2 Alternative 2: No San Juan–Chama Project Storage

As shown in Table 4-7, Alternative 2 would be the same as Alternative 1.

### 4.5.3 Alternative 3: No Carryover Provision

Under Alternative 3, the mean total allocation to EBID would be 264,752 acre-feet under the central tendency climatic scenario. The mean total allocation to EPCWID would be 310,152 acre-feet under the central tendency climatic scenario.

### 4.5.4 Alternative 4: No Diversion Ratio Adjustment

Under Alternative 4, the mean total allocation to EBID would be 321,955 acre-feet under the central tendency climatic scenario. The mean total allocation to EPCWID would be 310,152 acre-feet under the central tendency climatic scenario.

### 4.5.5 Alternative 5: Prior Operating Practices, No Action Alternative

Under Alternative 5 (No Action), the mean total allocation to EBID would be 314,327 acre-feet under the central tendency climatic scenario with a range from 268,652 to 362,229 acre-feet under the drier to wetter climate scenarios respectively. The mean total allocation to EPCWID would be 239,317 acre-feet under the central tendency climatic scenario with a range from 204,542 to 275,788 acre-feet under the drier to wetter climate scenarios respectively.

## 4.6 Rio Grande Project Releases

Figure 11 shows that simulated releases from Caballo Dam agree well with observed historical releases. Table 4-8 shows the simulated average annual project release in acre-feet by alternative and climate scenario. The maximum difference to EBID among the alternatives would be 91,665 acre-feet under drier conditions, 101,217 acre-feet under central tendency climatic conditions, and 90,915 acre-feet under wetter conditions. The maximum difference to EPCWID among the alternatives would be 64,668 acre-feet under drier conditions, 60,677 acre-feet under central tendency climatic conditions, and 59,925 acre-feet under wetter conditions.

Table 4-8 Average annual RGP release (acre-feet) by alternative and climate scenario

| | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| Drier | 479,601 | 479,601 | 478,320 | 482,903 | 480,759 |
| Central | 529,170 | 529,170 | 525,808 | 531,229 | 527,421 |
| Wetter | 585,623 | 585,623 | 578,858 | 587,718 | 527,421 |

### 4.6.1 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Under Alternative 1, Table 4-8 shows the central tendency annual project release would be 529,170 acre-feet under the central tendency climatic scenario and the total release would average 541,019 acre-feet.

### 4.6.2 Alternative 2: No San Juan–Chama Project Storage

As shown in Table 4-8, Alternative 2 would be the same as Alternative 1.

### 4.6.3 Alternative 3: No Carryover Provision

Under Alternative 3, the average annual project release would be 525,808 acre-feet under the central tendency climatic scenario and the total release would average 539,140 acre-feet.

### 4.6.4 Alternative 4: No Diversion Ratio Adjustment

Under Alternative 4, the average annual project release would be 531,229 acre-feet under the central tendency climatic scenario and the total release would average 543,089 acre-feet.

### 4.6.5 Alternative 5: Prior Operating Practices, No Action Alternative

Under Alternative 5 (No Action), the average annual project release would be 527,421 acre-feet under the central tendency climatic scenario and the total release would average 539,807 acre-feet.

## 4.7 Net Diversions

Table 4-9 shows the simulated average annual net diversions in acre-feet to the two districts by alternative and climate scenario. The simulations for EPCWID are for Rincon and Mesilla Valleys only. The maximum difference to EBID among the alternatives would be 49,426 acre-feet under wetter conditions, 49,165 acre-feet under central tendency conditions, and 41,220 acre-feet under drier conditions. The maximum difference to EPCWID among the alternatives would be 14,720 acre-feet under central tendency conditions, 12,794 acre-feet under drier conditions, and 7,678 acre-feet under wetter conditions.

Table 4-9 Average annual net diversion (acre-feet) to districts by alternative and climate scenario

| District & | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| EBID | | | | | |
| Drier | 148,818 | 148,818 | 154,454 | 190,038 | 189,864 |
| Central | 179,198 | 179,198 | 198,287 | 227,069 | 228,363 |
| Wetter | 223,271 | 223,271 | 217,316 | 266,742 | 256,654 |
| EPCWID | | | | | |
| Drier | 34,155 | 34,155 | 30,554 | 24,968 | 21,361 |
| Central | 40,262 | 40,262 | 34,805 | 29,491 | 25,543 |
| Wetter | 37,075 | 37,075 | 36,805 | 30,701 | 29,397 |

### 4.7.1 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Under Alternative 1, the mean annual net diversion to EBID would be 148,818 acre-feet under the central tendency climatic scenario. The mean annual net diversion to EPCWID would be 40,262 acre-feet under the central tendency climatic scenario.

### 4.7.2 Alternative 2: No San Juan–Chama Project Storage

As shown in Table 4-9, Alternative 2 would be the same as Alternative 1.

### 4.7.3 Alternative 3: No Carryover Provision

Under Alternative 3, the mean annual net diversion to EBID would be 198,287 acre-feet under the central tendency climatic scenario. The mean annual net diversion to EPCWID would be 34,805 acre-feet under the central tendency climatic scenario.

### 4.7.4 Alternative 4: No Diversion Ratio Adjustment

Under Alternative 4, the mean annual net diversion to EBID would be 227,069 acre-feet under the central tendency climatic scenario. The mean annual net diversion to EPCWID would be 29,491 acre-feet under the central tendency climatic scenario.

### 4.7.5 Alternative 5: Prior Operating Practices, No Action Alternative

Under Alternative 5 (No Action), the mean annual net diversion to EBID would be 228,363 acre-feet under the central tendency climatic scenario. The mean annual net diversion to EPCWID would be 25,543 acre-feet under the central tendency climatic scenario.

## 4.8 Farm Surface Water Deliveries

Table 4-10 shows the simulated average farm surface water deliveries in acre-feet to the two districts by alternative and climate scenario. The simulations for EPCWID are for Mesilla Valley only. The maximum difference to EBID among the alternatives would be 31,194 acre-feet under wetter conditions, 26,728 under central tendency conditions, and 23,908 acre-feet under drier conditions. The maximum difference to EPCWID among the alternatives would be 2,259 acre-feet under drier conditions, 2,058 acre-feet under central tendency conditions, and 1,699 acre-feet under wetter conditions.

Table 4-10 Average farm surface water deliveries (acre-feet) to districts by alternative and climate scenario

| District & | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| EBID | | | | | |
| Drier | 66,053 | 66,053 | 70,101 | 89,961 | 88,532 |
| Central | 84,054 | 84,054 | 94,477 | 110,782 | 110,314 |
| Wetter | 101,217 | 101,217 | 99,232 | 130,426 | 123,473 |
| EPCWID | | | | | |
| Drier | 13,259 | 13,259 | 12,416 | 11,949 | 10,999 |
| Central | 15,954 | 15,954 | 15,029 | 14,964 | 13,896 |
| Wetter | 17,156 | 17,156 | 16,553 | 15,935 | 15,456 |

### 4.8.1 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Under Alternative 1, the mean annual farm surface water delivery to EBID would be 84,054 acre-feet under the central tendency climatic scenario. The mean annual farm surface water delivery to EPCWID would be 15,954 acre-feet under the central tendency climatic scenario.

### 4.8.2 Alternative 2: No San Juan–Chama Project Storage

As shown in Table 4-10, Alternative 2 would be the same as Alternative 1.

### 4.8.3 Alternative 3: No Carryover Provision

Under Alternative 3, the mean annual farm surface water delivery to EBID would be 94,477 acre-feet under the central tendency climatic scenario. The mean annual farm surface water delivery to EPCWID would be 15,029 acre-feet under the central tendency climatic scenario.

### 4.8.4 Alternative 4: No Diversion Ratio Adjustment

Under Alternative 4, the mean annual farm surface water delivery to EBID would be 110,782 acre-feet under the central tendency climatic scenario. The mean annual farm surface water delivery to EPCWID would be 14,964 acre-feet under the central tendency climatic scenario.

### 4.8.5 Alternative 5: Prior Operating Practices, No Action Alternative

Under Alternative 5 (No Action), the mean annual farm surface water delivery to EBID would be 110,314 acre-feet under the central tendency climatic scenario. The mean annual farm surface water delivery to EPCWID would be 13,896 acre-feet under the central tendency climatic scenario.

## 4.9 Groundwater

Based on the assumptions described in Section 4-1 and Appendix C, Table 4-11 shows the simulated change in total groundwater storage in Rincon and Mesilla Valleys in acre-feet over the 43-year simulation period by alternative and climate scenario. The change in total groundwater storage is calculated as the difference in the total groundwater storage, summed over the simulated area of RMBHM, at the end of the simulation period compared to the start of the simulation period. The maximum difference among alternatives in the simulated change in groundwater storage would be 9,875 acre-feet under the wetter climate scenario, 5,513 acre-feet under the central tendency scenario, and 3,444 acre-feet under the drier scenario.

Table 4-11 Change in total groundwater storage (acre-feet) by alternative and climate scenario

| | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| Drier | -56,632 | -56,632 | -56,162 | -44,472 | -46,575 |
| Average | -29,470 | -29,470 | -28,055 | -25,657 | -23,957 |
| Wetter | -2,277 | -2,277 | -4,361 | 937 | -2,508 |

### 4.9.1 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Under Alternative 1, the total volume of groundwater storage in Rincon and Mesilla Valleys would decline by 29,470 acre-feet between 2007 and 2050 under the central tendency climatic scenario. The total volume of groundwater storage would decline by 56,632 acre-feet under the drier scenario and by 2,277 acre-feet under the wetter scenario.

### 4.9.2 Alternative 2: No San Juan–Chama Project Storage

As shown in Table 4-11, Alternative 2 would be the same as Alternative 1.

### 4.9.3 Alternative 3: No Carryover Provision

Under Alternative 3, the total volume of groundwater storage in Rincon and Mesilla Valleys would decline by 28,055 acre-feet between 2007 and 2050 under the central tendency climatic scenario. The total volume of groundwater storage would decline by 56,162 acre-feet under the drier scenario and by 4,361 acre-feet under the wetter scenario.

### 4.9.4 Alternative 4: No Diversion Ratio Adjustment

Under Alternative 4, the total volume of groundwater storage in Rincon and Mesilla Valleys would decline by 25,657 acre-feet between 2007 and 2050 under the central tendency climatic scenario. The total volume of groundwater storage would decline by 44,472 acre-feet under the drier scenario and increase by 937 acre-feet under the wetter scenario.

### 4.9.5 Alternative 5: Prior Operating Practices, No Action Alternative

Under Alternative 5, the total volume of groundwater storage in Rincon and Mesilla Valleys would decline by 23,957 acre-feet between 2007 and 2050 under the central tendency climatic scenario. The total volume of groundwater storage would decline by 46,757 acre-feet under the drier scenario and by 2,508 acre-feet under the wetter scenario.

## 4.10 Farm Groundwater Deliveries

Irrigation requirements that are not satisfied by RGP surface water deliveries are assumed to be met through supplemental groundwater pumping. As a result, combined total delivery of RGP surface water and supplemental groundwater to RGP lands in the Rincon and Mesilla Valleys would be nearly identical under all alternatives. Table 4-12 shows the simulated average annual farm groundwater deliveries in acre-feet to the two districts by alternative and climate scenario. The simulations for EPCWID are for Rincon and Mesilla Valleys only. The maximum difference to EBID among the alternatives would be 31,194 acre-feet under wetter conditions, 26,728 acre-feet under central tendency conditions, and 23,908 acre-feet under drier conditions. The maximum difference to EPCWID among the alternatives would be 2,259 acre-feet under drier conditions, 2,058 acre-feet under central tendency conditions, and 1,699 acre-feet under wetter conditions.

Table 4-12 Average annual farm groundwater deliveries (acre-feet) to districts by alternative and climate scenario

| District & | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| EBID | | | | | |
| Drier | 243,662 | 243,662 | 239,489 | 217,637 | 219,276 |
| Central | 214,370 | 214,370 | 202,791 | 184,273 | 185,061 |
| Wetter | 194,619 | 194,619 | 197,481 | 161,595 | 169,660 |
| EPCWID | | | | | |
| Drier | 15,563 | 15,563 | 15,951 | 16,406 | 17,357 |
| Central | 11,850 | 11,850 | 12,486 | 12,533 | 13,607 |
| Wetter | 10,593 | 10,593 | 10,859 | 11,454 | 11,939 |

### 4.10.1 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Under Alternative 1, the mean annual farm groundwater delivery (pumping of groundwater) to EBID would be 214,370 acre-feet under the central tendency climatic scenario. The mean annual farm groundwater delivery to EPCWID would be 11,850 under the central tendency climatic scenario.

### 4.10.2 Alternative 2: No San Juan–Chama Project Storage

As shown in Table 4-12, Alternative 2 would be the same as Alternative 1.

### 4.10.3 Alternative 3: No Carryover Provision

Under Alternative 3, the mean annual farm groundwater delivery to EBID would be 202,791 acre-feet under the central tendency climatic scenario. The mean annual farm groundwater delivery to EPCWID would be 12,486 acre-feet under the central tendency climatic scenario.

### 4.10.4 Alternative 4: No Diversion Ratio Adjustment

Under Alternative 4, the mean annual farm groundwater delivery to EBID would be 184,273 acre-feet under the central tendency climatic scenario. The mean annual farm groundwater delivery to EPCWID would be 12,533 acre-feet under the central tendency climatic scenario.

### 4.10.5 Alternative 5: Prior Operating Practices, No Action Alternative

Under Alternative 5, the mean annual farm groundwater delivery to EBID would be 185,061 acre-feet under the central tendency climatic scenario. The mean annual farm groundwater delivery to EPCWID would be 13,607 acre-feet under the central tendency climatic scenario.

## 4.11 Groundwater Elevations at Selected Wells

Water elevation data for 15 wells in the Rincon and Mesilla Basins were used for simulation analysis (Appendix C). Simulated fluctuations in groundwater elevations are qualitatively similar among all wells within each basin, so data from only one well in each basin are presented here. The mean monthly groundwater elevation for the representative well in the Rincon Basin (Rin-2) is shown in Table 4-13, along with the data from the well in the Mesilla Basin (Mes-6). As shown, the maximum difference in well elevations among the alternatives would be 3 feet for the Rin-2 well under central tendency climatic conditions, and 1 foot for the Mes-6 well under all climate scenarios.

Table 4-13 Average annual farm groundwater elevations at selected wells (feet above sea level) by alternative and climate scenario

| Well & | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| Rin-2 | | | | | |
| Drier | 4,059 | 4,059 | 4,060 | 4,062 | 4,062 |
| Central | 4,061 | 4,061 | 4,062 | 4,063 | 4,063 |
| Wetter | 4,063 | 4,063 | 4,063 | 4,065 | 4,065 |
| Mes-6 | | | | | |
| Drier | 3,813 | 3,813 | 3,813 | 3,814 | 3,814 |
| Central | 3,814 | 3,814 | 3,815 | 3,816 | 3,815 |
| Wetter | 3,816 | 3,816 | 3,816 | 3,817 | 3,817 |

### 4.11.1 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Under Alternative 1, the mean elevation in the Rincon-2 well would be 4,061 feet under the central tendency or central tendency climatic scenario with the mean under drier conditions of 4,059 feet to 4,063 feet under wetter climate conditions. The mean elevation in the Mesilla-6 well would be 3,814 feet under the central tendency climatic scenario with the mean under drier conditions of 3,813 feet to 3,816 feet under wetter conditions.

### 4.11.2 Alternative 2: No San Juan–Chama Project Storage

As shown in Table 4-13, Alternative 2 would be the same as Alternative 1.

### 4.11.3 Alternative 3: No Carryover Provision

Under Alternative 3, the mean elevation in the Rincon-2 well would be 4,062 feet under the central tendency or central tendency climatic scenario. The mean elevation in the Mesilla-6 well would be 3,815 feet under the central tendency climatic scenario.

### 4.11.4 Alternative 4: No Diversion Ratio Adjustment

Under Alternative 4, the mean elevation in the Rincon-2 well would be 4,063 feet under the central tendency or central tendency climatic scenario. The mean elevation in the Mesilla-6 well would be 3,816 feet under the central tendency climatic scenario.

### 4.11.5 Alternative 5: Prior Operating Practices, No Action Alternative

Under Alternative 5, the mean elevation in the Rincon-2 well would be 4,063 feet under the central tendency or central tendency climatic scenario. The mean elevation in the Mesilla-6 well would be 3,815 feet under the central tendency climatic scenario.

## 4.12 Water Quality

### 4.12.1 Analysis Methods and Assumptions

This FEIS incorporates by reference the water quality analysis from SEA (Reclamation 2013a). Assumptions are that increased reservoir storage or increased releases to the river would improve water quality. Other assumptions include:

- Water is generally not released from Caballo Reservoir in the non-irrigation season under any alternative. As such, water quality may fluctuate during this period but is not related to the alternatives.
- Water used by municipal users is treated, and the level of treatment would not change under the various alternatives.
- Changes in nonpoint source runoff would be the same under the various alternatives.

### 4.12.2 Effects Common to All Alternatives

Water quality effects are common to all alternatives. These are identified and described below.

#### *4.12.2.1 Mercury and PCBs in Fish*

Concentrations of methylmercury and other contaminants in fish would not be affected by the alternatives. Mercury and other contaminants in water bioaccumulate in fish due to complex ecological and biogeochemical processes and would not be affected by the volume of water in storage.

#### *4.12.2.2 Dissolved Oxygen*

Low dissolved oxygen below the two dams is a seasonal condition caused by upstream sources of deoxygenated water and nutrient levels, as well as release patterns. Given the common volumes and timing of released water among the alternatives, none of the alternatives would alter the existing seasonally low dissolved oxygen concentrations.

#### *4.12.2.3 Total Dissolved Solids, Salinity and Nutrients*

As shown in Section 4.6 and Table 4-8, across all alternatives, the differences in releases would be minor and insufficient to change the existing impairment of water quality due to high concentrations of dissolved oxygen, dissolved solids, nutrients, or salinity.

#### *4.12.2.4 Groundwater Quality*

As noted by the Texas Water Development Board (2016), groundwater quality issues in the study area are generally related to naturally high concentrations of total dissolved solids (TDS) or to the occurrence of elevated concentrations of individual dissolved constituents, and while there are local instances of groundwater quality degradation, there are no major trends suggesting a widespread water quality problem due to the downward percolation of surface contaminants. The groundwater well elevations may be suggestive of groundwater water quality. Results presented in Section 4.11 and Table 4-13 show the differences among alternatives in groundwater elevations are likely too small to result in any measurable differences in groundwater quality.

## 4.13 Vegetation and Wetlands

This section projects changes to vegetation communities and wetlands due to implementation of the alternatives. (No special status plants are present, as described in Chapter 3.) The study area for vegetation is the action area for special status aquatic and wildlife species and their designated or proposed critical habitats under the ESA. The action area is defined as all areas affected directly or indirectly by the Federal action (50 CFR 402.02) and is subdivided into the following reaches or segments:

- Elephant Butte Reservoir from full pool to dead pool
- The Rio Grande downstream from Elephant Butte Dam to Caballo Reservoir
- Caballo Reservoir from full pool to dead pool
- The Rio Grande from Caballo Dam downstream to International Dam

While vegetation in all these reaches was considered, the analysis focuses on vegetation in and around Elephant Butte Reservoir for three reasons. One, upland desert shrub communities further from the river would be unaffected by the alternatives because none of the alternatives would change the volume or pattern of releases from the dams to the extent that these vegetation communities would be affected.

Two, there is only a narrow band of riparian vegetation, including some wetlands, along the river banks between the reservoirs and downstream of Caballo Dam that could be affected by releases and this vegetation has been previously considered by Reclamation in the SEA (Reclamation 2013a) or by the USIBWC (various). Release data from Section 4.6 and Table 4-8 are provided below, but the vegetation communities and wetlands along the river would be unaffected by implementation of one or another alternative.

Three, Caballo Reservoir pool levels would be relatively stable under all alternatives. The vegetation in and around this reservoir is relatively constant: it is dense near the water's edge and gradually reduces in density away from the water line. For these reasons, the analysis focuses on Elephant Butte Reservoir vegetation.

### 4.13.1 Analysis Methods and Assumptions

The RMBHM hydrologic modeling of reservoir elevations (Appendix C, Section 4,3) and surface area (Table 4-14) is used to project changes in vegetation communities in and around Elephant Butte Reservoir because, as noted by Dick-Peddie et al. (1999:27-32), moisture availability is the primary factor influencing vegetation patterns in New Mexico, although climatic regime and disturbances such as fire, flood, grazing, plowing, etc. influence the distribution of individual plants and some vegetation communities. However, the moisture availability caused by fluctuating water levels of Elephant Butte, like all reservoirs (cf. Lesica and Miles 2004), creates habitats different from those associated with natural riparian systems due to the repeated cycles of inundation that tend to prevent vegetation from proceeding beyond the earliest stages of succession.

Section 4.3 and Table 4-5 describe the projected average Elephant Butte Reservoir elevations by alternative and Table 4-14 shows the surface area of the reservoir, but the indicator for change in vegetation is the duration of cycles of inundation or drawdown, shown by the time series simulations for reservoir elevations (Figs. 12, 13).

#### *4.13.1.1 Drawdown and Low Reservoir*

Presently most of the vegetation at Elephant Butte Reservoir occurs in the sediment delta, from full pool at River Mile 62 to where the Rio Grande enters into the current baseline pool at River Miles 38 to 36, and there is a gradient in density/quality from west to east and south to north. In the future, as simulated by the RMBHM and Section 4.3, reservoir levels will fluctuate and the assumption is that when the reservoir recedes, as it has over the last decade, it will expose moist, bare alluvium that is rapidly colonized by annuals, biennials, short-lived perennials, as well as woody species such as cottonwood, willow, and tamarisk. If the water level of the reservoir remains low, without periodic inundation, the vegetation upstream and adjacent to the reservoir pool would mature over time through natural succession and would eventually shift to longer-lived, more xeric, upland species.

Tamarisk appears to be better adapted to colonizing drawdown reservoir pools, but tamarisk greater than five years old rarely grow in most reservoirs because three months of inundation may kill them (Ellis et al. 2008, Lesica and Miles 2004).

#### *4.13.2.2 Inundation and High Reservoir*

Historically, Elephant Butte Reservoir has fluctuated and this is expected to occur under all alternatives and all climate scenarios. In the future when the reservoir water surface elevation rises, some plants (including mature cottonwoods) and patches of riparian vegetation would benefit from the rising water table. Habitat that is partially inundated could be enhanced through deposition of new sediments and nutrients, flushing of accumulated salts, and irrigation of the respective site.

However, prolonged or complete inundation could result in the total loss of particular plants and patches of riparian habitat, with the losses depending on the particular species and age class. Based on monitoring of Elephant Butte Reservoir vegetation, young Goodding's willows are more flood tolerant than saltcedars (Reclamation 2009). Following a period of six months of inundation with 18 to 24 inches of water over the terminal bud primarily during the dormant

season, Goodding's willow densities and heights increase. Similar observations have been reported by Ellis et al. (2008), who reported a die-off of saltcedar understory and survival of Goodding's willow at Roosevelt Lake, and by Lesica and Miles (2004) who found that tamarisk in reservoir pools were destroyed after two summers (three months) of inundation.

Prolonged or complete inundation, which is expected to occur during the analysis period, could result in the loss of some riparian habitat, and survivability would depend on species composition and age class. Ellis and others (2008) also found that most species were not able to survive more than one year of complete inundation. Reclamation (2009) has also previously reported that partial (10 to 15 feet) and temporary (less than six months) flooding would likely cause a reduction in woody vegetation. The shrub layer, if present, could be slow to recover.

Figures 12 and 13 provide the time series outputs from the hydrological model, showing projected durations of time or cycles when Elephant Butte Reservoir would be rising or falling. These figures, combined with the data on surface area of the reservoir in Table 4-14, are used to project vegetation effects of the alternatives. As shown by Table 4-14, the maximum difference in average values among the alternatives would be about 1,000 acres.

Table 4-14 Elephant Butte Reservoir mean surface area (acres) by alternative and climate scenario

| Area & | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| Drier | 8,780 | 7,637 | 8,878 | 8,299 | 8,533 |
| Average | 11,425 | 10,493 | 11,570 | 11,127 | 11,404 |
| Wetter | 11,349 | 10,478 | 11,661 | 10,958 | 11,306 |

Figure 12. Time series of Elephant Butte Reservoir by alternatives under a drier climate scenario.

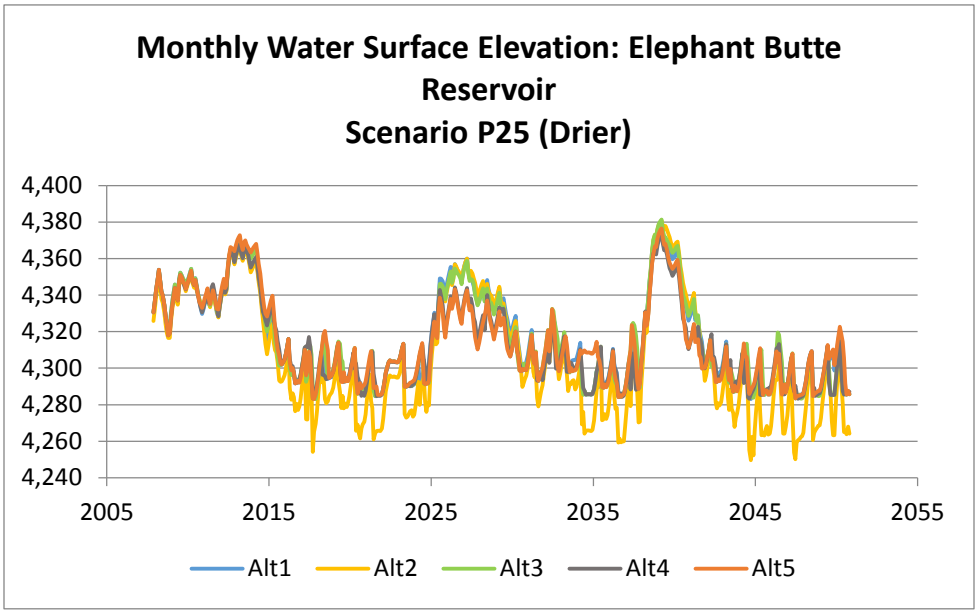
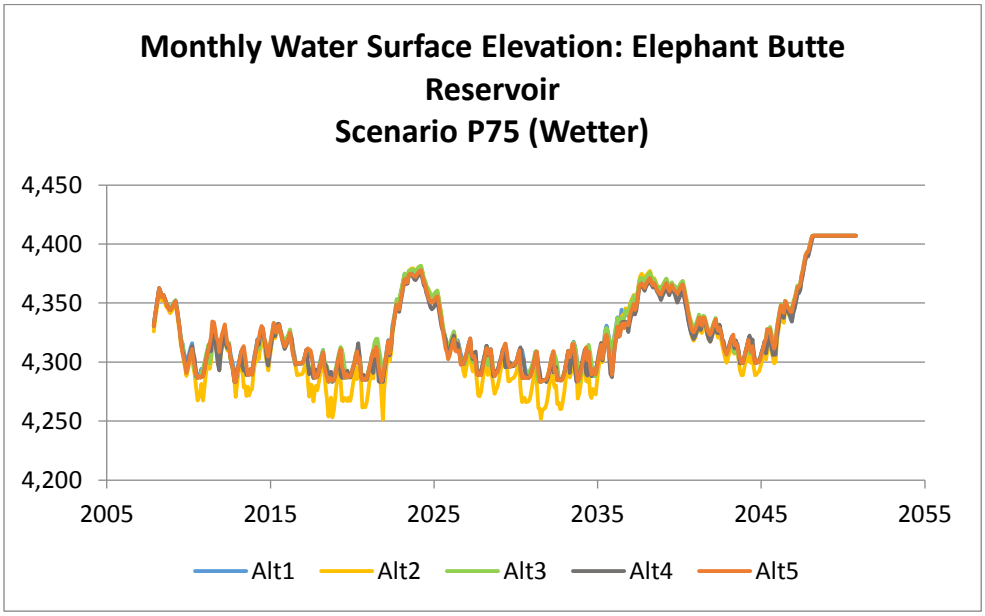


Figure 13. Time series of Elephant Butte Reservoir by alternatives under a wetter climate scenario.




### 4.13.3 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Alternative 1 is projected to have three periods of reservoir drawdown that could affect vegetation under all climate scenarios. As shown in Table 4-14, under Alternative 1, the average surface area of Elephant Butte Reservoir under the central tendency climate scenario would potentially cover or inundate 11,425 acres. The difference from No Action is projected to be an average of only 21 acres under central tendency climate conditions. Under central tendency climate conditions, releases under Alternative 1 would tend to be slightly higher (1,212 acre-feet) than Alternative 5 (No Action), but for the reservoir and river, there would be no difference to vegetation between Alternative 1 (Preferred) and Alternative 5 (No Action).

### 4.13.4 Alternative 2: No San Juan–Chama Project Storage

Alternative 2 would also have the same three periods of reservoir drawdown, but would tend to remain at lower levels than the other alternatives. Under Alternative 2, average surface area of Elephant Butte Reservoir under the central tendency climate scenario would be 10,493 acres, a difference of 910 acres from Alternative 5 (No Action). Releases would be the same as Alternative 1.

### 4.13.5 Alternative 3: No Carryover Provision

Alternative 3 would have the same three periods of reservoir drawdown that could affect vegetation. Average surface area under central tendency climate would cover or inundate 11,570 acres. Under the wetter climate scenario, vegetation would be the most affected with a projected mean of 11,661 acres inundated. For vegetation, the releases would be virtually the same as Alternative 5; the average difference in total releases would be -667 acre-feet.

### 4.13.6 Alternative 4: No Diversion Ratio Adjustment

Alternative 4 would tend to be the same as Alternative 5, which exhibits the same three periods of reservoir drawdown periods as the other alternatives. Average surface area under the central tendency climate scenario would cover or inundate 11,127 acres; i.e., 298 acres less than Alternative 1 and 277 acres less than Alternative 5. Under Alternative 4, releases would vary the most from Alternative 5 (No Action), with the average total release under the central tendency climate condition 3,282 acre-feet higher than Alternative 5.

### 4.13.7 Alternative 5: Prior Operating Practices, No Action Alternative

Alternative 5 (No Action) is projected to have the same three periods of reservoir drawdown that could affect Elephant Butte Reservoir vegetation. Average surface area under the central tendency climate scenario would cover or inundate 11,404 acres, less vegetation (surface acres) than Alternatives 1, 2, or 3, but it would tend to cover more surface acres than Alternative 4. Releases would be most similar to Alternative 3, with slightly higher total releases under Alternatives 1, 2, and 4, but again, no differences in moisture availability to riverine plants or wetlands is expected under any of the alternatives.

## 4.14 Wildlife and Special Status Species

Effects on wildlife are mostly based on how the alternatives would affect vegetation that serves as wildlife habitat in and around Elephant Butte Reservoir, especially the delta reach. The analysis focuses on the potential effects to flycatcher and the cuckoo. The endangered mouse is not expected to occur in the study area because of the lack of suitable habitat. Further, there is no proposed critical habitat for the mouse in the study area; the nearest proposed critical habitat is approximately 16 river miles upstream, at Bosque del Apache National Wildlife Refuge.

### 4.14.1 Analysis Methods and Assumptions

The analysis method for special status species is to determine the potential for the alternatives, particularly Alternative 1, the Preferred Alternative, to affect listed species or their critical habitat. Reclamation prepared a biological assessment of the effects of Alternative 1 on listed species and their critical habitat and consulted with the Service. The Service's biological opinion is provided in Appendix F.

In addition to how the cycles of rising or falling reservoir levels affect vegetation or wildlife habitat, indicators specific to wildlife include:

- Decline in reservoir elevations, which degrades the riparian habitat along the outside edge of the reservoirs, but also enhances and creates riparian habitat within the reservoir area from River Mile 62 to River Miles 38 to 36
- Death or decreased reproductive success of wildlife species due to habitat alteration

Current and historical information from field surveys conducted by Reclamation or others, as well as a literature review, was used to document the status of the species and their habitat in 2014—the environmental baseline for consultation with the Service under the ESA. If the presence of a listed species or supporting habitat features were determined to be likely, then the alternatives' potential effects were analyzed to determine whether they would affect the species or associated habitat. The following considerations apply:

- Fluctuations in Elephant Butte Reservoir and Caballo Reservoir water levels up to the full pool have historically been a normal feature of the reservoirs.

- The habitat that currently supports the largest flycatcher population in the Southwest was created when the Elephant Butte Reservoir receded, allowing various age classes of vegetation to develop.
- Based on hydrologic data collected since 2004, a large part of the northern portion of the reservoir pool receives water throughout the year. The source of this water is agricultural return from the outfall of the low flow conveyance channel (Reclamation 2005) and not from the river channel into the Elephant Butte Reservoir. Though habitats are changing, suitable habitat in this portion of the reservoir pool remains relatively abundant.
- The revised designated critical habitat for the flycatcher and proposed critical habitat for the cuckoo includes a part of the Elephant Butte Reservoir delta reach, downstream to River Mile 54. Above River Mile 54, the reservoir inundates designated critical habitat.
- The flycatcher and cuckoo are presently restricted to elevations in Elephant Butte Reservoir above 4,325 feet, which was the baseline for consultation with the Service. Flycatcher designated critical habitat and cuckoo proposed critical habitat extends to River Mile 54, at approximately the 4,380-foot elevation. The action's primary determinant of effect on birds would be months when Elephant Butte Reservoir surface elevation rises and remains greater than 4,325 feet. Above this elevation, rising waters might inundate and potentially affect flycatcher.
- Based on the 2014 flycatcher surveys, approximately 31 percent of the flycatcher territories (260) and 65.1 percent (161) of cuckoo territories would be affected by the reservoir rising to 4,380 feet (Moore and Ahlers 2015, Reclamation 2015b). The reservoir elevations typically begin rising in November, after minimum storage occurs in October, continuing to maximum storage peaks for the year as the spring releases begin, following irrigation demands. Thus, reservoir levels typically increase in the fall after flycatchers and cuckoos have departed for over-wintering territories and higher reservoir levels due to runoff end in the spring when the birds begin to establish breeding territories.

### 4.14.2 Effects Common to All Alternatives

References such as Reitan and Thingstad (1999) and the simulated reservoir water surface elevations presented in Section 4.3 and Table 4-5, were used to extrapolate potential effects of the alternatives into the future, relative to the range in water surface elevations from full pool (4,407 feet) to the 4,325 foot elevation level where flycatcher and cuckoo territories are currently, and the 4,380 foot elevation at River Mile 54 where the flycatcher designated critical habitat and the proposed cuckoo critical habitat extend into Elephant Butte Reservoir. The modeling simulates recurring cycles during which Elephant Butte Reservoir elevation would rise above the 4,325-foot level for different lengths of time. As shown in Figs. 12, 13 and Table 4-14, there are times when the reservoir is projected to rise above 4,325 feet, but most of the time, the reservoir would be below this level. As such, implementing one or another of the alternatives through 2050 is projected to produce little, if any, differences in direct effects on flycatchers, cuckoo, or their habitat in these segments, beyond impacts associated with current operations and climate variability.

Effects on flycatcher and cuckoo habitat under all alternatives are projected to be as follows:

- Without inundation from rising pool elevations, nutrients would not be replenished and salts would not be flushed in areas of trees associated with flycatchers and cuckoos. This would reduce the vigor of vegetation, degrading its overall habitat suitability for flycatchers and cuckoos. Periods of lower water inflows and lower pool elevations in Elephant Butte Reservoir would lead to maturation of vegetation communities and changes in species composition that could eventually render flycatcher and cuckoo nesting habitat unsuitable. This would come about without other types of disturbance in the delta reach, such as fire or mechanical disturbance.
- Inundation could create short-term impacts on birds and shrubs through the physical loss of riparian vegetation (Service 2014a); however, over the long term, a rising reservoir would support riparian vegetation by increasing the water table in some areas, resulting in denser vegetation and taller trees favored by the birds. Inundation would also flush accumulated salts from the soils, replenish nutrients, and deposit new sediments.

### 4.14.3 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Under Alternative 1, Table 4-14 and Figs. 12-13, and show there would be periods of both increasing and decreasing reservoir levels under all climate scenarios. To assess impacts on special status species, Reclamation consulted with the Service on the effects of the wetter climate scenario, which provided a conservative worst-case, based on the potential impacts to vegetation used by listed species. Reclamation's finding is that implementation of Alternative 1 "may affect, and is likely to adversely affect" flycatcher and cuckoo that could be present in Elephant Butte Reservoir. Compared to the 2014 baseline, individual birds may be displaced and some territories/nests may be inundated by a rising reservoir. Such a rising reservoir would result in only minor adverse effects because there is more suitable habitat available that is not being used, and vegetation regrowth could occur quickly under the right conditions.

Reclamation's finding for critical habitat is that Alternative 1 "may affect, and is likely to adversely modify" flycatcher designated critical habitat and cuckoo proposed critical habitat. Modeling presented in Section 4.3 and Table 4-5 shows that reservoir rising/filling would inundate existing critical habitat. This determination is also appropriate for indirect effects related to the habitat south of River Mile 54, which is projected to be regularly inundated due to water level increases in the reservoir.

Additionally, note that willow habitat, documented to be preferred for nesting in the delta reach of the Elephant Butte Reservoir, matures with time, becoming unsuitable for flycatcher nesting (Reclamation 2013a, Service 2002). Similarly, as described in the proposed critical habitat designation (Service 2014b), cuckoos require large tracts of willow-cottonwood forest or woodland for their nesting habitat. This habitat also matures with time, becoming unsuitable for cuckoo nesting. Prolonged flooding of the overly mature habitat would likely destroy the old vegetation. Quality nesting habitat would then be regenerated after the reservoir water level recedes.

### 4.14.4 Alternative 2: No San Juan–Chama Project Storage

Alternative 2 tends to reduce the reservoir water surface elevation relative to Alternative 5 (No Action). Under Alternative 2, Elephant Butte Reservoir would reach a lower elevation than under the other alternatives, and there would most likely be longer periods of lower elevations.

Therefore, the impacts on flycatchers and cuckoos associated with a rising reservoir and a greater number of acres of habitat inundated would occur.

When the reservoir recedes, reservoir bottomlands or nutrient-enriched exposed soils would quickly be revegetated with both desirable species, such as willow, and undesirable species, such as nonnative or invasive plants. This recession could create habitat for the flycatcher and cuckoo. If the reservoir were to remain at low water levels, habitat upstream to River Mile 62 and next to the reservoir pool would ultimately mature through natural succession past a point of suitability for the flycatcher and cuckoo. A low reservoir level equates to lower water in the Rio Grande system overall, so under drier conditions in the future degrading riparian vegetation would eventually be replaced by more upland species until the reservoir levels increase and this older vegetation is replaced.

Alternative 2 has the greatest potential for creating habitat, if the reservoir were to fill, depending on the timing and duration of filling. Alternative 2 also has the greatest amount of habitat that could be inundated and potentially destroyed. Therefore, under Alternative 2, riparian vegetation would expand, leading to more flycatcher and cuckoo habitat. Conversely, under Alternative 2, flycatcher and cuckoo habitat has the greatest potential for maturing beyond the point of suitability. It could also lead to increased drying and expansion of upland vegetation into formerly riparian areas.

### 4.14.5 Alternative 3: No Carryover Provision

Under Alternative 3, Elephant Butte Reservoir water surface elevations would fluctuate over time. The birds currently are above the 4,325-foot elevation level, so some impacts are expected when the reservoir rises above that elevation.

### 4.14.6 Alternative 4: No Diversion Ratio Adjustment

Under Alternative 4, Elephant Butte Reservoir water surface elevations would fluctuate over time. The birds are presently located above 4,325 feet, so under Alternative 4 some impacts are expected when the reservoir rises above that elevation.

### 4.14.7 Alternative 5: Prior Operating Practices, No Action Alternative

Under Alternative 5, the No Action Alternative, Elephant Butte Reservoir water surface elevations would fluctuate over time. Again, the birds are presently located above the 4,325-foot elevation level, so under Alternative 5 (No Action), some impacts would be expected when the reservoir rises above that elevation.

## 4.15 Aquatic Resources and Special Status Fish Species

This section projects effects of the alternatives on sport fish in the reservoirs and on the endangered Rio Grande silvery minnow, which is found in the riverine portion of Elephant Butte Reservoir.

### 4.15.1 Analysis Methods and Assumptions

Previous studies indicate the sport fishery benefits when the reservoirs rise or with full, stable reservoirs (Ozen 2002, Sammons and Bettoli 2000). The New Mexico Department of Game and Fish (NMDGF 2011, 2015b) reported that fluctuating water levels, both annual and inter-annual, plus resulting high turbidities and a general lack of emergent vegetation produce poor habitat

conditions for centrarchid species,[9] white bass, gizzard shad, and channel catfish in the reservoirs. Fluctuating water levels apparently result in increased populations of other species, such as blue catfish.

The NMDGF reported that declining water levels during spawning, water turbidity, and inadequate forage seem to be the limiting factors for smallmouth bass and largemouth bass populations. Because Elephant Butte Reservoir is 100 years old, it tends to have very little aquatic emergent or sub-emergent vegetation to provide a viable seed bank in years when water levels rise. As such, the development of necessary emergent vegetation communities commonly associated with healthy bass populations is lacking. The NMDGF (2011) adds that it is important to have flooded vegetation every three to four years to produce strong year classes of largemouth bass, which is what occurs as the reservoir fills since the upper portion of the reservoir is flatter with more recurring vegetative growth.

The NMDGF (2015b) suggests that centrarchid habitat could be improved if the lake would refill to near capacity. However, multiple years of low lake levels have allowed natural revegetation in the upper lake and have depressed centrarchids and other fish populations.

The analysis method is considering the potential effects of the alternatives on water resources to determine whether these would affect aquatic wildlife and their habitats. Reclamation considered data and information related to hydrology modeling used to develop the baseline conditions for aquatic resources in the study area. It used these data to assess potential biological responses to habitat condition modifications, including reservoir inundation extremes, during the assessment period (relative to baseline conditions of 2014).

Fluctuations in reservoir water surface elevations are anticipated during the 43-year simulation period for all alternatives and climate scenarios. In general, the Rio Grande silvery minnow would be expected to benefit from lower water levels and a longer river channel into Elephant Butte Reservoir.

In addition, Elephant Butte Reservoir is projected to reach capacity or full pool during both the central tendency and wetter climate scenarios (Appendix C). In general, sport fish would benefit from an increasing reservoir shoreline and flooded vegetation; although riverine fish would have slightly less riverine habitat in the reservoir pool, they are expected to move upstream to suitable habitat as the reservoir fills.

### 4.15.2 Effects Common to All Alternatives

Under all alternatives, there would be cycles of rising and falling reservoirs. During wetter periods, when the RMBHM model simulates rising water levels in the reservoirs, the populations of sport fish may increase or improve, while periods of reservoir decline would benefit the endangered Rio Grande silvery minnow due to increased riverine conditions.

For sport fish, periods of low water elevations might result in the localized loss of some species and restocking would be necessary to maintain or enhance the public's recreational opportunities. Fish stocking by NMDGF is commonly practiced to augment various fish species populations in both reservoirs.

[9] e.g., largemouth and smallmouth bass, crappie, and bluegill

### 4.15.3 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Under Alternative 1, Elephant Butte Reservoir is predicted to reach slightly higher maximums during modeled wet periods than predicted for the other alternatives (Fig. 13). Sport fish would benefit from an increasing reservoir shoreline and flooded vegetation; riverine fish would have slightly less habitat in the reservoir pool, but they are expected to move upstream to suitable habitat as the reservoir levels increase. Riverine fish species in Elephant Butte Reservoir headwaters would benefit from a lower reservoir and a longer river channel into the reservoir, while lake fish would have slightly less habitat in the reservoir pool.

#### *4.15.3.1 Rio Grande Silvery Minnow*

The model simulation indicates that Elephant Butte Reservoir would fill under both average and wetter climate scenarios (Fig. 13) and would displace minnows in the delta channel as the water elevation rises. The minnows would be displaced to more upstream reaches of the river in the delta reach until Elephant Butte Reservoir reaches its full storage volume. This gradual upstream movement of minnows could extend into their critical habitat reach of the Rio Grande, upstream of the full pool extent of Elephant Butte Reservoir (River Mile 62).

As the reservoir pool subsequently contracts, the minnows could and likely would again repopulate the river channel within the reservoir. Minnows could swim freely in the available delta channel habitat of the reservoir. Reclamation would continue to maintain the delta channel for efficient delivery of water to the reservoir; even without a maintained channel, a naturally formed river channel would develop as long as upstream river flows were sufficient to enter the Elephant Butte Reservoir pool. The minnow is not considered to live within the Elephant Butte Reservoir past the furthest south point of the river channel due to a lack of appropriate food and habitat. Minnows do not occur in the other downstream Rio Grande reaches of the OA study area below Elephant Butte Reservoir. The minnow has been extirpated from the river below Elephant Butte Reservoir, except for the pilot population of introduced minnows in Big Bend, Texas. Due to the absence of minnows in these reaches of the study area, continued implementation of the OA would not affect this species.

Reclamation consulted with the Service on the effects of implementing Alternative 1 on the Rio Grande silvery minnow and the Service's biological opinion is presented in Appendix F. The analysis was based on the wetter climate scenario, which constitutes a conservative, worst-case for the minnow and its habitat. Reclamation's finding was that given future fluctuations under Alternative 1, and based on the observations of biologists that in low water conditions, the minnow is able to move upstream/downstream, following the water, the action "may affect, is not likely to adversely affect" the minnow. With sufficient magnitude and duration of reservoir filling, critical habitat upstream of River Mile 62 may receive beneficial effects due to increased deposition of sediment north of the full pool of the reservoir.

### 4.15.4 Alternative 2: No San Juan–Chama Project Storage

The effects of Alternative 2 on the sport fish and the Rio Grande silvery minnow would be similar to those described under Alternative 1. The delta channel may extend farther into the reservoir for longer periods and would provide some additional riverine habitat due to fluctuations in reservoir levels.

### 4.15.5 Alternative 3: No Carryover Provision

The effects of Alternative 3 on sport fish and the Rio Grande silvery minnow would be almost identical to those described under Alternative 1 because of the fluctuations in reservoir levels over time.

### 4.15.6 Alternative 4: No Diversion Ratio Adjustment

The effects of Alternative 4 on sport fish and the Rio Grande silvery minnow would be almost identical to those under Alternative 1 because of the fluctuations in reservoir levels over time.

### 4.15.7 Alternative 5: Prior Operating Practices, No Action Alternative

Under the No Action Alternative (Alterantive 5) the effects on sport fish and the Rio Grande silvery minnow are projected to be the same as those under Alternative 1.

## 4.16 Invasive Species

### 4.16.1 Analysis Methods and Assumptions

As described in Section 4.13, the assumption is that lower reservoir levels may lead to the spread of noxious weeds and invasive plants including saltcedar, which competes with native, riparian vegetation. The spread of invasive animal species, including zebra and quagga mussels, is unrelated to reservoir elevations or releases from the dams. Therefore, these species are not relevant to the alternatives.

### 4.16.2 Effects Common to All Alternatives

The potential for spread and continued presence of invasive species, both plant and animal, would be the same under all alternatives. Invasive zebra and quagga mussels have been detected in upstream reservoirs. Under all alternatives, there is a potential for mussels to become established in Elephant Butte and Caballo Reservoirs; however, slight alterations in reservoir operations or flows in the river reaches do not affect the potential for the reservoirs' colonization or infestation by mussels. Preventative measures to clean boats entering and leaving reservoirs would continue under all alternatives.

## 4.17 Cultural Resources

### 4.17.1 Analysis Methods and Assumptions

Reclamation evaluated the effects of the alternatives on historic properties using the criteria defined in 36 CFR 800, which define adverse effects as "direct or indirect alteration of the characteristics that qualify a property for inclusion in the NRHP in a manner that diminishes integrity of location, design, setting, materials, workmanship, feeling, or association." The integrity of historic properties is assessed by the ability of the property to convey the important traditional, scientific, and public values for which it is determined to be historically significant.

### 4.17.2 Effects Common to All Alternatives

Under all alternatives, the effects would be the same: "no historic properties affected," in accordance with 36 CFR 800.4(d)(1). In November 2015, the New Mexico State Historic Preservation Officer concurred with this finding. (See Chapter 6 and Appendix D).

Because RGP water would continue to flow under all alternatives and allow the growth and harvesting of plants valued by the Mescalero Apache Tribe, there should be no effects to

resources of tribal concern. No Indian sacred sites have been identified to date, and thus there would be no effect on these cultural resources.

## 4.18 Indian Trust Assets

### 4.18.1 Effects Common to All Alternatives

Government-to-government consultation to date with potentially affected tribes, including the Mescalero Apache Tribe and the Pueblo of Ysleta del Sur, has not identified any ITAs. Therefore, implementing any of the alternatives would have no impact on ITAs.

## 4.19 Socioeconomics

### 4.19.1 Impact Indicators

The socioeconomic analysis evaluated impacts of the alternatives on economic benefits and regional economic indicators, as listed below. The summary of the results is found in Section 4.19.5. Economic benefit (direct impact) indicators are:

1. Economic value of agricultural water use in EBID
2. Economic value of agricultural water use in EPCWID
3. Economic value of urban water use in EPCWID
4. Economic value of recreation at Elephant Butte Reservoir
5. Economic value of hydropower generation at Elephant Butte Powerplant

Regional economic indicators are:

1. Employment (full and part-time jobs)
2. Income (employee compensation and proprietors' income)
3. Output (sales)

### 4.19.2 Analysis Methods and Assumptions

The proposed alternatives are analyzed using two economic measures: 1) the economic benefits, or direct impacts; and 2) the regional economic impacts. The economic benefits or direct impacts measure the effects of each alternative from a societal standpoint (a gain or loss to society from a change in activities). The regional economic impacts measure the effects of each alternative on a region's economy (such as changes in employment and income).

For this FEIS, the net economic benefit and regional economic impact calculations rely on hydrologic outcomes of project alternatives as provided by the hydrology technical memorandum (Reclamation 2015c; Appendix C) and available economic data.

The economic benefits and regional economic impacts stemming from the use of RGP water under each alternative are calculated and presented along with the differences from Alternative 5, the No Action Alternative. The economic benefits or direct impacts and regional economic impacts are calculated for the following categories of water use or users:

1. EBID
2. EPCWID
3. Hydropower production at Elephant Butte Powerplant

4. Recreation benefits at Elephant Butte Reservoir

Note that the regional economic impacts are measured based on the same general water use categories except for hydropower production at Elephant Butte Powerplant.

#### *4.19.2.1 Economic Benefits (Direct Impacts)*

##### 4.19.2.1.1 Elephant Butte Irrigation District

The estimation of net economic benefit value is limited to agricultural users and is based on the findings shown in the hydrology technical memorandum (Appendix C). The hydrologic simulation found that although depletion of shallow groundwater within the EBID service area occurs under all alternatives, the available supply to project irrigators was never exhausted, and therefore all crops received a full irrigation supply under all simulated conditions. The full impact of changes in project deliveries between alternatives is thus calculated as the differences in costs of pumping groundwater between alternatives.

The hydrologic modeling identified complete substitution of groundwater when surface water deliveries were not available. No changes in cropping or acreage resulted during the study period. Focusing solely on the Rincon and Mesilla Basins, the difference in the economic benefits between alternatives is limited to the differences in pumping costs incurred by project irrigators when surface water is not available.

Differences in costs of RGP surface water delivery between alternatives are not considered because costs are almost entirely fixed and are not volume dependent. While irrigators may experience differences in labor costs and other factors in using surface water instead of groundwater, there is no basis for quantifying these differences and so they are not considered.

Pumping costs are determined by the total volume pumped and the total head. Because both volume and head differ by alternative, each factor is used in calculating pumping costs. Capital costs are not considered, as all project irrigators are assumed by the hydrology technical memorandum (Appendix C) to have access to available supplemental groundwater as needed, and the relatively small volumes that differentiate alternatives are assumed to have no effect on pump lifetimes or maintenance costs.

*Groundwater pumping cost calculation*

The calculation of groundwater pumping costs was based on the energy costs of delivering the quantity of groundwater identified under each project alternative. The annual average groundwater delivery and the elevations and beginning of period well depths were taken from the hydrology technical memorandum (Appendix C), and the static head was taken from crop enterprise budgets for Sierra and Doña Ana Counties (New Mexico State University 2005). Energy (electric) costs and pump efficiency were likewise obtained from the crop enterprise budgets. The wells cover all cropping areas in EBID, and the simple average well elevation changes within each cropping area were used to calculate average pumping heads for each alternative.

Groundwater elevations for regions served by major canals were taken from the hydrology technical memorandum (Appendix C), which calculated groundwater elevations and initial groundwater depths. Groundwater elevations reported under each alternative for the 15 wells in the project area were averaged for the Rincon Valley and the Mesilla Valley Leasburg, Eastside, and Westside Canals. The total groundwater deliveries to EBID were allocated to each region based on the acreage reported in the hydrology technical memorandum (Appendix C). The

starting well depth was also taken from the hydrology technical memorandum (Appendix C). The typical head across the region and study period was 70 to 80 feet with 50 feet of static head (New Mexico State University 2005) and a calculated 20 to 30 feet well depth to water.

A pump efficiency of 0.47 for electric pumps and an electricity cost of $0.1098/kilowatt-hour for electricity were taken from crop enterprise budgets (New Mexico State University 2005). The cost of electricity was adjusted to 2015 levels using the producer price index for North American Industry Classification System 2211, electric utilities. A resulting energy cost of $0.152/kilowatt-hour was used (price index 2015 = 144.3; 2005 index = 104.2). The potential energy conversion is 1.024 kilowatt-hour /acre-foot/foot, meaning that at 100 percent efficiency, 1.024 kilowatt-hour of energy is required to lift one acre-foot of water to a height of 1 foot.

#### 4.19.2.1.2 El Paso County Water Improvement District Number 1

RGP deliveries to water users from the American Diversion Dam are not treated in the hydrologic modeling and there is no specific information on the disposition of RGP waters after delivery (Appendix C). The most recent financial report from El Paso Water (2015) gives an average year surface water delivery of 60,000 acre-feet for M&I uses, with these flows providing approximately half of the El Paso Water supply. The balance of the M&I water supplies is pumped from the Hueco and Mesilla Basins. All other surface water deliveries at the American Diversion Dam are then available for diversion for agricultural uses. (Deliveries to Mexico at the International Diversion Dam are included within the hydrologic modeling [Appendix C], and do not vary by alternative; therefore, they are not further considered in the economic analysis.) The historical full EPCWID allocation of 376,842 acre-feet then gives surface diversions of 316,842 acre-feet available for agricultural uses. Acreages of 6,494 and 62,516 in the Mesilla and El Paso Valleys, respectively, are used to calculate Mesilla and El Paso Valley full allocation diversions of 29,816 and 287,026 acre-feet, respectively. Any greater levels of urban surface water use would result in proportionally lower levels of Rio Grande agricultural diversions; this possibility is not considered here.

*EPCWID El Paso Valley agricultural water users*

Net benefits of RGP water use reported by Ward and Pulido-Velazquez (2012) are used to estimate the economic benefits associated with RGP surface water deliveries at the American Diversion Dam to El Paso Valley agricultural users. Their base scenario reports average deliveries to agricultural users of 237,000 acre-feet, with average net benefits of $112 per acre-foot. This is taken as the value of RGP surface water deliveries to El Paso Valley agricultural users when diversions fall below the full allocation level. According to Ward and Pulido-Velazquez (2012), agricultural users have not developed much groundwater pumping infrastructure and therefore are not reported to make significant use of groundwater to supplement their surface water use.

*EPCWID El Paso Valley urban water users*

El Paso urban uses rely heavily on groundwater, and sustainability of both the quantity and quality of groundwater supplies are a concern. To value the Rio Grande surface water delivered for urban use, the Ward and Pulido-Velazquez (2012) “sustaining” and “renewing” natural capital scenarios were used, which report a difference in urban water use of 6,000 acre-feet. The difference in the reported net benefits to urban water users is $574 per acre-foot and is taken here as the value of RGP water in El Paso urban uses when supply falls below 60,000 acre-feet.

*Distribution between agricultural and urban users*

The hydrology technical memorandum hydrologic studies provide no guidance on the distribution of RGP water to urban versus agricultural uses (Appendix C). Because values in urban and

agricultural uses can be substantially different, economic valuation would be sensitive to this distribution. The economic analysis here assumes that RGP water is distributed proportionally to urban and agricultural uses throughout the study period, and that urban uses are held to 60/376.842 = 15.9 percent of total EPCWID diversions, and agricultural uses receive 84.1 percent of diversions.

*EPCWID Mesilla Valley agricultural water users*
Deliveries of RGP water to EPCWID agricultural water users in the Mesilla Valley are valued identically to EBID agricultural water users. The hydrologic studies show full availability of groundwater to substitute for surface water when diversions fall below allocations. Total benefits from the use of groundwater and RGP surface water are calculated identically to EBID project users.

#### 4.19.2.1.3 Hydropower
The hydroelectric plant at Elephant Butte Dam generates power that is dependent on flow volume and head. Because both flows and reservoir elevation would differ between alternatives, expected power generation would also vary. There is currently no hydroelectric production at Caballo Dam, and thus no economic differences between alternatives exist, despite differing releases between alternatives.

*Reservoir elevation and releases*
The hydrology technical memorandum provides monthly elevations at Elephant Butte Reservoir for each alternative (Appendix C, Reclamation 2015c). Power production does not occur during winter months when RGP releases do not occur. Hydropower calculations are thus based on the calculated average elevation during the March to October period only. Annual releases from Elephant Butte Reservoir reported by the hydrology technical memorandum, reduced by the volume of spills, are used with the March to October average elevations (Appendix C) to calculate hydropower generation.

*Power plant characteristics and valuation*
The Elephant Butte Powerplant has a rated head of 140 feet and is assumed to operate with 90 percent efficiency. Energy generation is calculated from reservoir elevation, with the rated head achieved at the maximum elevation over the study period, and the potential energy conversion of 1.024 kilowatt-hour per acre-foot per foot of head. Calculated production based on the average March to October monthly elevation and release data for 2014 is 3 percent below the actual power plant production of 13.4 gigawatt-hours reported by Reclamation (2015d). Economic valuation of production is based on the economic opportunity cost concept and uses the same $0.152/ kilowatt-hour value as is assigned to the cost of groundwater pumping. This neglects distribution costs and losses (which would suggest a lower figure), but also does not consider use of the power plant for short-term peaking operations (which suggest an increased valuation). Reservoir elevation for purposes of hydropower calculations use only Alternative 1 reported values.

#### 4.19.2.1.4 Recreation
Elephant Butte Reservoir provides a variety of recreational benefits that vary based on reservoir storage. Because storage varies between project alternatives, recreational benefits are calculated for Elephant Butte Reservoir. Similarly, Caballo Reservoir provides recreational benefits. These benefits are not addressed, however, because the differences in Caballo Reservoir storage among alternatives are small and would not result in significant differences in economic benefits from recreation at Caballo Reservoir under each alternative.

Annual recreation benefits reported by Ward and Pulido-Velazquez (2012) are based on:

$$\textit{Value of Elephant Butte Reservoir recreation} = 379.82 + 2.21\,X - 0.0005030852\,X^2$$

where $X$ equals the average annual storage in thousand acre-feet and the economic value is in thousand dollars. Management costs of $0.31 per acre-foot of storage (due to increased visitation) are also identified (Ward 2014) and deducted from the economic benefit calculation reported here. The hydrology technical memorandum annual average reservoir storage is used with the above equation to estimate direct economic benefits of recreation (Reclamation 2015c, Appendix C).

#### *4.19.2.2 Regional Economic Impacts*

In addition to considering the net economic benefits or direct impacts of each alternative, the socioeconomic analysis estimates the potential regional economic impacts. The regional impacts may stem from changes in agricultural pumping costs, the costs of providing urban water, and recreation visitation expenditures. These direct economic impacts are input into the IMPLAN model to estimate total regional impacts. The direct economic impacts of hydropower are assumed to have no impacts on the regional economy.

IMPLAN is the modeling package used to assess the regional economic impacts stemming from the direct impacts associated with each alternative. IMPLAN is an economic input-output modeling system that estimates the effects of economic changes in a defined analysis area. IMPLAN is a static model that estimates impacts for a snapshot in time when the impacts are expected to occur, based on the makeup of the economy at the time of the underlying IMPLAN data. IMPLAN measures the initial impact on the economy but does not consider long-term adjustments as labor and capital move into alternative uses. Realistically, the structure of the economy would adapt and change; therefore, the IMPLAN results can only be used to compare relative changes between the No Action Alternative and the action alternatives and cannot be used to predict or forecast future employment, labor income, or output (sales).

Input-output models measure commodity flows from producers to intermediate and final consumers. Purchases for final use (final demand) drive the model. Industries produce goods and services for final demand and purchase goods and services from other producers. These other producers, in turn, purchase goods and services. This buying of goods and services (indirect purchases) continues until leakages from the analysis area (imports and value added) stop the cycle. These indirect and induced effects (the effects of household spending) can be mathematically derived using a set of multipliers. The multipliers describe the change in output for each regional industry caused by a $1.00 change in final demand.

This analysis used 2013 IMPLAN data for the counties encompassing the study areas. IMPLAN data files for the analysis area are compiled from a variety of sources, including the U.S. Bureau of Economic Analysis, the U.S. Bureau of Labor, and the U.S. Census Bureau.

### 4.19.3 Economic Benefits (Direct Impacts)

#### *4.19.3.1 Elephant Butte Irrigation District*

The hydrologic modeling assumes there are no changes in cropping or acreage during the study period. Focusing solely on the Rincon and Mesilla Basins, the difference in the economic benefits or direct impacts between alternatives is limited to differences in pumping costs incurred by project irrigators when surface water is not available. The hydrology modeling assumes that the

cropping pattern for each service area within the model domain is based on cropping data available for the year 2000.

The average annual ground water supply available to EBID as estimated by the hydrology model (Appendix C) are shown above in Section 4.10 entitled Farm Groundwater Deliveries. These EBID deliveries are split between the Rincon (roughly 20 percent) and Mesilla (roughly 73 percent) Valleys based on the acreage distribution between the two valleys (including EPCWID land in the Mesilla Valley).

Table 4-15 EBID average annual pumping costs (millions of dollars) by alternative and climate scenario

| Valley & | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| Rincon | | | | | |
| Drier | 1.3 | 1.3 | 1.3 | 1.1 | 1.1 |
| Central | 1.1 | 1.1 | 1.1 | 0.9 | 0.9 |
| Wetter | 1.0 | 1.0 | 1.0 | 0.8 | 0.9 |
| Mesilla | | | | | |
| Drier | 4.7 | 4.7 | 4.6 | 4.1 | 4.2 |
| Central | 4.1 | 4.1 | 3.8 | 3.4 | 3.4 |
| Wetter | 3.6 | 3.6 | 3.7 | 2.9 | 3.1 |

Table 4-16 EBID Agricultural benefit values (millions of dollars) relative to a change between No Action and action alternatives and climate scenario

| Valley & | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| Rincon | | | | | |
| Drier | -0.2 | -0.2 | -0.2 | 0.0 | No Action |
| Central | -0.2 | -0.2 | -0.2 | 0.0 | No Action |
| Wetter | -0.1 | -0.1 | -0.1 | 0.1 | No Action |
| Mesilla | | | | | |
| Drier | -0.5 | -0.5 | -0.4 | 0.1 | No Action |
| Central | -0.7 | -0.7 | -0.4 | 0.0 | No Action |
| Wetter | -0.5 | -0.5 | -0.6 | 0.2 | No Action |
| Total | | | | | |
| Drier | -0.7 | -0.7 | -0.6 | 0.1 | No Action |
| Central | -0.9 | -0.9 | -0.6 | 0.0 | No Action |
| Wetter | -0.6 | -0.6 | -0.7 | 0.3 | No Action |

#### 4.19.3.1.1 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Under Alternative 1, the estimated pumping costs equal $1.1 million in the Rincon Valley and $4.1 million in the Mesilla Valley based on the central climate scenario as shown in Table 4-15. The impact of this alternative is measured relative to Alternative 5 (No Action) as shown in Table 4-16. Under Alternative 1, pumping costs increase relative to Alternative 5, therefore under this alternative, economic benefits decrease, based on the central climate scenario, by $0.2 in the Rincon Valley and $0.7 in the Mesilla Valley.

#### 4.19.3.1.2 Alternative 2: No San Juan–Chama Project Storage

As shown in Tables 4-15 and 4-16, Alternative 2 would be the same as Alternative 1.

#### 4.19.3.1.3 Alternative 3: No Carryover Provision

Under Alternative 3, the estimated pumping costs equal $1.1 million in the Rincon Valley and $3.8 million in the Mesilla Valley based on the central climate scenario as shown in Table 4-15. The impact of this alterative is measured relative to Alternative 5 (No Action) as shown in Table 4-16. Under Alternative 3, pumping costs increase relative to Alternative 5, therefore under this alternative economic benefits decrease, based on the central climate scenario, by $0.2 and $0.4, in the Rincon Valley and Mesilla Valley, respectively.

#### 4.19.3.1.4 Alternative 4: No Diversion Ratio Adjustment

Under Alternative 4, the estimated pumping costs equal $0.9 million in the Rincon Valley and $3.4 million in the Mesilla Valley based on the central climate scenario as shown in Table 4-15. The impact of this alterative is measured relative to Alternative 5 (No Action) as shown in Table 4-16. Under Alternative 4, pumping costs do not change relative to Alternative 5, therefore under this alternative economic benefits are unchanged, based on the central climate scenario, in both the Rincon and Mesilla Valleys.

#### 4.19.3.1.5 Alternative 5: Prior Operating Practices, No Action Alternative

Under Alternative 5, the estimated pumping costs equal $0.9 million in the Rincon Valley and $3.4 million in the Mesilla Valley based on the central climate scenario as shown in Table 4-15. Alternative 5 is the No Action Alternative, therefore the impacts of the action alternatives are relative to this alternative.

### *4.19.3.2 El Paso County Water Improvement District No. 1*

As discussed in Section 4.19.2, EPCWID supplies water to both agricultural water users and urban or M&I users. The economic benefits and regional economic impacts are analyzed separately for agricultural and M&I water uses. The average annual water supply available to EPCWID is estimated by the hydrology model (Appendix C). The economic analysis here assumes that RGP water is distributed proportionally to M&I (15.9 percent of diversions) and agricultural (84.1 percent of diversions) uses throughout the study period.

#### 4.19.3.2.1 El Paso Valley agricultural use

EPCWID El Paso Valley agricultural water use value is based on the net benefits of RGP water use reported by Ward and Pulido-Velazquez (2012). Agricultural users in this area are not reported to make significant use of groundwater to supplement their surface water use. Therefore, the agricultural benefit value is based on the effects of surface water deliveries for each alternative as it relates to surface water deliveries.

Table 4-17 EPCWID El Paso Valley average annual agricultural benefits (millions of dollars) by alternative and climate scenario

| Valley & Climate | Alternative 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Drier | 20.6 | 20.6 | 20.5 | 19.2 | 19.5 |
| Central | 23.4 | 23.4 | 22.8 | 22.0 | 21.7 |
| Wetter | 26.2 | 26.2 | 26.3 | 25.3 | 25.2 |

Table 4-18 EPCWID El Paso Valley average annual agricultural benefits changes (millions of dollars) between alternatives and climate scenario

| Valley & Climate | Alternative 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Drier | 1.1 | 1.1 | 1.0 | -0.3 | No Action |
| Central | 1.7 | 1.7 | 1.1 | 0.3 | No Action |
| Wetter | 1.0 | 1.0 | 1.1 | 0.1 | No Action |

#### 4.19.3.2.1.1 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Under Alternative 1, the estimated value of production is $23.4 million in the El Paso Valley based on the central climate scenario as shown in Table 4-17. The impact of this alterative is measured relative to Alternative 5 (No Action) as shown in Table 4-18. Under Alternative 1 based on the central climate scenario, the change in value of production is $1.7 million compared to Alternative 5.

#### 4.19.3.2.1.2 Alternative 2: No San Juan–Chama Project Storage

As shown in Tables 4-17 and 4-18, Alternative 2 would be the same as Alternative 1. Under Alternative 2 based on the central climate scenario, the change in value of production is $1.7 million compared to Alternative 5 (No Action).

#### 4.19.3.2.1.3 Alternative 3: No Carryover Provision

Under Alternative 3, the estimated value of production is $22.8 million in the El Paso Valley based on the central climate scenario as shown in Table 4-17. The impact of this alterative is measured relative to Alternative 5 (No Action) as shown in Table 4-18. Under Alternative 3 based on the central climate scenario the change in value of production is $1.1 million compared to Alternative 5.

#### 4.19.3.2.1.4 Alternative 4: No Diversion Ratio Adjustment

Under Alternative 4, the estimated value of production is $22.0 million in the El Paso Valley based on the central climate scenario as shown in Table 4-17. The impact of this alterative is measured relative to Alternative 5 (No Action) as shown in Table 4-18. Under Alternative 4 based on the central climate scenario the change in value of production is $0.3 million compared to Alternative 5.

4.19.3.2.1.5 Alternative 5: Prior Operating Practices, No Action Alternative

Under Alternative 5, the estimated value of production is $21.7 million in the El Paso Valley based on the central climate scenario as shown in Table 4-17. Alternative 5 is the No Action Alternative, therefore the impacts of the action alternatives are relative to this alternative.

### 4.19.3.2.2 Mesilla Valley agricultural use

In the Mesilla Valley, the hydrologic studies show full availability of groundwater to substitute for surface water when diversions fall below allocations. The difference in the economic benefits or direct impacts between alternatives is limited to differences in pumping costs incurred by project irrigators when surface water is not available.

Table 4-19 EPCWID Mesilla Valley agricultural benefit values relative to a change ($ millions) between No Action and action alternatives and climate scenario

| Mesilla Valley & Climate | Alternative 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Drier | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 |
| Central | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| Wetter | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 |

Table 4-20 EPCWID Mesilla Valley annual agricultural benefits changes ($ millions) between No Action and action alternatives by alternative and climate scenario

| Mesilla Valley & Climate | Alternative 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Drier | 0.1 | 0.1 | 0.0 | 0.0 | No Action |
| Central | 0.0 | 0.0 | 0.0 | 0.0 | No Action |
| Wetter | 0.1 | 0.1 | 0.1 | 0.1 | No Action |

4.19.3.2.2.1 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Under Alternative 1, the estimated pumping cost is $0.3 million in the Mesilla Valley based on the central climate scenario as shown in Table 4-19. The impact of this alterative is measured relative to the No-Action Alternative (Alternative 5) as shown in Table 4-20. There is no change in pumping costs under Alternative 1 compared to the No-Action Alternative; therefore, the economic benefit value is unchanged.

4.19.3.2.2.2 Alternative 2: No San Juan–Chama Project Storage

As shown in Tables 4-19 and 4-20, Alternative 2 would be the same as Alternative 1. There is no change in pumping costs under Alternative 2 compared to Alternative 5 (No Action); therefore, the economic benefit value is unchanged.

4.19.3.2.2.3 Alternative 3: No Carryover Provision

Under Alternative 3, the estimated pumping cost is $0.3 million in the Mesilla Valley based on the central climate scenario as shown in Table 4-19. The impact of this alterative is measured relative to Alternative 5 (No Action) as shown in Table 4-20. There is no change in pumping

costs under Alternative 3 compared to Alternative 5; therefore, the economic benefit value is unchanged.

#### 4.19.3.2.2.4 Alternative 4: No Diversion Ratio Adjustment

Under Alternative 4, the estimated pumping cost is $0.3 million in the Mesilla Valley based on the central climate scenario as shown in Table 4-19. The impact of this alterative is measured relative to Alternative 5 (No Action) as shown in Table 4-20. There is no change in pumping costs under Alternative 4 compared to Alternative 5; therefore, the economic benefit value is unchanged.

#### 4.19.3.2.2.5 Alternative 5: Prior Operating Practices, No Action Alternative

Under Alternative 5, the estimated pumping cost is $0.3 million in the Mesilla Valley based on the central climate scenario as shown in Table 4-19. The impact of this alterative is measured relative to Alternative 5 (No Action) as shown in Table 4-20. Alternative 5 is the No Action Alternative; therefore, the impacts of the action alternatives are relative to this alternative.

### 4.19.3.2.3 EPCWID El Paso Valley urban use

The Ward and Pulido-Velazquez (2012) values were used to estimate the economic benefit values for urban water use in EPCWID as explained in Section 4.19.2. A value of $574 per acre-foot was applied to the estimated average annual urban deliveries to estimate the average annual benefits value for the alternative.

Table 4-21 EPCWID El Paso Valley urban use average annual economic benefits ($ millions) by alternative and climate scenario

| El Paso Valley & Climate | Alternative 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Drier | 19.9 | 19.9 | 19.6 | 18.3 | 18.3 |
| Central | 22.8 | 22.8 | 21.8 | 21.2 | 20.7 |
| Wetter | 25.3 | 25.3 | 25.1 | 23.8 | 23.7 |

Table 4-22 EPCWID El Paso Valley urban use average annual economic benefits ($ millions) changes between No Action and action alternatives by alternative and climate scenario

| El Paso Valley & Climate | Alternative 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Drier | 1.6 | 1.6 | 1.3 | 0.0 | No Action |
| Central | 2.1 | 2.1 | 1.1 | 0.5 | No Action |
| Wetter | 1.6 | 1.6 | 1.4 | 0.1 | No Action |

#### 4.19.3.2.3.1 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Under Alternative 1, the estimated value of urban water in EPCWID is $22.8 million based on the central climate scenario as shown in Table 4-21. The impact of this alterative is measured relative to Alternative 5 (No Action), as shown in Table 4-22. Under Alternative 1 based on the central climate scenario the change in value is $2.1 million compared to Alternative 5.

4.19.3.2.3.2 Alternative 2: No San Juan–Chama Project

As shown in Tables 4-21 and 4-22, Alternative 2 would be the same as Alternative 1. Under Alternative 2 based on the central climate scenario, the change in value is $2.1 million compared to Alternative 5 (No Action).

4.19.3.2.3.3 Alternative 3: No Carryover Provision

Under Alternative 3, the estimated value of urban water in EPCWID is $21.8 million based on the central climate scenario as shown in Table 4-21. The impact of this alterative is measured relative to Alternative 5 (No Action) as shown in Table 4-22. Under Alternative 3 based on the central climate scenario, the change in value is $1.1 million compared to Alternative 5.

4.19.3.2.3.4 Alternative 4: No Diversion Ratio Adjustment

Under Alternative 4, the estimated value of urban water in EPCWID is $21.2 million based on the central climate scenario as shown in Table 4-21. The impact of this alterative is measured relative to Alternative 5 (No Action) as shown in Table 4-22. Under Alternative 4 based on the central climate scenario the change in value is $0.5 million compared to Alternative 5.

4.19.3.2.3.5 Alternative 5: Prior Operating Practices, No Action Alternative

Under Alternative 5, the estimated value of urban water in EPCWID is $20.7 million based on the central climate scenario as shown in Table 4-21. Alternative 5 is the No Action Alternative; therefore, the impacts of Alternatives 1 to 4 are shown relative to this alternative.

#### *4.19.3.3 Hydropower*

Flows and reservoir elevations differ between alternatives; therefore, the expected power generation (gigawatt-hour) would also vary between alternatives. The estimated generation at Elephant Butte Dam by alternative is shown in Table 4-23. The estimated economic value of this generation is shown in Table 4-24 and the impacts by alternative are shown in Table 4-25.

Table 4-23 Elephant Butte hydropower (Gwh) average annual economic benefits by alternative and climate scenario

| Benefit & | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| Drier | 25.2 | 25.2 | 26.2 | 24.8 | 25.0 |
| Central | 34.8 | 34.8 | 34.3 | 33.5 | 33.7 |
| Wetter | 39.6 | 39.6 | 36.1 | 34.7 | 35.0 |

Table 4-24 Elephant Butte hydropower average annual economic benefits ($ millions) by alternative and climate scenario

| | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| Drier | 3.8 | 3.8 | 4.0 | 3.8 | 3.8 |
| Central | 5.3 | 5.3 | 5.2 | 5.1 | 5.1 |
| Wetter | 6.0 | 6.0 | 5.5 | 5.3 | 5.3 |

Table 4-25 Elephant Butte hydropower average annual economic benefits ($ millions) changes between No Action and action alternatives by alternative and climate scenario

| | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| Drier | 0.0 | 0.0 | 0.2 | 0.0 | No Action |
| Central | 0.2 | 0.2 | 0.1 | 0.0 | No Action |
| Wetter | 0.7 | 0.7 | 0.2 | 0.0 | No Action |

#### 4.19.3.3.1 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Under Alternative 1, the estimated value of hydropower is $5.3 million based on the central climate scenario as shown in Table 4-24. The impact of this alterative is measured relative to Alternative 5 (No Action) as shown in Table 4-25. Under Alternative 1 based on the central climate scenario the change in value is $0.2 million compared to Alternative 5.

#### 4.19.3.3.2 Alternative 2: No San Juan–Chama Project Storage

As shown in Tables 4-24 and 4-25, Alternative 2 would be the same as Alternative 1. Under Alternative 2 based on the central climate scenario, the change in value is $0.2 million compared to Alternative 5 (No Action).

#### 4.19.3.3.3 Alternative 3: No Carryover Provision

Under Alternative 3, the estimated value of hydropower is $5.2 million based on the central climate scenario as shown in Table 4-24. The impact of this alterative is measured relative to Alternative 5 (No Action) as shown in Table 4-25. Under Alternative 3 based on the central climate scenario the change in value is $0.1 million compared to Alternative 5.

#### 4.19.3.3.4 Alternative 4: No Diversion Ratio Adjustment

Under Alternative 4, the estimated value of hydropower is $5.1 million based on the central climate scenario as shown in Table 4-24. The impact of this alterative is measured relative to Alternative 5 (No Action) as shown in Table 4-25. Under Alternative 4 based on the central climate scenario there is no change in value compared to Alternative 5.

#### 4.19.3.3.5 Alternative 5: Prior Operating Practices, No Action Alternative

Under Alternative 5, the estimated value of hydropower is $5.1 million based on the central climate scenario as shown in Table 4-24. Alternative 5 is the No Action Alternative; therefore, the impacts of the action alternatives are relative to this alternative.

### *4.19.3.4 Recreation*

Elephant Butte Reservoir provides a variety of recreational benefits that vary based on reservoir storage. Because storage varies between alternatives, recreational benefits are calculated for Elephant Butte Reservoir (Mesilla Valley). Recreational activities at Caballo Reservoir also provide recreational benefits. Because the differences in Caballo storage between project alternatives are small and would not result in significant differences in economic benefits from Caballo recreation, these benefits were not estimated.

Table 4-26 Elephant Butte recreation average annual economic benefits ($ millions) by alternative and climate scenario

| | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| Drier | 0.9 | 0.9 | 0.9 | 0.8 | 0.9 |
| Central | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| Wetter | 1.1 | 1.1 | 1.2 | 1.1 | 1.1 |

Table 4-27 Elephant Butte recreation average annual economic benefits changes ($ millions) between No Action and Action Alternatives by alternative and climate scenario

| | Alternative | | | | |
|---|---|---|---|---|---|
| Climate | 1 | 2 | 3 | 4 | 5 |
| Drier | 0.0 | 0.0 | 0.0 | -0.1 | No Action |
| Central | 0.0 | 0.0 | 0.0 | 0.0 | No Action |
| Wetter | 0.0 | 0.0 | 0.1 | 0.0 | No Action |

#### 4.19.3.4.1 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

The estimated value of recreation is shown in Table 4-26. The impact of this alterative is measured relative to Alternative 5 (No Action) as shown in Table 4-27. The differences in Elephant Butte Reservoir storage compared to Alternative 5 are small and would not result in significant differences in economic benefits.

#### 4.19.3.4.2 Alternative 2: No San Juan–Chama Project Storage

As shown in Tables 4-26 and 4-27, Alternative 2 would be the same as Alternative 1. The differences in Elephant Butte Reservoir storage compared to Alternative 5 (No Action) are small and would not result in significant differences in economic benefits.

#### 4.19.3.4.3 Alternative 3: No Carryover Provision

The estimated value of recreation is shown in Table 4-26. The impact of this alterative is measured relative to Alternative 5 as shown in Table 4-27. The differences in Elephant Butte Reservoir storage compared to Alternative 5 (No Action) are small and would not result in significant differences in economic benefits.

#### 4.19.3.4.4 Alternative 4: No Diversion Ratio Adjustment

The estimated value of recreation is shown in Table 4-26. The impact of this alterative is measured relative to Alternative 5 as shown in Table 4-27. The differences in Elephant Butte Reservoir storage compared to Alternative 5 are small and would not result in significant differences in economic benefits.

#### 4.19.3.4.5 Alternative 5: Prior Operating Practices, No Action Alternative

Alternative 5 is the No Action Alternative; therefore, the impacts of the action alternatives are relative to this alternative.

## 4.19.4 Regional Economic Impacts

### *4.19.4.1 Elephant Butte Irrigation District*

The regional economic impacts in EBID would result from a change in pumping costs. Pumping cost changes would result in higher or lower net farm income, which translates to farm households having more or less money to spend within the regional economy.

Table 4-28 EBID regional economic impacts by alternative under the central tendency climate change scenario (incremental to Alternative 5)

| | Alternative | | | | |
|---|---|---|---|---|---|
| EBID Ag. | 1 | 2 | 3 | 4 | 5 |
| Employment | -5 | -5 | -4 | 0 | No Action |
| Labor Income | (185,947) | (185,947) | (123,965) | 0 | No Action |
| Output | (599,166) | (599,166) | (399,444) | 0 | No Action |

#### 4.19.4.1.1 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Pumping costs in the Rincon and Mesilla Valleys are estimated to increase by $0.9 million compared to Alternative 5 (No Action) under the central tendency climate change, as discussed in Section 4.19.3. The regional impacts of this alternative stem from a decrease ($0.9) in farm household income, because of the pumping cost increase, relative to Alternative 5. The changes in employment, labor income, and output under Alternative 1 are shown in Table 4-28.

#### 4.19.4.1.2 Alternative 2: No San Juan–Chama Project Storage

As shown in Table 4-28, Alternative 2 would be the same as Alternative 1. The regional impacts of this alternative stem from a decrease ($0.9) in farm household income because of the pumping cost increase relative to Alternative 5 (No Action).

#### 4.19.4.1.3 Alternative 3: No Carryover Provision

Pumping costs in the Rincon and Mesilla Valleys are estimated to increase by $0.6 million compared to Alternative 5, under the central tendency climate change, as discussed in Section 4.19.3. The regional impacts of this alternative stem from a decrease ($0.6) in farm household income, because of the pumping cost increase, relative to Alternative 5 (No Action). The changes in employment, labor income, and output under the Alternative 3 are shown in Table 4-28.

#### 4.19.4.1.4 Alternative 4: No Diversion Ratio Adjustment

Compared to Alternative 5, under the central tendency climate scenario there is no estimated change in pumping costs in the Rincon and Mesilla Valleys under Alternative 4 as discussed in Section 4.19.3. Therefore, there is no change in the estimated regional impacts under this alternative as shown in Table 4-28.

#### 4.19.4.1.5 Alternative 5: Prior Operating Practices, No Action Alternative

The regional economic impacts are measured based on incremental changes from Alternative 5 conditions; therefore, the total regional impacts associated with Alternative 5 (No Action) were not measured.

### *4.19.4.2 El Paso County Water Improvement District No. 1*

#### 4.19.4.2.1 El Paso Valley agricultural use

The regional impacts stemming from El Paso Valley agricultural use are based a change in production value as shown in Table 4-18.

Table 4-29 EPCWID, El Paso Valley agriculture regional impacts under the central tendency climate change scenario by alternative (incremental to Alternative 5)

| | Alternative | | | | |
|---|---|---|---|---|---|
| EPCWID Ag. El Paso | 1 | 2 | 3 | 4 | 5 |
| Employment | 45 | 45 | 29 | 8 | No Action |
| Labor Income | 1,107,627 | 1,107,627 | 716,700 | 195,463 | No Action |
| Output | 3,194,525 | 3,194,525 | 2,067,046 | 563,740 | No Action |

4.19.4.2.1.*1 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative*

Under Alternative 1, the agricultural production value is estimated to increase by $1.7 million (shown in Table 4-18) compared to Alternative 5 (No Action). This increase in value has a positive impact on the regional economy in terms of job, labor income, and output as shown in Table 4-29.

4.19.4.2.1.2 Alternative 2: No San Juan–Chama Project

As shown in Table 4-29, Alternative 2 would be the same as Alternative 1 in terms of job, labor income, and output as shown in Table 4-29.

4.19.4.2.1.3 Alternative 3: No Carryover Provision

Under Alternative 3, the agricultural production value is estimated to increase by $1.1 million (shown in Table 4-18) compared to Alternative 5 (No Action). This increase in value has a positive impact on the regional economy in terms of job, labor income, and output as shown in Table 4-29.

4.19.4.2.1.4 Alternative 4: No Diversion Ratio Adjustment

Under Alternative 4, the agricultural production value is estimated to increase by $0.3 million (shown in Table 4-18) compared to Alternative 5 (No Action). This increase in value has a positive impact on the regional economy in terms of job, labor income, and output as shown in Table 4-29.

4.19.4.2.1.5 Alternative 5: Prior Operating Practices, No Action Alternative

The regional economic impacts are measured based on incremental changes from Alternative 5 conditions; therefore, the total regional impacts associated with Alternative 5 (No Action) were not measured.

#### 4.19.4.2.2 Mesilla Valley Agricultural Use

The estimated change in economic benefits or direct impacts are unchanged for all alternatives relative to Alternative 5 (No Action) as shown in Table 4-20.

#### 4.19.4.2.3 EPCWID Urban Use

The regional impacts stemming from El Paso Valley urban water use are based a change in the change in economic value or direct impacts as shown in Table 4-22.

Table 4-30 EPCWID, El Paso Valley urban regional impacts under the central tendency climate change scenario by alternative (incremental to Alternative 5)

| EPCWID M&I, El Paso | Alternative 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Employment | 15 | 15 | 8 | 7 | No Action |
| Labor Income | 1,041,396 | 1,041,396 | 545,493 | 557,497 | No Action |
| Output | 3,603,279 | 3,603,279 | 1,887,432 | 857,923 | No Action |

##### 4.19.4.2.3.1 Alternative 1: Continued OA and San Juan–Chama Storage, Preferred Alternative

Under Alternative 1, the value of urban water use is estimated to increase by $2.1 million (shown in Table 4-22) compared to Alternative 5 (No Action). This increase in value has a positive impact on the regional economy in terms of job, labor income, and output as shown in Table 4-30.

##### 4.19.4.2.3.2 Alternative 2: No San Juan–Chama Project

As shown in Tables 4-22 and 4-30, Alternative 2 would be the same as Alternative 1 in terms of job, labor income, and output.

##### 4.19.4.2.3.3 Alternative 3: No Carryover Provision

Under Alternative 3, the value of urban water use is estimated to increase by $1.1 million (shown in Table 4-22) compared to Alternative 5 (No Action). This increase in value has a positive impact on the regional economy in terms of job, labor income, and output as shown in Table 4-30.

##### 4.19.4.2.3.4 Alternative 4: No Diversion Ratio Adjustment

Under Alternative 4, the value of urban water use is estimated to increase by $0.5 million (shown in Table 4-22) compared to Alternative 5 (No Action). This increase in value has a positive impact on the regional economy in terms of job, labor income, and output as shown in Table 4-30.

##### 4.19.4.2.3.5 Alternative 5: Prior Operating Practices, No Action Alternative

The regional economic impacts are measured based on incremental changes from Alternative 5 conditions; therefore, the total regional impacts associated with Alternative 5 (No Action) were not measured.

### *4.19.4.3 Hydropower*

The regional impacts are not affected by hydropower production at Elephant Butte.

#### *4.19.4.4 Recreation*

The differences in Elephant Butte Reservoir storage for all action alternatives compared to Alternative 5 (No Action) are small and would not result in significant differences in regional economic impacts.

### 4.19.5 Summary Conclusions

The average annual economic benefits under the central tendency climate scenario for each alternative and water use category are summarized in Table 4-31. Generally, Alternatives 1 to 4 would increase the total benefits compared to Alternative 5 (No Action). The economic benefits estimated for EBID would decrease compared to Alternative 5 for all of the alternatives except Alternative 4, while the benefits estimated for EPCWID would increase compared to Alternative 5.

The regional impacts under the central tendency climate scenario estimated for each alternative and water use category are summarized in Table 4-32. Generally, the regional impacts in the New Mexico study area (Doña Ana and Sierra Counties, New Mexico) where EBID is located decrease compared to Alternative 5 for all action alternatives.

The regional impacts in the Texas study area (El Paso and Hudspeth Counties) where EPCWID is located increase for all action alternatives compared to Alternative 5. Compared to the overall region, these changes (positive and negative) are small compared to the entire regional economies of the New Mexico and Texas study areas.

Table 4-31 Summary of economic benefits (millions of dollars) by alternative under the central tendency climate scenario

| | Alternative | | | | |
|---|---|---|---|---|---|
| Valley & Resource | 1 | 2 | 3 | 4 | 5 |
| Rincon Agriculture | -0.20 | -0.20 | -0.20 | 0.00 | No Action |
| Mesilla Agriculture | -0.70 | -0.70 | -0.40 | 0.00 | No Action |
| EPCWID El Paso Ag. | 1.70 | 1.70 | 1.10 | 0.30 | No Action |
| EPCWID Mesilla Ag. | 0.00 | 0.00 | 0.00 | 0.00 | No Action |
| EPCWID El Paso M&I | 2.10 | 2.10 | 1.10 | 0.50 | No Action |
| Hydropower | 0.20 | 0.20 | 0.10 | 0.00 | No Action |
| Recreation | 0.00 | 0.00 | 0.00 | 0.00 | No Action |
| Total | 3.10 | 3.10 | 1.70 | 0.80 | No Action |

Table 4-32 Regional impacts summary (jobs, dollars) by alternative under the central tendency climate scenario

| | Alternative | | | | |
|---|---|---|---|---|---|
| Valley/Resource | 1 | 2 | 3 | 4 | 5 |
| EBID Agriculture | | | | | |
| Employment | -5 | -5 | -4 | 0 | No action |
| Labor Income | (185,947) | (185,947) | (123,965) | 0 | No action |
| Output | (599,166) | (599,166) | (399,444) | 0 | No action |
| EPCWID El Paso Valley Agriculture | | | | | |
| Employment | 45 | 45 | 29 | 8 | No action |
| Labor Income | 1,107,627 | 1,107,627 | 716,700 | 195,463 | No action |
| Output | 3,194,525 | 3,194,525 | 2,067,046 | 563,740 | No action |
| EPCWID Mesilla Valley -Ag | No Change | No Change | No Change | No Change | No action |
| EPCWID El Paso – M&I (Urban) | | | | | |
| Employment | 15 | 15 | 8 | 7 | No action |
| Labor Income | 1,041,396 | 1,041,396 | 545,493 | 557.497 | No action |
| Output | 3,603,279 | 3,603,279 | 857,923 | 563,740 | No action |

# 4.20 Environmental Justice

## 4.20.1 Analysis Methods and Assumptions

As informed by the Federal Interagency Working Group on Environmental Justice and NEPA Committee (2016), a disproportionately high and adverse impact on minority or low-income populations is based on a comparison of the adverse impacts on the environmental justice community relative to the impacts on the overall population of the study area, based on the particular resource analyzed in the NEPA document. As described in Section 3.15 of Chapter 3, Doña Ana, El Paso, and Hudspeth Counties are environmental justice communities, while Sierra County is not an environmental justice community. However, because the economic analysis combined Sierra County with Doña Ana County as the New Mexico study area, this combination is retained here.

## 4.20.2 Employment

From 1970 to 2014, employment in the four counties grew from 179,838 to 515,740 jobs, a 187 percent increase (Commerce, Bureau of Economic Analysis 2015). Tables 4-28 and 4-32 project a potential loss of 4 or 5 farm jobs in the non-environmental justice communities (Doña Ana and Sierra Counties, New Mexico study area) under the action alternatives compared to Alternative 5 (No Action). Tables 4-29 and 4-32 show that the environmental justice communities (El Paso and Hudspeth Counties, Texas study area) would experience a slight positive benefit: a potential increase of 8 to 45 farm jobs compared to Alternative 5 (No Action). Relative to 515,740 total jobs in the study area during 2014, 4 to 45 jobs is insignificant. This means there is neither a high nor disproportionate effect on environmental justice communities.

## 4.20.3 Income

From 1970 to 2014, personal income grew from $8,820.3 million to $33,568.8 million, a 281 percent increase across the four-counties (Commerce, Bureau of Economic Analysis 2015). Tables 4-28 and 4-32 project a potential maximum decrease in labor income in the non-environmental justice communities (Doña Ana and Sierra Counties, New Mexico study area) of $185,947. Tables 4-29 and 4-32 indicate there would be a potential maximum increase of $1,107,627 in the environmental justice communities (El Paso and Hudspeth Counties, Texas study area), an insignificant effect relative to the $34 million incomes in the counties.

# 5 Cumulative Effects and Other NEPA Considerations

This chapter discusses the cumulative effects of the alternatives within the context of other past, present, and reasonably foreseeable future actions. It also presents other NEPA considerations from 40 CFR 1502.16 including adverse effects which cannot be avoided should the proposal be implemented, the relationship between short-term uses and long-term productivity, and any irreversible and irretrievable commitments of resources involved in the proposal should it be implemented.

## 5.1 Regulatory Framework

CEQ regulations require consideration of cumulative impacts defined as:

> "…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. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." [40 CFR 1508.7]

Following CEQ guidance, the cumulative impact study area for identifying these actions is expanded beyond the immediate project area to include actions that might affect the same water resources, biological, cultural and socioeconomic resources of the environment as those described in Chapters 3 and 4. Cumulative actions that could result in cumulative impacts are listed below.

## 5.2 Reasonably Foreseeable Future Actions

Actions which have the potential to create ongoing or additive effects to those of the alternatives are summarized in chronological order with the most recent documents first

### 5.2.1 Far West Texas Water Development Board Plan (2016) and El Paso Water Plan (2013)

The 2016 Far West Texas Water Plan prepared by the Texas Water Development Board (2016) recognizes that current and future water demand and supply sources are constantly changing and indicates water plans need to be updated every 5 years. The plans recognize the City of El Paso as one of the fastest growing cities in Texas and that throughout Far West Texas (a larger area than the study are for this FEIS), the largest category of water use is irrigated agriculture. The 2016 Far West Texas Water Plan states that irrigation water shortages have occurred in El Paso and Hudspeth Counties due to insufficient water in the Rio Grande during the recent drought and those farmers in these counties have generally reduced irrigated acreage, changed types of crops planted, or not planted crops.

El Paso Water is the largest supplier of municipal water in Far West Texas and the utility has implemented a water conservation program that has significantly reduced per capita water demand. The City of El Paso has historically received about 50 percent of its M&I supply from surface water and 50 percent from groundwater in the Hueco Bolson and the Mesilla Bolson.

According to Hutchison (2006), historic pumping in the Mesilla Bolson has not resulted in significant changes in groundwater levels or groundwater quality, but pumping up to 1979 in the Hueco Bolson lowered groundwater levels and led to brackish groundwater intrusion. In the 1980s, El Paso reduced its groundwater pumping in the Hueco Bolson to about 80,000 AFY by increasing surface water diversion from the Rio Grande, increasing conservation efforts, and increasing reclaimed water use. By 2002, El Paso Water pumping in the Hueco Bolson dropped below 40,000 AFY and has since remained at these levels (Hutchison 2006). Reclamation, 2014a. River Maintenance Program-Delta Channel Maintenance Project Environmental Assessment
The Delta Channel Maintenance Project maintains the existing, constructed Delta Channel to facilitate efficient delivery of Rio Grande water to the Elephant Butte Reservoir pool. It involves such activities as channel sediment removals, berm repair, site access, and staging area maintenance. River maintenance is conducted along 20.8 miles of the Delta Channel. Project-related road and staging area maintenance would be conducted within an approximately 293-square mile study area boundary in Socorro and Sierra Counties, New Mexico.

### 5.2.2 Reclamation River Maintenance Program-Delta Channel Maintenance Project Environmental Assessment and Finding of No Significant Impact

The Delta Channel Maintenance Project maintains the existing constructed delta channel to facilitate efficient delivery of Rio Grande water to Elephant Butte Reservoir. It involves activities such as channel sediment removal, berm repair, site access, etc. River maintenance is conducted along a 20.8 miles in Socorro and Sierra Counties, New Mexico. The project includes a suite of conservation measures to minimize or avoid adverse impacts on water quality, vegetation, species habitat, and wildlife. In addition, Reclamation is implementing recovery actions identified in the flycatcher and Rio Grande silvery minnow recovery plans.

### 5.2.2 USIBWC River Management Alternatives for the Rio Grande Canalization Project, River Management Plan, FEIS and Record of Decision (2014, 2012, 2009)

The USIBWC completed an evaluation of river management alternatives for the Rio Grande Canalization Project. This project affects a 105.4-mile long river reach from Percha Dam to the international boundary at El Paso and Cuidad Juarez, Chihuahua. The status is that the USIBWC is in the second phase of implementation of their 2009 Record of Decision on the River Management Alternatives for the Rio Grande Canalization Project and complying with the Service's (2012) biological opinion. The project, as proposed, would include ongoing channel maintenance and floodplain management, including levee improvements, vegetation management, habitat restoration work, and conservation of endangered birds following a flycatcher management plan. The USIBWC committed to establish flycatcher habitat and no-mow zones to enhance riparian vegetation.

### 5.2.3 Corps FLO-2D Model Development, Caballo Reservoir Flood Release and Court Order No. CIV-90-95 HB/WWD (2013, 2005)

As part of USIBWC's Rio Grande Canalization Project, USIBWC contracted with the Corps of Engineers who subcontracted with Tetra Tech to update the calculations of design storms affecting Caballo Dam releases. While the report is not an "action" per se, in conjunction with Reclamation and USIBWC management of Caballo flood releases, the cumulative action with cumulative effects is that there is statistically almost no chance of a 5,000 cubic feet per second (cfs) release for flood control, although historically, there have been greater than 5,000 cfs flows at the USIBWC's gage below Caballo Dam. The peak discharge is approximately 2,990 cfs, which essentially precludes overbank flooding below Caballo.

### 5.2.4 Corps of Engineers and CH2MHill (2012) and Rio Grande Salinity Management Program (2012)

The Corps and others have formed a coalition to reduce salinity from San Acacia to Fort Quitman. The project consists of four phases: salinity assessment, salinity management alternatives analysis, feasibility and pilot control project testing, expanded scale salinity control project and evaluation of project effectiveness. Effects of this ongoing project may result in improvements (decreases) in salinity and other contaminants in the Rio Grande through the study area for this FEIS.

### 5.2.5 City of Las Cruces Wastewater System Master Plan Update (CDM 2008) and 40-Year Water Development Plan (2007)

The City of Las Cruces has had a water and wastewater plan in place since 1995. In 2007, it prepared a 40-year water development plan. In 2008, the City updated their water and wastewater plan which projected that by 2025, with low growth demand it would need a total of 20,549 acre-feet per year; with high growth demand it would need a total of 33,307 acre-feet per year (CDM 2008:6-4). As of 2008, the City's water supply is groundwater from wells in the Mesilla and Jornada groundwater basins. The City's plans include three elements: conjunctive use of surface and groundwater, water conservation, and reclaimed water use. The City anticipates that some but not all of any increase in groundwater pumping would require offsets. The City's director of utilities (Garcia 2008) indicated that they have been acquiring and leasing some surface water rights through EBID with verification from the NMOSE. The City's strategy is to concentrate on surface water supply. Working with EBID, they have implemented a Special Water Users Association. The City of Las Cruces has not contracted with EBID and Reclamation for conversion of irrigation water to municipal and industrial uses.

### 5.2.6 New Mexico State Parks, Elephant Butte Lake State Park Management Plan (2006)

This is a resource management plan guiding recreation and the management of public recreational opportunities at Elephant Butte Lake State Park. NM State Parks also manages recreational areas at Caballo, Percha, and Leasburg Diversion Dams.

### 5.2.7 New Mexico Lower Rio Grande Regional Water Plan (2004)

This plan, with a revision currently in progress, provides population projections through 2040 for three different rates of regional growth to provide a high estimate, a medium-range estimate, and a low range estimate. Projected public water supply requirements for the area are made through the year 2040 for the low, medium and high growth scenarios. This plan includes other public water supply systems located within the planning area with relevant estimates of the population served and the total amount of water provided by these systems.

### 5.2.8 NMOSE Active Water Resource Management Initiative (2004)

This project of the NMOSE, initiated in 2004, could have ongoing effects in the cumulative impact study region. Under this initiative, the NMOSE declared the Lower Rio Grande a "priority basin" (NMAC 19.25.13). The objective is to supervise the physical distribution of water to protect senior water right owners, to assure compliance with interstate stream compacts and to prevent calls by senior water rights holders for administration of water rights. In addition, these rules fulfill the mandates of Section 72-2-9.1 NMSA, requiring the state engineer to adopt rules for priority administration based on appropriate hydrological models and facilitate marketing within water master districts subject to priority administration.

### 5.2.9 Reclamation Elephant Butte and Caballo Reservoirs Resource Management Plan, Record of Decision and FEIS (2003, 2002)

This is Reclamation's resource management plan designed to guide Reclamation and other Federal, state, local, and participating agencies in managing, allocating, and appropriately using Elephant Butte and Caballo Reservoirs' land and water resources. The RMP was also designed to assist Reclamation in making decisions regarding the management of recreation resources.

## 5.3 Cumulative Impacts by Resource

This section projects cumulative impacts of the reasonably foreseeable future actions listed in Section 5.2 on resources described in Chapters 3 and 4 of the FEIS.

### 5.3.1 Water Resources including Reservoir Storage, Elephant Butte Reservoir Elevations, Allocations, Releases, Diversions, Farm Surface Water Deliveries

Effects of the Federal actions listed above were included in the modeling of the effects of the alternatives, so there would be no additional cumulative effects to water resources. While water management plans of the Cities of Las Cruces and El Paso and of Far West Texas (Texas Water Development Board 2016) are listed as cumulative actions above, due to uncertainties, future effects of these municipal plans have only partially been incorporated in Chapter 4 water resource analyses. The original 1920 Act contracts with the City of El Paso were done in 1940 which allowed the city to purchase 2,000 acres of irrigated farmland for conversion of the water allocated to that land to M&I supply. By the 1950s (President's Commission 1950), El Paso and Albuquerque had experienced water shortages. Back then, El Paso began buying additional lands from landowners within the RGP to obtain rights to water under arrangements with EPCWID. These effects were part of the modeling of water resources analyses in Chapter 4 (Sections 4.1 to 4.12). The City of Las Cruces, through its 40-Year Water Plan, is considering a similar strategy of acquiring or leasing surface water rights through EBID. While their plan is considered a cumulative action, there are not enough data or details to model how this might occur.

### 5.3.2 Groundwater

The assumption of the Chapter 4 groundwater analyses (Sections 4.9 to 4.11) is that irrigation water requirements that are not satisfied by RGP surface water deliveries are met through supplemental groundwater pumping. For groundwater elevations, the model projects that the differences that would be caused by implementing one or another of the alternatives would be less than the differences that might arise due to future climatic conditions.

Increases in future groundwater pumping by the Cities of Las Cruces or El Paso were not modeled, but could be anticipated to result in lower groundwater levels in the future unless offset by decreases in pumping in other parts of the aquifer. No data or models are presently available to Reclamation to quantify groundwater effects of the cities' future actions related to groundwater uses.

### 5.3.3 Water Quality

Since the 1950s, quality of surface water in the Rio Grande has been documented as degrading from the San Luis Valley to Fort Quitman (President's Commission 1950), although in the latest 303d report of New Mexico (NMED 2016: 175-178), water quality has improved in Elephant Butte Reservoir. When the effects of the alternatives are added to those ongoing effects from Reclamation's Delta Channel Maintenance Project and low flow conveyance channel, water

quality in the reservoir is expected to be within the ranges historically documented with possible impairments due to mercury, nutrients and polychlorinated biphenyls. Likewise, cumulative impacts to water quality in Caballo Reservoir are expected to fluctuate over time with the quantity of water in storage, but with ongoing impairments due to high nutrient levels.

Downstream of Caballo Reservoir in the USIBWC Rio Grande Canalization Project, water quality should improve over time when the effects of the alternatives are added to those of USIBWC's Record of Decision implementation (2012, 2009), which includes more efficient water delivery, soil erosion prevention, and habitat restoration, water quality should improve slightly over time. Also, the Corps' Salinity Management Program and work of El Paso Water should result in cumulative improvements to water quality.

### 5.3.4 Vegetation and Weeds

As described in Sections 3.6 and 4.13, the existence of the reservoirs, combined with USIBWC's Rio Grande Canalization Projects downstream of Caballo Reservoir has led to the present status of vegetation communities across the cumulative impact study area. At the inflow area to Elephant Butte Reservoir, ongoing effects of Reclamation's Delta Channel Maintenance Project would continue to help moderate potential impacts from inundating vegetation and vegetation loss or degradation in Elephant Butte Reservoir.

The reservoir pool elevations would continue to fluctuate under all alternatives and these fluctuations would continue to affect individual plants throughout the reservoir area. Although given the low probabilities of the reservoir surface water remaining at one elevation for a prolonged period, it is unlikely that whole patches of vegetation would be affected or that there would be a net loss of habitat for nesting birds.

Downstream of the RGP reservoirs, the Rio Grande was canalized between 1938 and 1943, and the vegetation in most areas is managed by the USIBWC and monitored as part of USIBWC's and Reclamation's ESA commitments. There are sections of the downstream environment where some native vegetation is being managed by USIBWC to improve wildlife habitat and there are ongoing beneficial effects due to their non-native plant control program (USIBWC 2012). These beneficial effects are expected to continue into the future.

While there is some potential for noxious weeds to grow or increase in the short-term, however as a cumulative impact of management by both the USIBWC and Reclamation noxious weeds are managed under an integrated pest management framework. As a result, no increase in cumulative impacts to weeds is expected.

### 5.3.5 Wetlands and Floodplains

No additional cumulative impacts to wetlands and floodplains would be anticipated based on the cumulative actions listed in Section 5.2. There are patches of emergent marsh plants in the sediment delta inflow area to Elephant Butte Reservoir, but these patches are not expected to become jurisdictional wetlands due to the repeated cycles of wetting and drying: the fluctuations are unlikely to support the development of hydric soils.

For floodplains in the cumulative impact study region, between the USIBWC's and Reclamation's ongoing actions of managing releases from Elephant Butte and Caballo Dams and actively managing the river segments, there would be no change in base floodplains and no construction proposed in the 100- or 500-year floodplains that has not undergone prior NEPA analysis.

As stated by the USIBWC (2007, 2009a, b), the Rio Grande floodplain was enclosed by a levee system and dredged river channel beginning in 1938 and completed in 1943. The canalization extends some 105.4 miles along the Rio Grande from below Percha Dam in Sierra County, New Mexico to American Dam in El Paso, Texas, and along the river to Fort Quitman, Texas. The USIBWC increased flood containment capacity as a result of raising levees between 4 – 12 feet in height and dredging the river channel in a series of past actions; and these effects of managing the floodplains to meet Federal Emergency Management Agency certification requirements would continue into the future (USIBWC 2007, 2009b).

### 5.3.6 Wildlife and Special Status Species

The potential cumulative impacts to terrestrial wildlife (defined by NEPA, not ESA) and special status wildlife species are essentially the same as the projected effects for vegetation. As described in Section 4.14, the flycatcher and the cuckoo are seasonally present in Elephant Butte Reservoir and their habitats may be degraded, expanded, or enhanced depending on the duration at which the water surface elevations remain at a particular elevation. None of the actions listed in Section 5.2 would create cumulative impacts on wildlife or special status species that have not been included in the Section 4.14 analysis or the consultation with the Service.

Along the Rio Grande below Caballo Dam, cumulative impacts to wildlife from the actions of the USIBWC have been described in a series of environmental assessments, environmental impact statements, and consultations (USIBWC 2007, 2009a, b; 2012, 2014a). The USIBWC committed to work on restoring riparian shrub communities suitable for breeding flycatchers in this reach. When Reclamation's action of releasing water from Caballo Dam is added to the actions of the USIBWC, there should be no cumulative impacts to vegetation, wildlife or special status species that have not already been consulted upon.

### 5.3.7 Aquatic Resources and Special Status Fish Species

The existence of the RGP dams and reservoirs led to the extirpation of native fish, as discussed in Sections 3.8 and 4.15, but dam existence is in the baseline and cumulative effects are restricted to Reclamation's Delta Channel Maintenance Project that extends the river into Elephant Butte Reservoir and provides additional occupied habitat for riverine species, including the endangered Rio Grande silvery minnow. Conservation measures included in the project provide habitat features in the channel to support the minnow's life stages and avoid harming the fish during construction and maintenance. No other cumulative effects to aquatic resources and special status fish are expected to occur through 2050.

Similar to the other biological resources, the range of releases to the Rio Grande from the alternatives is within the range of historical operations. When all the actions listed above are added to the potential effects of the alternatives, no additional cumulative effects to aquatic resources and special status fish species are expected to occur through 2050.

### 5.3.8 Cultural Resources

Management of historic properties within the cumulative impact study areas is being conducted by Reclamation and the USIBWC as part of their respective Section 110 compliance responsibilities. No other undertakings are reasonably foreseeable that have not undergone Section 106 or 110 compliance; thus, no cumulative effects to historic properties are expected to occur through 2050.

No adverse impacts to Indian sacred sites or resources of tribal concern would be anticipated from the alternatives (as described in Section 4.17); therefore, no cumulative effects would apply to these resources.

### 5.3.9 Indian Trust Assets

The Rio Grande is recognized as aboriginal territory of the Apache and the Pueblo of Ysleta del Sur has interests in the area around El Paso, but no ITAs have been identified in the cumulative impact study area. As a result, there would be no adverse impacts of the alternatives to ITAs and no cumulative effects on ITAs. The Federal agencies are committed to government-to-government consultation with these Indian tribes, going into the future.

### 5.3.10 Socioeconomics, Including Farmland

The primary purpose of the RGP is irrigated agriculture and maintaining the water supply for this purpose would continue into the future under all the alternatives. When the cumulative impacts of the actions of the USIBWC are added to those in this FEIS, there are no anticipated changes to farmland in production. As noted by the USIBWC (2009), measures associated with their Integrated Land Management Alternative were selected and are being implemented to minimize the conversion of farmland to non-agricultural uses. As the USIBWC found, no significant impacts on prime farmland are anticipated.

Simulation and analysis of project operations was carried out to evaluate relative changes in the storage, release, and delivery of project water to diversion points for EBID, EPCWID, and Mexico from the five alternatives under future possible climate and hydrologic conditions within the project area, but with the assumption that future M&I demands would be consistent with recent demands. This assumption allows for analysis of changes in project operations because of alternatives, without confounding effects of changes in M&I demand or uses.

The modelling for the FEIS assumes that future pumping for M&I uses would be consistent with recent pumping and there would be no reasonably foreseeable change into future. This assumption is consistent with water plans of the cities in the study area, as cited above.

## 5.4 Unavoidable Adverse Effects

As described in Chapters 4 and 5, implementation of any of the alternatives, combined with climate change, could result in adverse impacts to birds listed under the ESA and on designated or proposed critical habitat. However, with careful monitoring and reservoir management, and coordination with the Service, adverse effects to birds or their habitat should be avoided or reduced below the level of significance. No other significant adverse effects to resources are projected by the FEIS.

## 5.5 Relationship between Short-term Uses of the Environment and Maintenance and Enhancement of Long-term Productivity

To assess the relationship between short-term uses and maintenance of long-term productivity, Reclamation considers the period through 2050 to be short-term when compared with the long history of the RGP or the indefinite period beyond 2050 when the RGP continues to be operated and maintained. Within this short-term time frame, Reclamation's implementation of the OA would result in increased certainty to the RGP water users, given the increased flexibility afforded by carryover allocation and adjustments for project efficiency projected by the diversion ratio. With this FEIS, the RGP water users should have a better understanding of how the system

would operate in the future under climate change. There will be times when the districts experience a smaller allocation of surface water which would translate into a smaller surface allocation of water to farms and possible future M&I users, which would be supplemented by groundwater at the discretion of each farmer. Conversely, during wetter climatic conditions, the districts would receive larger surface water allocations resulting in more water to farms and possible future M&I users, which would translate to less groundwater use, all water use dependent on crop types and population.

## 5.6 Irreversible and Irretrievable Commitments of Resources

The CEQ's regulations at 40 CFR 1502.16 require consideration of irreversible and irretrievable commitments of resources. This is interpreted to mean decisions affecting non-renewable resources such as land, or causing a species to become extinct, or a resource to be destroyed or removed. The term irreversible also describes the loss of future options.

None of the alternatives has or would result in an irreversible or irretrievable commitment of resources. The proposed action would ensure that the RGP water would continue to be managed consistently and efficiently with respect to the RGP authorization, the districts' rights, the 1906 treaty, and other applicable laws, court decrees, agreements, and contracts.

# 6 Preparers, Consultation and Coordination

This chapter details the consultation and coordination among Reclamation and other Federal, state and local agencies, American Indian tribes, and the public in preparing this FEIS. The public scoping process was described in Section 1.9 of the FEIS. This chapter also includes the list of preparers.

## 6.1 Cooperating Agency Involvement

Reclamation invited nine agencies to cooperate in the NEPA process. Three agencies either declined or did not respond to the request: HCCRD, the New Mexico Interstate Stream Commission, and ABCWUA. Six agencies signed a memorandum of understanding with Reclamation to become cooperating agencies. In October 2015, the City of Santa Fe Water Division ended its role as a cooperating agency. The five agencies cooperating throughout the process are:

- Colorado Division of Water Resources
- Elephant Butte Irrigation District of New Mexico
- El Paso County Water Improvement District No. 1
- Texas Rio Grande Compact Commissioner
- U.S. Section, International Boundary and Water Commission

Reclamation hosted periodic cooperating agency meetings throughout the preparation of this FEIS to ensure that the agencies were informed of and involved in the process based on their legal jurisdiction or special expertise.

## 6.2 Tribal Consultation

Following Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, Reclamation sent letters on June 24, 2014, asking the two tribes with potential interests in the RGP: Ysleta del Sur Pueblo of Texas and the Mescalero Apache Tribe of the Mescalero Reservation, New Mexico, if they wished to be consulted or had issues or concerns with the proposed action. In October 2015, Reclamation reached out to the tribes via phone call and follow-up e-mail. To date, no response has been received from either tribe.

During the preparation of the SEA covering the OA from 2013 to 2015, the Mescalero Apache Tribe, whose aboriginal territory lies within the project area, expressed concerns about native plants growing along the irrigation canals in the service areas of EBID and EPCWID. Tribal members collect plant material for cultural purposes. This is identified as a resource of tribal concern in the cultural resources analysis (Section 4.17.2).

## 6.3 Other Consultations and Coordination

### 6.3.1 U.S. Fish and Wildlife Service

To comply with ESA Section 7(a)(2), Reclamation submitted a biological assessment to the Service on August 20, 2015. Reclamation's finding was that Alternative 1 "may affect, but is not likely to adversely affect" the Rio Grande silvery minnow (*Hybognathus amarus*). The finding was that Alternative 1 "may affect, and is likely to adversely affect" the flycatcher, the cuckoo, and "may affect, is likely to adversely modify proposed or designated critical habitat" for the birds. The finding for the mouse was no effect, because the species is not present in the action area. On May 25, 2016, the Service issued its biological opinion.

### 6.3.2 Consultation with the Government of Mexico

The USIBWC served as a cooperating agency and assisted Reclamation in conforming to the requirements of Executive Order 12114 regarding effects of proposed Federal actions in other countries. This FEIS describes water deliveries to Mexico, but the modeling assumptions or descriptions in this FEIS are not intended to constitute an interpretation or application of the Treaty with Mexico or to represent current U.S. policy or a determination of future U.S. policy regarding deliveries to Mexico.

### 6.3.3 New Mexico State Historic Preservation Officer

To comply with the NHPA, Reclamation consulted with the New Mexico Historic Preservation Officer on October 29, 2015, requesting concurrence on the determination of "no historic properties affected." Reclamation received concurrence on November 25, 2015 (see Appendix D).

## 6.4 Final EIS Distribution

The notice of availability of this FEIS was sent to area libraries, other Federal, state and local agencies, American Indian tribes, and the public. All parties listed in Table 6-1 received a CD or electronic version of the FEIS. Copies may be reviewed at the locations listed below:

- Reclamation, Albuquerque Area Office, 555 Broadway NE, Albuquerque, NM 87102
- Reclamation, El Paso Office, 10737 Gateway West, Suite 350, El Paso, TX 79935
- Natural Resources Library, U.S. Department of the Interior, 1849 C Street NW, Main Interior Building, Washington D.C. 20240-0001
- Elephant Butte Irrigation District, 530 South Melendres Street, Las Cruces, NM 88005
- El Paso County Water Improvement District No. 1, 13247 Alameda Avenue, Clint, TX 79836

A copy of the FEIS is available on Reclamation's website at:
http://www.usbr.gov/uc/envdocs/eis.html

Table 6-1 Distribution list

| Affiliation | Name |
|---|---|
| **Federal:** | |
| US Environmental Protection Agency | Houston, Robert |
| U.S. International Boundary and Water Commission | Anaya, Gilbert |
| U.S. Fish and Wildlife Service | Tuggle, Benjamin |
| **State or Quasi-state:** | |
| Colorado Division of Water Resources | Sullivan, Mike |
| Colorado Attorney General | Wallace, Chad M. |
| Colorado Compact Commissioner | Wolfe, Dick |
| Colorado Department of Law | Wallace, Chad M. |
| Counsel for EPCWID | Speer Jr., James M. |
| El Paso Water Control and Improvement District, No. 1 | Stubbs, Johnny |
| Elephant Butte Irrigation District of New Mexico | Salopek, James |
| New Mexico Attorney General | Balderas, Hector |
| New Mexico Department of Game & Fish | Wunder, Matt |
| New Mexico Environment Department | Flynn, Ryan |
| New Mexico Interstate Stream Commission | Dixon, Deborah K. |
| New Mexico Office of the State Engineer | Verhines, Scott |
| New Mexico State Historic Preservation Office | Pappas, Jeff |
| New Mexico State Parks | Tafoya, Christy |
| Texas Rio Grande Compact Commissioner | Gordon, Pat |
| **Local Agencies:** | |
| Albuquerque Bernalillo County Water Utility Authority | Sanchez, Mark |
| City of Las Cruces | Miyagishima, Ken |
| Stein & Brockman for the City of Las Cruces | Stein, Jay F. |
| **American Indian/Tribal:** | |
| Mescalero Apache | Chino, Frederick |
| Ysleta del Sur | Paiz, Frank |
| **Libraries:** | |
| New Mexico State University Library | Carter, Stephanie |
| University of Texas at El Paso | Gaunce, Charles |
| **Organizations and Individuals:** | |
| Audubon New Mexico | Bardwell, Beth |
| Individual | Welsh, Heidi |
| New Mexico B.A.S.S. Nation | Earl Conway |
| Paso del Norte Watershed Council | Keyes, Conrad |
| Southwest Environmental Center | Bixby, Kevin |
| Wild Earth Guardians | Pelz, Jen |

## 6.5 List of Preparers

This FEIS was prepared by Reclamation's Upper Colorado Region, Albuquerque Area Office, with contributions from the Denver Policy Office, with assistance from Environmental Management and Planning Solutions, Inc. (EMPSi), Santa Fe, New Mexico. The names of persons who prepared various sections, provided information, or participated to a significant degree in reviewing the document are listed in Table 6-2.

Table 6-2 List of preparers

| Name and Title | EIS Responsibility |
|---|---|
| **Reclamation Preparers:** | |
| Cortez, Filiberto, special assistant | Technical coordination, water resources |
| Coulam, Nancy, environmental protection specialist | Technical coordination, environmental justice |
| Coykenall, Arthur, biologist | ESA policy and biology review |
| Cunningham, Catherine, environmental protection specialist | NEPA policy and review |
| Engel, Paula, economist | Socioeconomics |
| Ferguson, Ian, civil engineer | Hydrology, climate change, water resources |
| Garcia, Hector, environmental protection specialist | Technical coordination, quality control |
| Graham, Rhea, special project officer | Project manager |
| Heffernan, Beverly, division manager | NEPA policy and review |
| Llewellyn, Dagmar, hydrologist | Hydrology, climate change, water resources |
| Painter, M. Jeff, resource management specialist | Technical coordination, quality control |
| **Environmental Management and Planning Solutions, Inc. (EMPSi):** | |
| Batts, David, principal-in-charge | Technical coordination, quality control |
| Cordle, Amy, administrative planner | Quality control, editing |
| Crump, Sarah, administrative | Document and administrative record support |
| Doyle, Kevin, project manager | Technical coordination, cultural resources |
| Estep, Melissa, engineer | Water resources |
| Gahli, Zoe, environmental planner | Socioeconomics, environmental justice |
| McCarter, Molly, environmental planner | Administrative record support |
| Parker, Nicholas, environmental planner | Technical coordination, quality control |
| Patterson, Katie, legal reviewer | Legal sufficiency |
| Prohaska, Holly, environmental planner | Quality control |
| Rice, Kevin, biologist | Biological resources |
| Rickey, Marcia, GIS specialist | Maps, figures |
| Ricklefs, Chad, environmental planner | Cumulative effects, quality control |
| Schad, Cindy, administrative | 508 compliance, formatting |
| Vankat, Drew, planner | Cumulative, consultation and coordination |
| Varney, Randy, technical editor | Document editing |

| | |
|---|---|
| **Tetra Tech, Inc.:** | |
| Barna, Jeff B., ecologist | Biological resources |
| Marcus, Mike, biologist | Biological resources |
| Martz, Merri, biologist | Biological resources |
| Pershall, Alaina, environmental scientist | Biological resources |
| **Precision Water Resources Engineering, Inc. (PWRE):** | |
| Coors, Shane, engineer | Water resources |
| Erkman, Caleb, engineer | Water resources |
| Gacek, Heather, engineer | Water resources |
| Powell, Anthony, engineer | Water resources |
| Winchester, John, engineer | Water resources |

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OPERATING AGREEMENT

FOR THE RIO GRANDE PROJECT

THIS OPERATING AGREEMENT ( " Agreement " ) is entered into this 10th day of March 2008, by and among the United States of America, by and through the Bureau of Reclamation ( " United States " or " Reclamation " or " USA " ) acting pursuant to the Reclamation Act of June 17, 1902, 32 Stat. 390, as amended and supplemented; the Elephant Butte Irrigation District ( " EBID " ), an irrigation district and a quasi municipal corporation in the State of New Mexico, incorporated and organized under New Mexico law, N.M.S.A. 1978, § 73 10 1 et seq. (1985 Repl. Pamp.); and the El Paso County Water Improvement District No. 1 ( " EPCWID " ), a political subdivision of the State of Texas, under Art. XVI, § 59 of the Texas Constitution (collectively, " the Parties " to this Agreement).

NOW THEREFORE, the Parties recognize the following terms and conditions to constitute an operational plan for the Rio Grande Project and the Parties agree as follows:

## 1 DEFINITIONS

When used in this Agreement, unless otherwise distinctly expressed or manifestly incompatible with the intent hereof, the following definitions shall apply:

### 1.1. Normal Annual Release

A Normal Annual Release from Project Storage for all authorized uses is 790,000 acre-feet as measured at the first gauging station downstream of Caballo Dam. It is possible that during any Water Year the aggregate quantity of water released for EBID and EPCWID, and for the United States (pursuant to the Convention of 1906), including release of Carryover Water for EBID and EPCWID, may be more or less than the Normal Annual Release from Project Storage of 790,000 acre-feet.

### 1.2. Project-Authorized Acreage

There are 159,650 authorized acres within the Project. Of the Project Authorized Acreage, 90,640 acres are within EBID and 69,010 acres are within EPCWID.

### 1.3. Project Storage

Elephant Butte Reservoir, Caballo Reservoir, and such additional storage facilities (less flood control space) as may be authorized by Congress or provided for pursuant to the Rio Grande Compact (Act of May 31, 1939, 53 Stat.785).

### 1.4. Rio Grande Project

The Project was authorized by an Act of Congress on February 25, 1905, 33 Stat. 814, pursuant to the Reclamation Act of 1902, 32 Stat. 390. The Project includes facilities and works with their appurtenant lands authorized by the Act of February 25, 1905, as amended and supplemented, particularly Elephant Butte Dam and Reservoir, Caballo Dam and Reservoir, a power generating plant, and six diversion dams (Percha, Leasburg, Mesilla, American, International, and Riverside) on the Rio Grande in New Mexico and Texas, and includes the Project lands and service area authorized for water delivery pursuant to the Rio Grande Project Act of February 25, 1905, as amended and supplemented and the Reclamation Act of 1902 as amended and supplemented.

### 1.5. Water Year

The water year shall be a calendar year beginning on the first day of January and ending on the thirty-first day of December.

### 1.6. Project Water

Project Water, as used herein, shall mean: 1) usable water in Project Storage; 2) all water required by the Rio Grande Compact of 1938 to be delivered into Elephant Butte Reservoir; and 3) all water released from Project Storage and all inflows reaching the bed of the Rio Grande between Caballo Dam, New Mexico and Fort Quitman, Texas.

### 1.7. Annual Allocated Water

Annual Allocated Water is the quantity of Project Water that is determined by United States, in accordance with this Agreement, the Operations Manual, and in consultation with EBID and EPCWID, to be allocated each Water Year for delivery to EBID and EPCWID, and to the United States (pursuant to the Convention of 1906).

### 1.8. Carryover Water

Carryover Water is the Annual Allocated Water allotment balance remaining on the water account for each district at the end of a given Water Year. EBID and EPCWID shall have the right to carry over any amount of their respective Annual Allocated Water subject to provisions of Section 1.10 herein.

### 1.9. Actual Carryover Water

Actual carryover water is the increase in a district's allocation due to applying carryover water amounts for each district in the allocation calculations.

### 1.10 Carryover Limit

Actual carryover water may be accumulated in an account for each district to a maximum of sixty percent (60%) of each district's respective full yearly allocation or an amount of actual carryover water equal to 232,915 acre-feet for EPCWID and 305,918 acre-feet for EBID.

### 1.11 Excess Carryover Balance

At the end of the water year, either district's carryover balance in excess of its respective carryover limit shall be transferred to the carryover account of the other district. If both districts' carryover limits are exceeded, each district's carryover balance shall be equal to its respective limit.

### 1.12 Rio Grande Project Water Accounting and Operations Manual (Operations Manual)

The United States, EBID, and EPCWID shall produce an Operations Manual. The Operations Manual shall contain detailed information regarding the methods, equations, and procedures used by EBID, EPCWID, and the United States to account for all water charges and operating procedures for the Rio Grande Project. This Agreement shall be effective upon execution regardless of the status of the Operations Manual.

### 1.13 Non-Allocated Water

Project Water is available for diversion from the Rio Grande by EBID or EPCWID that is not charged by the United States against any allocation account. Non-Allocated water is typically available only during periods when no water is being released from storage or during flood events.

## 2. ALLOCATION OF PROJECT WATER

### 2.1. Use of Project Water

All Project Water in Project Storage, including any actual Carryover Water shall be used for the authorized purposes set forth in the Reclamation Act of June 17, 1902, 32 Stat. 390, and the Rio Grande Project Act of February 25, 1905, 33 Stat. 814, as amended and supplemented.

### 2.2. Determination of Project Water in Project Storage

At the beginning of each Water Year and during each month of the Water Year, The United States shall determine the total quantity of Project Water in Project Storage.

## 2.3. Determination of Annual Allocation to Mexico, EBID, and EPCWID

The United States shall determine the quantity of Annual Allocated Water to Mexico, EBID, and EPCWID by the first of December for the following Water Year utilizing the Project Water in storage amounts and Carryover Water amounts for each district. The United States may reconsider the Annual Allocated Water each month during a Water Year and adjust it as necessary in consultation with EBID and EPCWID in accordance with this Agreement.

## 2.4. Annual Allocation for United States for delivery to Mexico

The portion of the Annual Allocated Water which shall be allocated for the United States to meet its obligations pursuant to the Convention of 1906 shall be 11.3486 percent (11.3486%) of the sum of the quantity of Project Water delivered to lands in the United States plus the quantity of Project Water delivered to the head works of the Acequia Madre in acre-feet per Water Year as set forth in equation 2-1 and Table 1 that follow:

$$Y = 0.8260932\ (X) - 102{,}305 \qquad (2\text{-}1)$$

where X =Annual Released Water (in acre-feet per Water Year), and Y = sum of the quantity of Projcct Water delivered to lands in the United States plus the quantity of Project Water delivered to the head works of the Acequia Madre (in acre-feet per Water Year).

Table 1

| Annual Amount of Water Released from Caballo Reservoir (ac-ft/acre) | Sum of the quantity of Project Water delivered to lands in the United States plus the quantity of Project Water delivered to the head works of the Acequia Madre (in acre-feet per Water Year). | Quantity of Project Water delivered to the head works of the Acequia Madre (in acre-feet per Water Year). |
|---|---|---|
| 790,000 | 550,309 | 60,000 |
| 763,842 | 528,700 | 60,000 |
| 700,000 | 475,960 | 54,015 |
| 650,000 | 434,656 | 49,327 |
| 600,000 | 393,351 | 44,640 |
| 550,000 | 352,046 | 39,952 |
| 500,000 | 310,742 | 35,265 |
| 450,000 | 269,437 | 30,577 |
| 400,000 | 228,132 | 25,890 |
| 350,000 | 186,828 | 21,202 |
| 300,000 | 145,523 | 16,515 |
| 250,000 | 104,218 | 11,827 |
| 200,000 | 62,914 | 7,140 |

The United States shall be entitled to release all or such portion of the Annual Allocated Water which has been allocated for the United States as it deems necessary to meet the

requirement of the Convention of 1906 to deliver water in the bed of the Rio Grande at the head works of the Acequia Madre.

### 2.5. Annual Allocation for EBID and EPCWID

EBID's and EPCWID's portions of the quantity of Annual Allocated Water, exclusive of the United States' portion of Annual Allocated Water pursuant to the Convention of 1906, shall be determined by the process described in Table 2 for a full allocation condition and Table 3 when there is less than a full water supply available. EBID 's and EPCWID 's yearly allocation shall be determined using the empirically derived linear regression analysis equation (D-2). Equation D-2 was derived using historical Rio Grande Project data correlating releases from Rio Grande Project storage and corresponding yearly deliveries to Rio Grande Project diversions from the Rio Grande for EBID, EPCWID and Mexico during the Water Years 1951 to 1978 inclusive. The amount of Annual Allocated Water shall be determined using the D-2 equation for EPCWID, using equation 2-1 for the United States (pursuant to the Convention of 1906), and using the diversion ratio (ratio of the amount of water Charged to the amount of water Released) for EBID and in accordance with Tables 1 through 4 herein.

Table 2 – Rio Grande Project Hypothetical Example of Full Allocation

| | | |
|---|---|---|
| 1 | **Rio Grande Project Diversion Allocations** | **ac-ft** |
| 2 | Elephant Butte Reservoir Storage | 1,000,000 |
| 3 | Caballo Reservoir Storage | 44,005 |
| 4 | Total Rio Grande Project Storage | 1,044,005 |
| 5 | Estimated Rio Grande Compact Credit Waters | (196,000) |
| 6 | Estimated San Juan-Chama Water | (4,553) |
| 7 | Water Released from Storage | - |
| 8 | Total Usable Water Available for Release | 843,452 |
| 9 | Carryover Obligation using Estimated Diversion Ratio | 14,654 |
| 10 | Total Usable Water Available for Current Year Allocation | 790,000 |
| 11 | EBID Allocation Balance (Previous Year) | 10,000 |
| 12 | EPCWID Allocation Balance (Previous Year) | 5,000 |
| 13 | EBID Estimated Allocation Balance (End-of-Year) | - |
| 14 | EPCWID Estimated Allocation Balance (End-of-Year) | - |
| 15 | Storage for EBID and EPCWID Estimated Allocation Balance (End-of-Year) | - |
| 16 | Estimated Release of Current Usable Water | 804,654 |
| 17 | Estimated End-of-Year Release for Diversion Ratio | 781,208 |
| 18 | D1 Delivery | 562,414 |
| 19 | Mexico's Current Diversion Allocation | 60,000 |
| 20 | Gross D2 Diversion Allocation | 972,709 |
| 21 | EPCWID ACE Conservation Credit | - |
| 22 | Net D2 Diversion Allocation for EBID and EPCWID | 912,709 |
| 23 | D2 Diversion Allocation for EPCWID | 394,526 |
| 24 | EPCWID Diversion Allocation (w/o Conservation Credit) | 399,526 |
| 25 | EPCWID Diversion (w/o Conservation Credit or 67/155ths of Row 30) | 399,526 |
| 26 | Diversion Ratio | 1.023633 |
| 27 | Diversion Ratio Adjustment | 19,017 |
| 28 | Sum of Release and Diversion Ratio Adjustment | 823,670 |
| 29 | EBID D2 Diversion Allocation | 518,183 |
| 30 | Difference between EBID Diversion Ratio Allocation and D2 Diversion Allocation | - |
| 31 | EBID Diversion Ratio Allocation | 354,144 |
| 32 | EBID Diversion Allocation | 354,144 |
| 33 | Total EBID Diversion Allocation (includes 88/155th of Value in Row 30) | 364,144 |
| 34 | Total EPCWID Allocation (includes Row 21 and 67/155th of Value in Row 30) | 399,526 |
| 35 | Total EBID, EPCWID, and Mexico Allocation | 823,670 |

Table 3 – Rio Grande Project Hypothetical Example of Less than Full Allocation

| | | |
|---|---|---|
| 1 | **Rio Grande Project Diversion Allocations** | **ac-ft** |
| 2 | Elephant Butte Reservoir Storage | 408,773 |
| 3 | Caballo Reservoir Storage | 23,772 |
| 4 | Total Rio Grande Project Storage | 432,545 |
| 5 | Estimated Rio Grande Compact Credit Waters | (187,800) |
| 6 | Estimated San Juan-Chama Water | (4,053) |
| 7 | Water Released from Storage | - |
| 8 | Total Usable Water Available for Release | 240,692 |
| 9 | Carryover Obligation using Estimated Diversion Ratio | 112,931 |
| 10 | Total Usable Water Available for Current Year Allocation | 127,761 |
| 11 | EBID Allocation Balance (Previous Year) | - |
| 12 | EPCWID Allocation Balance (Previous Year) | 106,982 |
| 13 | EBID Estimated Allocation Balance (End-of-Year) | - |
| 14 | EPCWID Estimated Allocation Balance (End-of-Year) | - |
| 15 | Storage for EBID and EPCWID Estimated Allocation Balance (End-of-Year) | - |
| 16 | Estimated Release of Current Usable Water | 240,692 |
| 17 | Estimated End-of-Year Release for Diversion Ratio | 600,000 |
| 18 | D1 Delivery | 96,529 |
| 19 | Mexico's Current Diversion Allocation | 10,955 |
| 20 | Gross D2 Diversion Allocation | 80,948 |
| 21 | EPCWID ACE Conservation Credit | - |
| 22 | Net D2 Diversion Allocation for EBID and EPCWID | 69,994 |
| 23 | D2 Diversion Allocation for EPCWID | 30,255 |
| 24 | EPCWID Diversion Allocation (w/o Conservation Credit) | 137,237 |
| 25 | EPCWID Diversion (w/o Conservation Credit or 67/155ths of Row 30) | 137,237 |
| 26 | Diversion Ratio | 0.947320 |
| 27 | Diversion Ratio Adjustment | (12,680) |
| 28 | Sum of Release and Diversion Ratio Adjustment | 228,012 |
| 29 | EBID D2 Diversion Allocation | 39,738 |
| 30 | Difference between EBID Diversion Ratio Allocation and D2 Diversion Allocation | 40,082 |
| 31 | EBID Diversion Ratio Allocation | 79,820 |
| 32 | EBID Diversion Allocation | 39,738 |
| 33 | Total EBID Diversion Allocation (includes 88/155th of Value in Row 30) | 62,495 |
| 34 | Total EPCWID Allocation (includes Row 21 and 67/155th of Value in Row 30) | 154,563 |
| 35 | Total EBID, EPCWID, and Mexico Allocation | 228,012 |

Table 4 Description of Values and Calculations Tables 2 and 3

| Row | Description | Source of Value | Equation |
|---|---|---|---|
| 1 | Rio Grande Project Diversion Allocations | NA | NA |
| 2 | Elephant Butte Reservoir Storage | USBR | NA |
| 3 | Caballo Reservoir Storage | USBR | NA |
| 4 | Total Rio Grande Project Storage | Calculated | [2]+[3] |
| 5 | Estimated Rio Grande Compact Credit Waters | USBR | NA |
| 6 | Estimated San Juan-Chama Water | USBR | NA |
| 7 | Water Released from Storage | USBR | NA |
| 8 | Total Usable Water Available for Release | Calculated | [4] + [5] + [6] + [7] |
| 9 | Carryover Obligation using Estimated Diversion Ratio | Calculated | ([11] + [12]) / [26] |
| 10 | Total Usable Water Available for Current Year Allocation | Calculated | MIN(790000,[8] - [9]) |
| 11 | EBID Allocation Balance (Previous Year) | EPCWID, EBID, USBR | NA |
| 12 | EPCWID Allocation Balance (Previous Year) | USBR | NA |
| 13 | EBID Estimated Allocation Balance (End-of-Year) | EBID | NA |
| 14 | EPCWID Estimated Allocation Balance (End-of-Year) | EPCWID | NA |
| 15 | Storage for EBID and EPCWID Estimated Allocation Balance (End-of-Year) | Calculated | ([14]+[13] ) / [26] |
| 16 | Estimated Release of Current Usable Water | USBR | [10] + [9] - [15] |
| 17 | Estimated End-of-Year Release for Diversion Ratio | USBR | NA |
| 18 | D1 Delivery | Calculated | MAX(0,([16]*0.8260932) - 102305) |
| 19 | Mexico's Current Diversion Allocation | Calculated | MIN(60000,[18]*0.113486) |
| 20 | Gross D2 Diversion Allocation | Calculated | MIN(763842,[10])*1.3377994-89970+MAX(0,[16]-763842) |
| 21 | EPCWID ACE Conservation Credit | USBR | NA |
| 22 | Net D2 Diversion Allocation for EBID and EPCWID | Calculated | [20] - [19] |
| 23 | D2 Diversion Allocation for EPCWID | Calculated | [22] * 67 / 155 |
| 24 | EPCWID Diversion Allocation (w/o Conservation Credit) | Calculated | [23] + [12] |
| 25 | EPCWID Diversion (w/o Conservation Credit or 67/155ths of Row 30) | Calculated | [24] - [14] |
| 26 | Diversion Ratio | Calculated | 0.00000042113634*[17]+0.6946382 |
| 27 | Diversion Ratio Adjustment | Calculated | ([26] - 1) * [16] |
| 28 | Sum of Release and Diversion Ratio Adjustment | Calculated | [16] + [27] |
| 29 | EBID D2 Diversion Allocation | Calculated | [22] * 88 / 155 |
| 30 | Difference between EBID Diversion Ratio Allocation and D2 Diversion Allocation | Calculated | IF([16]<600000,MAX(0,[31]-[29]),0) |
| 31 | EBID Diversion Ratio Allocation | Calculated | [28] - [25] - [19] - [11] - [21] |
| 32 | EBID Diversion Allocation | Calculated | IF([16]<600000,MIN([29],[31]),[31]) |
| 33 | Total EBID Diversion Allocation (includes 88/155th of Value in Row 30) | Calculated | [32]+[11]+88/155*[30] |
| 34 | Total EPCWID Allocation (includes Row 21 and 67/155th of Value in Row 30) | Calculated | [24]+[30]*67/155+[21] |
| 35 | Total EBID, EPCWID, and Mexico Allocation | Calculated | [34]+[33]+[19] |

## 3. RELEASE FROM STORAGE

### 3.1. Orders for Release of Rio Grande Project Water from Storage

EBID and EPCWID may order releases from Project storage to meet their respective delivery requirements of Annual Allocated Water or Carryover Water at their river headings during the Water Year at such times and in such quantities as they respectively elect. Water orders shall be delivered by the United States to their respective diversion and delivery points as prescribed by agreed to travel times, or as described in the Operations Manual when completed. EBID shall not order changes more frequently than four times per week. EPCWID shall not order changes more frequently than twice per week.

EBID and EPCWID shall determine the amount of water to be released from Caballo Reservoir necessary to meet the diversion orders at the time and days requested by EBID, EPCWID, and the United States (pursuant to the Convention of 1906). If EBID and EPCWID cannot agree on the amount or timing of release, then the United States shall make such determinations.

The parties shall develop a schedule of order changes that will best meet the needs of each party at their respective delivery points.

The United States shall only release Project Water ordered by EBID when EBID has Annual Allocated Water or Carryover Water remaining in their allocation. The United States shall only release Project Water ordered by EPCWID when EPCWID has Annual Allocated Water or Carryover Water remaining in their allocation.

The Parties may make non-scheduled order changes to adjust for rainfall/runoff or flood events, accident to the delivery system, or for public safety.

The United States may make releases from storage in such quantities as necessary to meet the requirements of the Convention of 1906 and according to the schedule determined by the United States under the authority of the Convention of 1906.

## 4. DELIVERIES

### 4.1. Operation of Release and Diversion Structures

The United States shall operate Elephant Butte Reservoir so as to provide for sufficient quantities of water to be available for released from Caballo Reservoir to the Parties, as outlined in Section 3.1 herein. The United States or its designee shall operate Percha, Leasburg, and Mesilla diversion dams so as to provide sufficient flows for the districts'

diversions on the Rio Grande. The United States shall operate the American and International diversion dams and make the diversions into the American Canal.

### 4.2. Obligations to Deliver Project Water

Within a reasonable amount of time from the time requested for the release by EBID and EPCWID, or as defined in the Operations Manual when completed, the United States shall release from project storage those quantities of Project Water which will meet the individual requirements of each district as communicated in their water order to the United States to be delivered at the Arrey Canal Heading, Leasburg Canal Heading, Eastside Canal Heading, Westside Canal Heading, Del Rio Lateral Heading and any additional authorized points of delivery for EBID, and to be delivered to the Franklin Canal Heading, the Riverside Canal Heading, the City of El Paso 's water treatment plants and any additional authorized points of delivery for EPCWID. Within a reasonable of amount time from the time requested for the delivery, or as defined in the Operations Manual when completed, the United States shall deliver those quantities of Project Water in the Rio Grandc at the head works of the Acequia Madre in accordance with the orders designated by the United States.

## 5. FLOW REQUIREMENTS

### 5.1. Order

An " Order " is a request to the United States by a Party to deliver a quantity of Project Water to each district's delivery and accounting stations at a specific flow rate (cubic feet per second) and at specified delivery time and day.

### 5.2. Release

A " Release " is a flow rate (cubic feet per second) of Project Water released from Project Storage.

### 5.3. Delivered Flow

A " Delivered Flow " is a flow rate (cubic feet per second) of Project Water that meets the conditions required to meet the delivery requirement for each district and Mexico at their designated delivery point or metering stations (stations) and at specified delivery time and day.

### 5.4. Charge

A " Charge " is a quantity of Project Water (acre-feet) that is deducted from (i.e. charged against) a Party's Annual Allocated or actual Carryover Water account.

### 5.5. Charge Against EBID's and EPCWID's Annual Allocated Water including Carryover Water

EBID 's and EPCWID 's remaining Annual Allocated Water shall be computed by subtracting a Charge which shall be equal to EBID 's or EPCWID 's respective delivery at main canal headings and any other designated and authorized metering stations at the Rio Grande diversion dams against their respective remaining portion of Annual Allocated Water including carryover water.

Allocation charges for water diverted by EPCWID, EBID, and Mexico shall be made as follows, or in accordance with the procedures and methods contained in the Operations Manual when completed.

1. EBID and EPCWID shall report to the United States the flow records for their respective diversion and water delivery stations for each month by the 5th day of the following month.
2. The reports may be transmitted electronically by any party to the other parties.
3. The United States shall report to EBID and EPCWID the previous month's Allocation Charges and the cumulative year-to-date Allocation Charges for EBID, EPCWID, and the United States by the 10th day of the month.

A hypothetical example of summary tables of the Allocation Charges for EBID and EPCWID is contained in Appendix A attached here to.

Water diverted from the Rio Grande by EBID may be returned (bypassed) to the Rio Grande for credit to their water allocation account at one designated location each within the Leasburg, Eastside, and Westside canal system, and two designated locations within the Arrey Canal system. Water diverted from the Rio Grande by EPCWID may be returned (bypassed) to the Rio Grande for credit to their water allocation account at one designated location on the La Union East Canal. Such credits shall be the smaller of the amount of water declared for bypass by the respective district or the actual amount of water that was measured and returned to the Rio Grande.

The United States shall make every effort to match the delivery and the order for each district at all designated metering and delivery stations in order to minimize spill water and meet the order at any given time.

### 5.6. Charge Against United States' Annual Allocated Water for Delivery to Mexico

United States' remaining quantity of Annual Allocated Water shall be equal to United States' previous allocation of Annual Allocated Water during the current Water Year minus the water delivered to Mexico at their diversion point on the Rio Grande at the Acequia Madre during the Water Year. The United States will maintain the gates at the International Dam so as to minimize the leakage to the greatest extent practical.

### 5.7. Compliance with Delivery of Project Water to Mexico at the Acequia Madre

If the flow at the first metering station above International Diversion Dam does not meet the Acequia Madre delivery requirement, the United States will adjust the gates at American Diversion Dam to reduce the flow to meet the corresponding delivery requirement for that day. The United States will give notice to EBID and EPCWID of such action except when such flow is due to storm runoff or flood events, short term debris clearing or sluicing operations. Any time the United States manually adjusts the flow at the American Diversion Dam by more than 25 cfs, for any reason, or at anytime the flow diverted at the American Diversion Dam into the American Canal exceeds the capacity of the American Canal, United States shall notify EPCWID as soon as possible.

### 5.8. Diversion Points

The diversion points used for EBID are as follows: Percha Lateral, Arrey Canal, Leasburg Canal, California Extension, various designated river pumps, Del Rio Lateral, East Side Canal, and West Side Canal. The diversion points used for the EPCWID are as follows: the New Mexico/Texas state line crossings for the La Union East Lateral, Three Saints Lateral, and La Union West lateral in the Mesilla Valley. In the El Paso Valley, deliveries to EPCWID will be made at the Robertson/Umbenhauer Water Treatment Plant, Franklin Canal, Jonathan Rogers Water Treatment Plant, and Riverside Canal.

### 5.9. Compliance with Delivery of Project Water to EBID and EPCWID

The United States shall closely match the order and diversion at each designated delivery metering station through close monitoring of releases from Project Storage and river accretions or losses. Close coordination and daily communication shall be maintained between EBID, EPCWID, and the United States in order to make adjustments to releases

from Project Storage such that water deliveries match water order amounts as closely as possible at each delivery point in the Project.

## 6. GENERAL PROVISIONS

### 6.1. Compliance with Federal Law

The terms of this Agreement are subject to applicable federal law. All Parties will cooperate to comply with all federal law prior to and during implementation of this Agreement.

### 6.2. Other Agreements

This Agreement is not intended to conflict with terms of any prior agreements or contracts between the EBID and EPCWID, or EBID and the United States, or EPCWID and the United States, or among all of the Parties; however, the Agreement represents the current conditions and present understanding that future operations shall be as provided for herein unless further modified upon having reached unanimous consent of the Parties.

### 6.3. Required Continuous Flow Metering Stations

A list of required continuous flow metering stations is attached to this Agreement as Appendix B. Each Party shall distribute and exchange copies of all flow records for all flow metering stations for which it is responsible, as listed in Appendix B, among the other Parties at least monthly with a goal of real time data exchanges.

### 6.4. Regulating Reservoirs Downstream of Caballo Dam

Nothing in this Agreement shall be interpreted to prohibit the construction and/or operation of an off-channel regulating reservoir, providing however that no such reservoir shall affect the water order or delivery requirements of the Parties under this Agreement.

### 6.5. Emergency Conditions (Force Majeure)

If any Party through no fault of its own is rendered unable, wholly or in part, by Force Majeure to carry out its obligations under this Agreement, then the obligations of such Party, so far as they are affected by such Force Majeure, shall be suspended during the time reasonably necessary to remedy such inability, but for no longer period. The term "Force Majeure" shall mean acts of God, wars, terrorism, vandalism, insurrections, riots, epidemics, landslides, lightning, earthquakes, fires, storms, floods, hazardous spills, or explosions.

### 6.6. Term of Agreement

This Agreement shall be in effect from January 1, 2008 until December 31, 2050.

### 6.7. Modification of Agreement

The Parties may modify any provisions of this Agreement upon having reached unanimous consent.

### 6.8. Assignment Limited - Successors and Assigns Obligated

The provisions of this Agreement shall apply to and bind the successors and assigns of the Parties hereto. No assignment of any right or obligation shall be made by any Party without first obtaining written approval by the other Parties.

### 6.9. Obligations to Indian Tribes Not Affected

Nothing in this Agreement shall be construed as affecting the obligations of the United States of America to the Indian Tribes, or as impairing the rights of the Indian Tribes.

### 6.10. Obligations to Mexico Not Affected

Nothing in this Agreement shall be construed as affecting the obligations of the United States of America to Mexico under existing treaties.

### 6.11. Amendment of Agreement

This Agreement shall be reviewed for improvement of operations at least on an annual basis or as agreed to by the majority of the parties. Any of the parties may submit a written request to the other parties for review of this Agreement at any time.

### 6.12. Rio Grande Compact

Nothing herein is intended to alter, amend, repeal, modify, or be in conflict with the provisions of the Rio Grande Compact.

## APPENDIX A – Hypothetical Example of Allocation Charges for EBID and EPCWID

The tables below are hypothetical examples of summary tables of Allocation Charges for EBID and EPCWID. The Operations Manual, when completed, shall contain detailed information regarding the methods, equations, and procedures used by EBID, EPCWID, and the United States to account for all water charges and operating procedures for the Rio Grande Project.

**EPCWID Diversion Allocation Charges**

| Diversion Location | Metered Volume | Adjustment for Conveyance Losses for NM Deliveries | Diversion Allocation Charges for Month | Beginning-of-Month Totals | End-of-Month Totals |
|---|---|---|---|---|---|
| | ac-ft | ac-ft | ac-ft | ac-ft | ac-ft |
| L U E Canal - TX | 2,395 | 95% | 2,275 | 17,065 | 19,340 |
| L U W Canal - TX | 947 | 95% | 900 | 6,620 | 7,520 |
| Three Saints Lateral | 134 | 100% | 134 | 1,426 | 1,560 |
| Total Mesilla Valley (Texas) | | | 3,309 | 25,112 | 28,420 |
| Umbenhauer/Robertson Water Treatment Plant | 3,345 | 100% | 3,345 | 16,701 | 20,046 |
| Franklin Canal | 7,400 | 100% | 7,400 | 39,293 | 46,694 |
| United States - Ysleta del Sur Agreement | 0 | 100% | 0 | 200 | 200 |
| United States Section - IBWC (Construction Water) | 1 | 100% | 1 | 22 | 23 |
| Jonathan W. Rogers Water Treatment Plant | 4,666 | 100% | 4,666 | 27,747 | 32,413 |
| Riverside Canal | 20,079 | 100% | 20,079 | 125,831 | 145,910 |
| Haskell R. Street WWTP Effluent | -1,599 | 100% | -1,599 | -8,180 | -9,779 |
| Credit for Diversions greater than Orders (EP Valley) | -2,790 | 100% | -2,790 | -3,233 | -6,023 |
| **Total Allotment Diversions Charges** | | | **34,411** | **223,493** | **257,904** |
| Diversion Allocation | | | | 382,486 | 390,105 |
| Est. Annual Conservation Credit Diversion Allocation | | | | | 18,742 |
| Accrued Conservation Credit Diversion Allocation | | | | | 12,390 |
| Total Diversion Allocation | | | | 382,486 | 402,495 |
| **District Allotment Balance** | | | | **158,993** | **144,591** |
| 2006 Carryover Balance | | | | | 36,200 |

# ELEPHANT BUTTE IRRIGATION DISTRICT

WATER ALLOTMENT CHARGES

SUBJECT TO REVISION

| | GROSS DIVERSIONS (AC-FT) | | DIVERTED TO TEXAS (AC-FT) | | NET DIVERSIONS (AC-FT) | |
|---|---|---|---|---|---|---|
| | | TO DATE | | TO DATE | | TO DATE |
| ARREY CANAL | 9775 | 63725 | | | 9775 | 63725 |
| PERCHA LATERAL | 93 | 508 | | | 93 | 508 |
| LEASBURG CANAL | 8739 | 67663 | | | 8739 | 67663 |
| CALIFORNIA EXTENTION | 0 | 353 | | | 0 | 353 |
| EASTSIDE CANAL | 7295 | 48677 | 311 | 1920 | 6984 | 46757 |
| DEL RIO LATERAL | 476 | 2989 | | | 476 | 2989 |
| WESTSIDE CANAL | 18793 | 135991 | 5267 | 41097 | 13526 | 94894 |
| PUMPED FROM RIVER** | 0 | 56 | | | 0 | 56 |
| GROSS TOTAL | 45171 | 319962 | 5578 | 43017 | 39593 | 276945 |

| | NET DIVERSION | TO DATE |
|---|---|---|
| TOTAL CHARGES (AC-FT) | 39593 | 276945 |
| CREDIT AT ARREY (-) | 1216 | 3882 |
| CREDIT AT LEASBURG (-) | 0 | 233 |
| NET ALLOTMENT CHARGE | 38,377 | 272,830 |
| DISTRICT ALLOTMENT | | 311,517 |
| DISTRICT BALANCE | | 38,687 |

** GREENWOOD AND DURAN RIVER PUMPS (EBID DATA)



Printed: 5:09:36 PM 2/1/2008

**APPENDIX B – Required Flow Metering Stations**

In order to assure accurate metering of allocated water deliveries to EBID, EPCWID and Mexico, the following metering stations will be maintained by the described agencies. The letter prefix before each metering station indicates the valley in which the metering station is located (R for Rincon, M for Mesilla, and E for El Paso).

**The following continuous stage recorders shall be maintained by the United States:**

R1 – Rio Grande Below Caballo – located on the east side of the river and approximately 0.8 mile downstream of Caballo Dam.

M2 - Rio Grande at Leasburg Canal – located approximately 1.5 miles downstream of Leasburg Diversion Dam on the river channel just downstream of Leasburg Wasteway No. 1.

Miscellaneous Sites: Any location, not identified herein, at which water from Rio Grande downstream of Elephant Butte Dam and upstream of the Ft. Quitman, Texas, is diverted by the United States, including without limitation, diversions for the Bonita Lateral.

**The following continuous stage recorders shall be maintained by EBID:**

R2 – Arrey Canal – The metering bridge is located just downstream of the canal heading and the CMP shelter and recorder are located just downstream of the Percha State Park bridge crossing.

R3 – Percha Lateral – The lateral water flow is measured just downstream of the lateral heading and the CMP shelter with recorder are located downstream of the metering RC Box culvert.

R4 – Wasteway No. 5 at Hatch Siphon – This wasteway is located upstream of the Hatch Siphon at the Rio Grande.

R5 – Garfield Drain – located north of the US Hwy 85 bridge, 3 miles north of Hatch, New Mexico, and west of the highway on the drain channel.

R6 – Rio Grande at Hatch – located approximately 3 miles north Hatch, New Mexico, and west of the US Hwy 85 bridge on the right side of the river channel.

R7 – Wasteway No. 16 at Rincon Siphon – located downstream on the river channel from the A.T. & S. F. Railroad crossing the Rio Grande approximately 2 miles east of Hatch, New Mexico.

R8 – Hatch Drain – located on the drain upstream of UW Hwy 85 approximately 2.5 miles east of Hatch, New Mexico.

R9 – Wasteway No. 18 from Rincon Lateral – located approximately 8 miles east of Hatch, New Mexico, north of the US Hwy 85, and on the left side of the Rio Grande.

R10 – Rio Grand at Hayner Bridge – located approximately 8 miles east of Hatch, New Mexico on the Rio Grande just upstream of the Tonuco River crossing.

R11 – Rincon Drain – located approximately 8 miles east of Hatch, New Mexico, 1 mile north of the Tonuco River crossing, and downstream of the intersection of the Rincon Lateral and Rincon Drain.

M1 – Leasburg Canal – located approximately 1.5 miles form the canal heading and approximately 0.5 miles east from the intersection of Fort Selden Road (from US I-25) and US Hwy 85.

M3 – Selden Drain – located approximately 3.5 miles south of Radium Springs, New Mexico and just east of U.S. Hwy 85, immediately upstream of the intersection of Kerr Lateral with the drain.

M4 – Wasteway No. 5 – located approximately 5 miles north of Las Cruces, New Mexico and one mile south of the intersection of NM Hwy 430 and US Hwy 85, on the left side of the river channel.

M5 – Wasteway No. 8 – located approximately 3 miles north of Las Cruces, New Mexico on the left side of the river approximately 2 miles west of US Hwy 85.

M6 – Picacho Drain – located approximately 2.0 miles northwest from Mesilla Diversion Dam, west of the Rio Grande, and just downstream from the Nusbaum Lateral inflow into the Picacho Drain.

M8 – West Side Canal – located west off the Mesilla Diversion Dam. Station is located approximately 0.5 miles downstream of the canal heading and contains a metering bridge and CMP shelter with recorder.

M9 – East Side Canal – located east off the Mesilla Diversion Dam. The Station is located approximately 0.25 miles downstream of the canal heading and contains a metering bridge and CMP shelter with recorder.

M10 – Del Rio Lateral – located east off the Mesilla Diversion Dam. Station is located approximately 0.5 miles downstream of the lateral heading and contains a metering bridge and CMP shelter with recorder.

M11 – Rio Grande Below Mesilla – located approximately 0.75 miles downstream of Mesilla Diversion Dam on the Rio Grande.

M12 – Wasteway No. 15 – located approximately 200 feet upstream of the left (east) of the river levee and 1.6 miles downstream from the New Mexico State Hwy No. 28 bridge crossing of the Rio Grande.

M13 – Santo Tomas River Drain – located approximately 3.4 miles downstream of the New Mexico State Hwy No. 28 bridge crossing and 0.8 miles upstream of the Mesquite-San Miguel Road bridge crossing the Rio Grande. The station is on the west side of the river on the Santo Tomas River Drain upstream of the culvert through the levee.

M14 – Wasteway No. 25 – located approximately 3.5 miles downstream of the New Mexico State Hwy No. 28 bridge crossing and 0.7 mile upstream of the Mesquite-San Miguel Road Bridge crossing the Rio Grande. The station is on the west side of the river on the tail end of the Santo Tomas River Lateral on the river side of the lateral embankment.

M15 – Wasteway No. 26 – located approximately 1.5 miles west of Mesquite, New Mexico on the right side of the river off the Upper Chamberino Lateral and just downstream of the river crossing the Mesquite-San Miguel state road.

M16 – Brazito River Lateral Wasteway – located on the east side and 0.7 mile downstream of the Mesquite-San Miguel Road bridge crossing the Rio Grande. The station is on the tail end of the Brazito River Lateral and is downstream o f the river levee.

M17 – Wasteway No. 18 – located approximately 1.5 miles northwest from Vado, New Mexico on the left (east) side of the river. This station is just upstream where the wasteway crosses Del Rio Drain and downstream of the railroad tracks.

M19 – Del Rio Drain – located approximately 3 miles south of Mesquite, New Mexico and north of Vado, New Mexico. Station is just west off US Hwy 85 and 125 feet downstream of the Vado Mesquite Road Crossing Del Rio Drain.

M20 – Wasteway No. 19 – located between a fork formed by the river on the west and the A.T. & S.F. railroad and approximately 2.0 miles northwesterly from Berino, New Mexico. The wasteway station is approximately 500 feet from the Three Saints Lateral and wastes this lateral into the Rio Grande.

M21 – Wasteway No. 30 – located downstream of the New Mexico State Road 226 from Berino, and downstream of the river levee between the Chamberino East Lateral and the Rio Grande.

M22- La Mesa Drain - located approximately 2 .5 miles west of Berino, New Mexico, west of the river, and ½ mile from wasteway No. 31.

M23 – Wasteway No. 31 – located approximately 2.5 miles southwest of Berino, New Mexico, west of the river, and 3 miles downstream from the intersection of the river with State Hwy 226 (Berino to Chamberino).

M24 – Wasteway No. 20 – located on the east side of the Rio Grande and wastes the Three Saints West Lateral. This wasteway is approximately 1.6 miles upstream of the Anthony bridge crossing the Rio Grande.

M25 – Wasteway No. 31B – located approximately 0.5 mile upstream of the Anthony bridge crossing and on the west side of the Rio Grande. This wasteway is on the tail end of the Jimenez Lateral and is upstream of the river levee.

M26 – Wasteway No. 21 – located approximately 0.5 mile upstream and on the east side of the Rio Grande. This wasteway is on the tail end of the Three Saints West Lateral and is 300 feet upstream of the river levee.

M27 – La Union West Canal – located approximately 3 miles west of Anthony, New Mexico just downstream of the canal heading.

Miscellaneous Sites: Any location where diversion of water from the Rio Grande occurs in New Mexico downstream of Caballo Dam and upstream of the upstream of the American Diversion Dam, including but not limited to the California Lateral Extension and various river pumps.

**The following continuous stage recorders shall be maintained by EPCWID:**

M28 – La Union East Canal – located approximately 3 miles west of Anthony, New Mexico just downstream of the canal heading.

M29 – Three Saints East – located approximately 0.3 mile upstream of the intersection of the Three Saints Lateral and FM1905 from Anthony.

M30 – Wasteway No. 32 – located approximately 2 miles west of Anthony, New Mexico, on the right side of the river, and just downstream of New Mexico State Hwy 225.

M32 – East Drain – located approximately 2 miles south of Anthony, New Mexico and west of US Hwy 80A.

M33- Wasteway No. 32A – located 2 miles upstream of the Anthony bridge crossing and on the west side of the Rio Grande. This wasteway is on the tail end of the Rowley Lateral and just upstream of the river levee.

M35 – Wasteway No. 32B – located west and downstream of the Vinton bridge crossing the Rio Grande. Station is on the tail end of the Vinton Cutoff Lateral and just downstream of the river levee.

M36 – Wasteway No. 34 – located just downstream of the Montoya Siphon and is on the tail end of the Canutillo Lateral.

M37 – Wasteway No. 34A – located approximately 0.6 mile upstream of the Combined La Union Lateral and on the west side of the Rio Grande.

M38 – Wasteway No. 35 – located 3.5 miles downstream from Canutillo, Texas on the right side (west) of the Rio Grande.

M39 – Wasteway No. 35C – located just downstream and on the west side of the Rio Grande. Station is on the tail end of the Schutz Lateral and upstream of the river levee.

M40 – Wasteway No. 36 - located at the tail end of the Montoya Lateral A and on the east side of the Rio Grande.

M41 – Montoya Drain – located in the Upper Valley, Texas, approximately two miles downstream of Country Club Road on the Montoya Drain.

M42 – Wasteway No. 38 – located just down stream of the Sunland Park Road on the Montoya Main Lateral.

M45 – Rio Grande at Canutillo – located approximately 1.0 mile north of Canutillo, Texas and on the right and west side of the Rio Grande.

E1 – American Canal – located off Paisano Drive on canal concrete lined channel just downstream of the Paisano Siphon and ASARCO plant.

E2 – Robertson/Umbenhauer Water Treatment Plant – located adjacent to the American Canal Extension near Canal Street in downtown El Paso.

E3 – Franklin Canal – located downstream of heading of the Franklin Canal near the 2nd Street Check on the American Canal Extension.

E4 – Jonathan Rogers Water Treatment Plant - located adjacent to the Riverside Canal immediately upstream of the E5 metering station

E5 – Riverside Canal – located on the right side (south) and approximately 800 feet downstream of the canal heading.

E6 – Riverside Canal Wasteway No. 1 – located on the right side of the canal just south of the Bosque Park. Wasteway is from Riverside Canal to the Rio Grande.

E7 – Riverside Canal Wasteway No. 2 – located downstream from Riverside Canal Wasteway No. 1, at a point where the canal channel departs from the river levee, approximately 2.5 miles northwest of Cuadrilla, Texas.

E8 – Fabens Waste Drain – located on the Waste Drain Channel just west of U.S. Hwy 20 at Fabens, Texas.

E9 – Fabens Waste Channel – located southeast of Fabens, Texas, downstream on the waste channel from the Tornillo Canal Heading and the Cook-Schultz Lateral inlet intersection.

E10 – Waste Channel Below Tornillo Wasteway No. 1 – located on the Fabens Waste Channel below the Tornillo Canal Wasteway and the Tornillo-Caseta Road.

E12 – Hudspeth Feeder Canal – located on the Hudspeth Feeder Canal approximately six miles downstream from the Guadalupe-Caseta Road and International Bridge in to Caseta, Mexico.

E13 – Tornillo Canal Wasteway No. 2 – located approximately 1 mile east of Alamo Alto, Texas on the canal channel adjacent to U.S. Hwy 20 Alternate.

E14 – Tornillo Drain – located on drain channel just downstream and 800 feet from the Alamo Alto Drain inlet, approximately 0.5 miles southeast of Alamo Alto, Texas.

Miscellaneous Sites: Any location where diversion of water from the Rio Grande occurs in Texas downstream of Mesilla Dam and upstream of the former location of Riverside Diversion Dam.

IN WITNESS WHEREOF, the Parties have executed this Agreement as of the 10th day of March, 2008.

Attest:

ELEPHANT BUTTE IRRIGATION DISTRICT

Willie Koenig
Secretary

By: James Salopek
President

Attest:

EL PASO COUNTY WATER IMPROVEMENT DISTRICT NO. 1

Indar Singh
Secretary

By: Johnny P. Stubbs
President of the Board of Directors

Attest:

UNITED STATES OF AMERICA

for Field Solicitor
Regional

By: Regional Director
Upper Colorado Region
Bureau of Reclamation

Revision of May 2012

RIO GRANDE PROJECT - OPERATIONS MANUAL


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# 1 Disclaimer

This Rio Grande Project Water Accounting and Operations Manual (Operations Manual) contains detailed information regarding the methods, equations and procedures used by the United States Bureau of Reclamation (Reclamation), El Paso County Water Improvement District No. 1 (EPCWID), and Elephant Butte Irrigation District (EBID) to operate the Rio Grande Project and account for all water charges under the Rio Grande Project Operating Agreement. This Operations Manual is an addendum to the Rio Grande Project Operating Agreement and is intended to be consistent with the Project Storage, release and delivery and allocation provisions in the Rio Grande Project Operating Agreement; nothing in the Operations Manual modifies or changes the language and requirements set forth in the Operating Agreement. To the extent any provisions in this Operations Manual are inconsistent or incompatible with the Operating Agreement, such inconsistencies are superseded by the Operating Agreement and/or are null and void.

# 2 Definitions

**Allocated Water**: that portion of the project water supply, as defined in the Operating Agreement, which is determined to be available for diversion and use by EBID, EPCWID and the United States for delivery to Mexico during the primary irrigation season. Accounting of allocated water is subject to the time that it takes water to travel from Caballo Dam to each district's respective diversion points.

**Primary Irrigation Season**: the primary irrigation season is defined as that period of a year when water is being released from Caballo Reservoir for irrigation purposes.

**Allocation Charge:** the debit applied to EBID's, EPCWID's or Mexico's respective amount of allocated Allocation Water.

**Non-Allocated Water:** water in the Rio Grande, during non-irrigation season and after the closing of the Caballo Dam release gates and prior to opening of the Caballo Dam release gates for the subsequent primary irrigation season, which originates from drain flows and other sources which may be diverted by the irrigation districts for application to irrigable land area within their boundaries. All diversions made by the Districts during the non-irrigation season utilizing return flow waters shall not be charged against the District's respective allocations.

**Operating Agreement:** Agreement executed on March 10, 2008 between the United States, EBID and EPCWID.

# 3 Allocation of Project Water

## 3.1 EBID and EPCWID

The U.S. Bureau of Reclamation (Reclamation) shall, prior to the 2nd Tuesday of each month of, allocate Rio Grande Project water in accordance to the Operating Agreement to EBID, EPCWID, and the United States for delivery to Mexico. The final allocation for the year shall include storage and allocation accounting data through the month of October of such year.

## 3.2 Bonita Private Irrigation Canal

The Reclamation shall each month inform EBID, EPCWID, and US-IBWC of the amount of water diverted from Caballo Reservoir into the Bonita Private Irrigation Canal by the United States for use in New Mexico.

## 3.3 United States for Delivery to the Republic of Mexico

Reclamation shall advise US-IBWC based on the storage conditions at the end of November whether the project waters available for release from Project Storage for the following year are sufficient for a full allocation or whether a proportionally reduced allocation will be made. The initial allocation letter provided by the U.S. Bureau of Reclamation to the US-IBWC is received mid-December of each year, with projected storage conditions in Elephant Butte and Caballo reservoirs through the end of the year.

During drought years when proportionally reduced allotments are made, regular monthly meeting are held at the US-IBWC headquarters. Monthly updates based on the end of previous month reservoir storage conditions and allocation projections for the remainder of the year are presented by Reclamation to the US-IBWC, CILA, EBID, EPCWID and CONAGUA, Juarez irrigation district.

## 3.4 Diversion of Flood Water in Excess of Project Water Orders

Reclamation may declare that flood flows, in a specific amount and duration, entering the Rio Grande downstream of Caballo Dam and in amount in excess of Project Water Orders to be Non-Allocated Water and available for diversion by EBID and EPCWID.

# 4 Water Delivery and Accounting

## 4.1 Ordering of Water by the Districts

Figure 1 below shows the order forms to be completed by EPCWID and EBID for review by Reclamation. The amount of flow ordered for delivery to Mexico shall be specified by US-

IBWC. The data fields in Figure 1 shall be entered by EBID and EPCWID each order day during the primary irrigation season by 10:00 am. Based on the information entered into to Figure 1 and the “Flow Regulation Calibration at Caballo Dam” report contained in Appendix D, Prior to 11:00 am each order day, the low level gates at Caballo Dam shall be set to the opening values calculated in Figure 1. The official record of releases of Project Water from Caballo Reservoir shall be calculated by Reclamation and shall be based on the flows recorded by the metering station immediately downstream of Caballo Dam and operated by Reclamation. The amount of opening of the low-level gates shall not be changed if the difference in the amount of the gate opening is ± 0.02 feet from the prior gate setting. Reclamation will perform a flow measurement at the river station below Caballo Dam whenever there is a change in the release from Caballo Dam of ± 100 cfs.

Figure 1 - Internet-Based Order Forms

**RIO GRANDE PROJECT ORDER**

| | | | | | |
|---|---|---|---|---|---|
| Ord:1124 | Effective Date: 7/8/2008 | | Prior:1123 | Effective Date: 7/7/2008 | |
| BOR | Date/Time Received: 07/08/08 15:36 | Received By: IO | BOR | Date/Time Received: 07/07/08 15:09 | Received By: IO |
| EPCWID #1 | Date/Time Entered: 07/08/08 08:39 | Approved By: RR | EPCWID #1 | Date/Time Entered: 07/07/08 09:49 | Approved By: RR |
| EBID | Date/Time Entered: 07/08/08 08:49 | Approved By: MJN | EBID | Date/Time Entered: 07/07/08 09:51 | Approved By: MJN |

Upper Valley From: 7/8/2008 To: 7/9/2008

| Location | Current | Prior | Change |
|---|---|---|---|
| Arrey Canal | 140 | 140 | 0 |
| (-) Bypass | 0 | 0 | 0 |
| River Pumps | 0 | 0 | 0 |
| Leasburg Canal | 170 | 230 | -60 |
| (-) Bypass | 0 | 0 | 0 |
| California Ext. | 0 | 0 | 0 |
| Del Rio Lateral | 0 | 0 | 0 |
| Eastside Canal | 110 | 140 | -30 |
| Westside Canal | 380 | 400 | -20 |
| (-) Bypass WW32 | -30 | -70 | 40 |
| **Total Upper Valley** | 770 | 840 | -70 |

State Line From: 7/8/2008 To: 7/9/2008

| Location | Current | Prior | Change |
|---|---|---|---|
| La Union West TX | 20 | 30 | -10 |
| La Union West NM | 20 | 30 | -10 |

| Gate Settings | Current | Prior | Change |
|---|---|---|---|
| East Gate Recommended | 3.98 | 4.41 | -0.43 |
| West Gate Recommended | 3.98 | 4.41 | -0.43 |

EBID Comments

-

SUMMARY

| | Current | Prior | Change |
|---|---|---|---|
| **RIVER BOOST** | 50 | 0 | 50 |

| River Reaches/Stations | Current | Prior | Change |
|---|---|---|---|
| **Caballo Release** | 1683 | 1873 | -190 |
| Flow below Percha Dam | 1543 | 1733 | -190 |
| Gain/Loss (+/-) above Leasburg | 50 | 0 | 50 |
| Flow at Leasburg Cable | 1423 | 1503 | -80 |
| **Gain/Loss (+/-) Leasburg/Mesilla** | 0 | 0 | 0 |
| Flow below Mesilla Dam | 933 | 963 | -30 |
| Gain/Loss (+/-) Mesilla-American | 0 | 0 | 0 |
| Flow at American Dam | 963 | 1033 | -70 |

| District Totals | Current | Prior | Change |
|---|---|---|---|
| **Total for EBID** | 690 | 780 | -90 |
| **Total for EPCWID #1** | 866 | 916 | -50 |
| **Total for Both Districts** | 1556 | 1696 | -140 |

| Project Totals | Current | Prior | Change |
|---|---|---|---|
| **Total Gains/Loss** | 50 | 0 | 50 |
| Total EBID, EPCWID, Mexico | 1733 | 1873 | -140 |
| **Release** | 1683 | 1873 | -190 |

State Line From: 7/10/2008 To: 7/12/2008

| Location | Current | Prior | Change |
|---|---|---|---|
| La Union East TX | 60 | 30 | 30 |
| La Union East NM | 30 | 20 | 10 |
| 3 Saints East TX | 0 | 0 | 0 |
| 3 Saints East NM | 0 | 0 | 0 |
| **Total State Line** | 130 | 110 | 20 |

Lower Valley From: 7/11/2008 To: 7/13/2008

| Location | Current | Prior | Change |
|---|---|---|---|
| UR-WTP | 56 | 56 | 0 |
| Franklin Canal | 160 | 130 | 30 |
| JR-WTP | 85 | 85 | 0 |
| Riverside Canal | 485 | 585 | -100 |
| **Total Lower Valley** | 786 | 856 | -70 |

Comments - EPCWID

-

Mexico From: 7/11/2008 To: 7/13/2008

| Location | Current | Prior | Change |
|---|---|---|---|
| Mexico | 177 | 177 | 0 |
| **Total Mexico** | 177 | 177 | 0 |

Comments - Mexico

-

Reclamation Order # 1124

| Caballo Elevation | Current | Prior | Change |
|---|---|---|---|
| USBR Elevation (ft) | 4148.58 | 4148.44 | 0.14 |
| Recommended River Boost (cfs) | 0.00 | 0.00 | 0 |
| Accretions (cfs) | 50.00 | 0.00 | 50 |

| Gate Settings | Current | Prior | Change |
|---|---|---|---|
| **East Gate (ft)** | 3.98 | 4.41 | -0.43 |
| **West Gate (ft)** | 3.98 | 4.41 | -0.43 |

| Recommended Flow Setting | Current | Prior | Change |
|---|---|---|---|
| **CFS** | 1683 | 1873 | -190 |

| | |
|---|---|
| *Scheduled Time of Change* | 10:00 |

| USBR River Measurement | Date | Time | Flow |
|---|---|---|---|
| **Measured Flow (cfs)** | 7/8/2008 | 13:15 | 1756 |

| | |
|---|---|
| *USBOR Confirmation of Mexico Order* | Yes |

Comments

BOR recom. gate settings @ 3.86 ea.=1683 Dist. recom. gate settings @ 3.98 ea.=1735

| | |
|---|---|
| Date/Time Received: 07/08/08 15:36 | Received By: IO |

## 4.2 Estimate of the Time Required for Water Released from Caballo Reservoir to Travel in the Rio Grande to Diversion Dams

Project Water is released from Caballo Reservoir is diverted at the Percha, Leasburg, Mesilla, and American diversion dams located downstream of Caballo Dam on the Rio Grande. The time required for water released from Caballo Reservoir to travel to each of these dams varies with the amount of water in the Rio Grande, the amount of water released, the amount of change in the amount of water released (both magnitude and sign), the amount of water being diverted at each diversion point, and other considerations. As water released from Caballo travels from Caballo Dam towards American Dam in the Rio Grande it does such as a wave that is attenuated and modified with distance. For example, if the amount of flow released from Caballo Dam is changes from 1,000 cfs to 1,500 cfs, the 500 cfs increase occurs almost instantly, but assuming no water is lost or gained between Caballo Dam and American Dam, the arrival of the change-in-release would be gradual. Figure 2 below show the measured hydrographs during the initial release of water from Caballo Dam in 2007 at various locations on the Rio Grande downstream of Caballo Dam. Because the change-in-release is modified as it flows downstream, the estimated travel times are based on the time that 90% of the anticipated change arrives at the given diversion dam. For the above example of a 500 cfs change at Caballo with no loss or gain of water, the travel time would be that when 450 cfs of the change arrived at given location. Table 1 below lists the distance and average travel time for the Rio Grande Project diversion dams on the Rio Grande.

Figure 2 - Hydrographs for Initial Release of Water from Caballo Dam in 2007

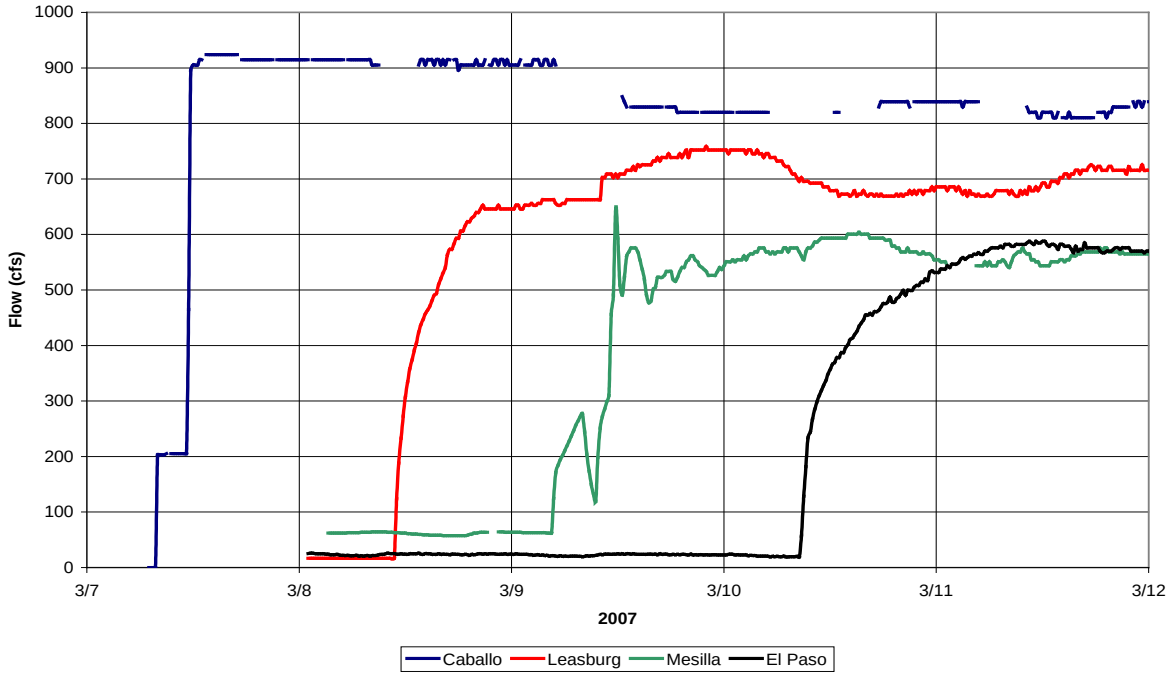


Table 1 - Average Travel from Caballo Dam to Various Diversion Dams

| River Location / Reach | River Miles from Caballo Dam | River Reach Miles | Travel Velocity | Cumulative Travel Time in Hours | Travel Time per River Reach in Hours | Example Day of Week | Example Hour of Day |
|---|---|---|---|---|---|---|---|
| Rio Grande at Caballo Dam | 0 | - | | 0 | 0 | Monday | 11:00 AM |
| Percha Diversion Dam | 1.2 | 1.2 | 0.6 | 2 | 2 | Monday | 1:00 PM |
| Leasburg Diversion Dam | 44.8 | 43.6 | 2.4 | 20 | 18 | Tuesday | 7:00 AM |
| Mesilla Diversion Dam | 67.5 | 22.7 | 2.3 | 30 | 10 | Tuesday | 5:00 PM |
| American Diversion Dam | 106.8 | 39.3 | 1.1 | 66 | 36 | Thursday | 5:00 AM |
| International Diversion Dam | 108.9 | 2.1 | 1.1 | 68 | 2 | Thursday | 7:00 AM |

## 4.3 Sharing of Storages

Flows at American Canal Heading occasionally drop below the order of the EPCWID. At times when the actual flow at EPCWID delivery points is 100 CFS or more below the EPCWID's order, and at EPCWID option, the following method of sharing the shortage between EBID and EPCWID shall be implemented:

> EBID shall release additional water through wasteways equal to one half of the amount of shortage at Riverside Canal Heading. EBID and EPCWID shall adjust the order for release from Caballo Reservoir to correct for such shortage. EBID shall receive credit against their allocation charge for the amount of additional water released through their wasteways because of such shortage.

## 4.4 Water Flow Measurement Stations

Each party shall maintain and operate the water flow measurement (metering) stations as listed in the Operating Agreement. Each station used in accounting of delivery of allocated water and listed in sections 4.5.2 and 4.5.3 shall be equipped with a Steven's Type F recorder and the water levels shall be continuously recorded on paper charts. A digital copy of the charts shall be made available by the party maintaining the metering station upon request by any other party.

## 4.5 Measurement of Flow and Volume

Water flow and volume measurement shall generally following procedures as outlined in USGS Water Supply Paper 2175. Rating tables for metering stations shall be determined at least annually by the party maintaining the station using previous flow measurements.

### *4.5.1 United States Section of the International Boundary and Water Commission (US-IBWC)*

The US-IBWC measures twice a week at the Below American Dam gaging station and twice weekly at the headworks of the Acequia Madre, preferably on Mondays and Fridays each week

during the primary irrigation season. CILA measures the amount of water flowing in Acequia Madre at its headworks three times a week, usually on Mondays, Wednesdays and Fridays. All information regarding measurements are exchanged between the two sections. Based upon the latest US measurements, the US-IBWC determines the appropriate gage height setting at the metering station immediately downstream of American Dam on the Rio Grande and the corresponding gate setting at American Dam to deliver the requested flow rate into the Acequia Madre.

The water delivered to Mexico in the Rio Grande at the headworks of the Acequia Madre pursuant to the 1906 Convention is computed by subtracting 1) computed losses in the reach between Below American Dam gauging station and the Acequia Madre headworks and 2) estimated leakage through International Dam from the computed flows at the Below American Dam gauging station.

### *4.5.2 EBID*

Figure 3 - Example of EBID's Monthly Water Allotment Charges Report

ELEPHANT BUTTE IRRIGATION DISTRICT
WATER ALLOTMENT CHARGES (acre-feet)
**for Month of April 2008**
SUBJECT TO REVISION

| | Gross Diversions | | Diverted to Texas | | Net Diversion | |
|---|---|---|---|---|---|---|
| | Month | Year to Date | Month | Year to Date | Month | Year to Date |
| ARREY CANAL | 12,091 | 22,237 | | | 12,091 | 22,237 |
| PERCHA LATERAL | 67 | 71 | | | 67 | 71 |
| LEASBURG CANAL | 11,439 | 18,710 | | | 11,439 | 18,710 |
| CALIFORNIA EXTENTION | 0 | 0 | | | 0 | 0 |
| EASTSIDE CANAL | 7,771 | 11,954 | -353 | -514 | 7,418 | 11,441 |
| DEL RIO LATERAL | 466 | 823 | | | 466 | 823 |
| WESTSIDE CANAL | 20,594 | 38,029 | -6,248 | -13,019 | 14,347 | 25,010 |
| PUMPED FROM RIVER** | 0 | 0 | | | 0 | 0 |
| GROSS TOTAL | 52,429 | 91,824 | 6,601 | 13,533 | 45,828 | 78,292 |
| TOTAL CHARGES | | | | | 45,828 | 78,292 |
| CREDIT AT ARREY (-) | | | | | -692 | -763 |
| CREDIT AT LEASBURG (-) | | | | | -87 | -87 |
| NET ALLOTMENT CHARGE | | | | | 45,049 | 77,442 |
| DISTRICT ALLOTMENT | | | | | | 198,384 |
| DISTRICT BALANCE | | | | | | 120,942 |

** GREENWOOD AND DURAN RIVER PUMPS (EBID DATA)

Charges to EBID are made using the following diversion points:

a) Arrey Canal,

b) Percha Lateral,

c) Irrigations from Leasburg Canal above gauging station,

d) Leasburg Canal,

e) California Lateral,

f) West Side Canal (NM portion),

g) East Side Canal (NM portion),

h) Del Rio Lateral, and

i) the Greenwood, Duran, Roundtree, Dulin, Dorser, and Thurston pumps located in the Rincon Valley.

### *4.5.3 EPCWID*

Figure 4 - Example of EPCWID's Monthly Water Allotment Charges Report

**EPCWID Diversion Allocation Charges for Mar 2008**

| Diversion Location | Metered Volume | Adjustment for Conveyance Losses for NM Deliveries | Diversion Allocation Charges for Month | Beginning-of-Month Totals | End-of-Month Totals |
|---|---|---|---|---|---|
| | ac-ft | ac-ft | ac-ft | ac-ft | ac-ft |
| L U E Canal - TX | 3,092 | 95% | 2,937 | 0 | 2,937 |
| L U W Canal - TX | 1,096 | 95% | 1,041 | 0 | 1,041 |
| Three Saints Lateral | 133 | 100% | 133 | 0 | 133 |
| Total Mesilla Valley (Texas) | | | 4,112 | 0 | 4,112 |
| Umbenhauer/Robertson Water Treatment Plant | 1,820 | 100% | 1,820 | 61 | 1,881 |
| Franklin Canal | 6,246 | 100% | 6,246 | 256 | 6,502 |
| United States - Ysleta del Sur Agreement | 0 | 100% | 0 | 0 | 0 |
| United States Section - IBWC (Construction Water) | 0 | 100% | 0 | 0 | 0 |
| Jonathan W. Rogers Water Treatment Plant | 2,539 | 100% | 2,539 | 0 | 2,539 |
| Riverside Canal | 21,751 | 100% | 21,751 | 1,680 | 23,431 |
| Haskell R. Street WWTP Effluent | -1,461 | 100% | -1,461 | -239 | -1,700 |
| Credit for Diversions greater than Orders (El Paso Valley) | -200 | 100% | -200 | 0 | -200 |
| **Total Allotment Diversions Charges** | | | **34,806** | **3,132** | **36,565** |
| Diversion Allocation | | | | 232,339 | 257,951 |
| Est. Annual Conservation Credit Diversion Allocation | | | | | 16,207 |
| Accrued Conservation Credit Diversion Allocation | | | | | 2,297 |
| Total Diversion Allocation | | | | 232,339 | 260,248 |
| **District Allotment Balance** | | | | **229,207** | **223,684** |

Charges to EPCWID are made using the following diversion points:

a) East Side Canal (Texas portion)

b) La Union East Canal (Texas portion)

c) La Union West Canal (Texas portion)

d) Franklin Canal

e) City of El Paso Water Treatment Plants

f) American Canal Extension for the United States (Ysleta del Sur and US-IBWC)

g) Riverside Canal

## 4.6 Water Order by Only One District

### *4.6.1*

At the start of the Primary Irrigation Season and when one District orders water for diversion prior to the other, allocation charges to that District shall start on the date and time that water arrives to the delivery point and shall equal the greater of the amount of water ordered for delivery or the amount of water released from Caballo Dam. Any charges based on the amount of water released from Caballo Dam shall be discontinued upon the other district or Mexico ordering water for delivery.

### *4.6.2*

During years with less than a full allocation and diversion have been discontinued for only one district because of insufficient diversion allocation balance and during the time prior to the termination of release of water from Caballo Dam at the end of the Primary Irrigation Season (when only one District orders water for diversion), the allocation charges shall equal the greater of the amount of diversion charges made in accordance with Appendices A, B, and C of this manual or the amount of water released from Caballo Dam.

## 4.7 End of Primary Irrigation Season

Except when Section 4.6.2 is in effect and after the gates at Caballo Dam have been closed, allocated water will be charged to the Districts until such time as the stored water is no longer available at their respective headings or the estimated travel times listed in Section 4.2 above have elapsed, whichever is less. If Section 4.6.2 is in effect, allocation charges for either district shall end at the date and time the gates at Caballo Dam are closed..

## 4.8 Emergency Conditions

Each Party shall be allowed to make changes to the water order in response to emergencies such as ditch breaks, flood flows, excessive arroyo inflows, or other accidents to the system. Reclamation shall make the change in the release from Caballo Reservoir as soon as possible. The order change for accounting purposes, at the respective diversion point, shall take effect as per the travel times in Section 4.2.

In the event of a total closing of the release gates from Caballo due to an emergency, accounting of delivered allocated water shall be in accordance with Section 6.5 Emergency Conditions (Force Majeure) of the Operating Agreement. Documentation of the changes in orders shall be completed utilizing the process in Section 4.1 as soon as possible and verified by each party.

## 4.9 Accounting Mistakes Regarding Mexico's Allocation

During an extraordinary drought or serious accident to the irrigation system in the United States, Mexico's delivery allocation (that has been diminished in the same proportion as the water delivered to lands in the irrigation districts in the United States) shall not be decreased during the calendar year except in the situation where an accounting or measurement mistake has been made resulting in an allocation to Mexico in an amount greater than would have been made if such error had not been made.

In November of each year, if under any situation Mexico's allocation is greater than the same proportion as the water delivered to lands in the irrigation districts in the United States, then the difference in the amount greater than the proportion as the water delivered to lands in the irrigation districts in the United States shall be charged against the delivery allocation of the irrigation districts in amounts proportional to their respective irrigable acres.

## 4.10 Correction of D2- Linear Regression Equation During Multi-Year Extreme Drought

The D2 Linear Regression Equation fails to accurately predict the measured amount of water that was diverted from the Rio Grande during consecutive calendar years when the total amount of water released from Caballo Reservoir is less than 400,000 acre-feet. For example during the years 1954 through 1957 the amount of water released from Caballo Reservoir was less than 400,000 acre-feet, and the amount of measured diversions was 88%, 78%, and 75% of the amount predicted by the D2 Linear Regression Equation for the years 1955, 1956, and 1957, respectively. During the 2$^{nd}$ consecutive year when the amount of water released from Caballo Reservoir is less than 400,000 acres feet the "Corrected D2 Linear Regression Equation" shall equal the value predicted by the D2 Linear Regression Equation multiplied by 0.88.

During the 3rd consecutive year when the amount of water released from Caballo Reservoir is less than 400,000 acres feet the "Corrected D2 Linear Regression Equation" shall equal the value predicted by the D2 Linear Regression Equation multiplied by 0.78.

During the 4th and all following consecutive years when the amount of water released from Caballo Reservoir is less than 400,000 acre feet the "Corrected D2 Linear Regression Equation" shall equal the value predicted by the D2 Linear Regression Equation multiplied by 0.75.

If the measured diversion ratio for a consecutive drought year in which the correction to the D2 Linear Regression Equation is applied, is higher than the diversion ratio predicted by the Corrected D2 Linear Regression Equation defined in this section, the measured diversion ratio shall be used for allocation purposes.

# 5 Exchange of Information

## 5.1 Allocation Water Charges

Reclamation will provide the EBID and the EPCWID written notification of allocation water charges by the 10th of each following month.

## 5.2 Communications

Reclamation will provide timely information on any unusual circumstances which could affect the water deliveries to the Districts or Mexico. EBID and EPCWID will immediately notify Reclamation concerning ditch breaks, unusual operating conditions, climatic conditions, or other major disruptions to orderly irrigation operations.

Reclamation will provide river status information daily to the Districts. Additional information or assistance may be requested at any time during Reclamation's operation hours. Any requests for information or assistance during non-operating hours should be limited to emergencies and not routine items. Reclamation's project water operations office and field operating hours during the irrigation season will be as follows:

| | Office | Field |
|---|---|---|
| Weekdays | 6:00 am to 4:30 pm | NM: 6:00 am to 6:00 pm |
| | | TX: 6:00 am to 2:30 pm |
| Weekends | (none) | NM: 6:00 am to 2:30 pm |
| | | TX: 6:00 am to 2:30 pm |

A current roster of contact numbers for EBID, EPCWID, US-IBWC and Reclamation shall be distributed by each of the above entities to EBID, EPCWID, US-IBWC, and Reclamation. The roster shall be updated as necessary.

### 5.3 Information Provided to Reclamation

EBID and EPCWID shall provide to Reclamation and the other district the following:

a) Water orders by 10:00 am on order days

b) Average flow data (cfs) for all metering station listed in the Operating Agreement by the 2nd Monday of each month following the month in which the data was measured.

c) Crop report information by January 15, each year.

d) Water charges to the farms by January 15, each year.

Reclamation shall obtain the following from US-IBWC:

a) Water orders by 10:00 am on order days.

b) Preliminary average flow data (cfs) for the Acequia Madre listed in the Operating Agreement by the 2nd Monday of each month following the month in which the data was measured.

c) Final average flow data (cfs) by the last day of each month following the month in which the data was measured.

### 5.4 Information Provided by Reclamation

Reclamation shall provide to EBID, EPCWID, and US-IBWC the following information by the 2nd Tuesday of each month.

a. Amount of water stored in Elephant Butte and Caballo Reservoirs

b. Amount of non-project water storage

c. Amounts of project water stored above Elephant Butte in the Upper Rio Grande Basin

d. Cumulative annual amount of water released from Elephant Butte and Caballo Reservoir

e. Current inflow to Elephant Butte and Caballo Reservoir

In addition to the above information, Reclamation shall, by January 15 of each year, provide to all parties documentation of compliance, during the previous year, by the City of El Paso with terms of “Exhibit C – Determination of Underflow of the Rio Grande Captured by the City of El

Paso's Groundwater Withdrawal" of the contract among the City of El Paso, EPCWID, the United States numbered 01-WC-40-6760 (2001 Implementing Contract).

# 6 Updating of Operations Manual

EBID, EPCWID, and Reclamation (including representation from US-IBWC under the auspice of Reclamation) will meet once a year in January, or more frequently if requested by one of the three parties, to review this operating manual. The Parties may modify any provisions of this manual upon having reached unanimous consent. No unilateral departure from this manual is allowed. Proposals for updates shall be submitted to all parties by January 1st of each year for review during the January meeting. The proposal shall consist of a detailed description of the proposed update with a justification for the update. Adoption of the update shall be by unanimous consent for the start of the irrigation season agreed to by the parties. At any time during the year any party may submit proposal for updating this manual. The proposal shall consist of a detailed description of the proposed update with a justification for the update.

Adoption of the update shall be by unanimous consent on the date agreed to by the parties. Consent of adoption of the update shall communicated by letter to each party. The Bureau of Reclamation shall make the updated manual available to the general public upon implementation. No unilateral departure from this manual is allowed.

# 7 Record of Changes Made to This Operating Manual

| | |
|---|---|
| August 13, 2008 | Original Manual |
| January 15, 2009 | No changes made. |
| January 12, 2010 | Deletions, additions, revisions, and changes made to sections 3.1, 3.3, 4.1,4.5.1, 4.6,1, 4.6.2, 4.7, 4.9, 5.2, 5.3, and 6. as shown in the redline version dated January 12, 2010. No changes made to appendices. |
| May 8, 2012 | Addition of Section 4.10. No changes made to appendices. |

# APPENDIX A – RIO GRANDE PROJECT OPERATING AGREEMENT

## APPENDIX B – EXAMPLE OF EPCWID'S MONTHLY CHARGES

The following descriptions are provided for convenience only. The actual equations, procedures, and representations contained in the electronic spreadsheet named EPCWID_Charges_2008.xls and attached to this document as Exhibit 1 shall be used for determining EPCWID charges.

**Description of Calculations used to determine EPCWID's Allocation Charges**

Overview: EPCWID monthly allocation charge are calculated using information from Table B-1 –Monthly Summary, Table B-2 – Average Daily CFS Values, and Table B-3 – El Paso Valley Spills. Each of the three tables is specific for each month of the year and a single spreadsheet file (MS-EXCEL) shall be distributed by EPCWID to the other parties each month that contains the tables. Table B-1 is linked to Tables B-2 and B-3 and previous monthly tables to provide the summary of the allocation charges and a running balance of the amount of Project Water available for diversion by EPCWID. Table B-2 contains the daily flow (average cfs) values for each of the flow metering sites that is used in the calculations of charges and the respective amount of water ordered by EPCWID or EPCWID and EBID at La Union East, La Union West, and Three Saints irrigation canals. Table B-3 contains the daily volumes of water flowing out of EPCWID wasteways and spillways in the El Paso Valley. Table B-3 is used to determine the amount of water that is eligible for evaluation in Table B-2 for an allocation credit to EPCWID. The purpose of the allocation credit is to provide an accounting procedure that promotes conservation by allowing EPCWID to attempt to use water that is in excess of EPCWID's order for Project Water on any given day and is diverted at the American Diversion Dam into the American Canal.

**Table B-1: EPCWID Diversion Allocation Charges Summary**

**Row 4**: The La Union East irrigation canal supplies water to irrigable lands in both Texas and New Mexico. The metered volume for the La Union East irrigation canal is obtained from Table B-2. The EPCWID allocation charge is 95% of the metered volume. The 5% reduction is in consideration of the transportation losses associated with the water delivered to lands in New Mexico.

**Row 5:** The La Union West irrigation canal supplies water to irrigable lands in both Texas and New Mexico. The metered volume for the La West East irrigation canal is obtained from Table B-2. The EPCWID allocation charge is 95% of the metered volume. The 5% reduction is in consideration of the transportation losses associated with the water delivered to lands in New Mexico.

**Row 6:** The Three Saints irrigation canal downstream of the Texas state line only supplies water to irrigable lands in Texas. The metered volume for the La Union East irrigation canal is obtained from Table B-2.

**Row 7:** EPCWID total allocation charges for the Mesilla Valley equal the sum of charges for rows 4, 5, and 6.

**Row 8:** The Umbenhaur-Robertson WTP diverts water from the American Canal Extension upstream of the Franklin Canal Heading. The amount of water diverted is measured by the City of El Paso and Reported to EPCWID. The gross amount of the measured volume is used as the allocation charge.

**Row 9:** EPCWID diverts water from the American Canal Extension upstream at the Franklin Canal Heading. The amount of water diverted is measured by EPCWID. The gross amount of the measured volume is used as the allocation charge.

**Row 10:** The United States on behalf of the Ysleta del Sur Nation diverts water from the American Canal Extension into the Rio Grande immediately upstream of the former Riverside Diversion Dam. The Ysleta del Sur Nation owns irrigable land within EPCWID that receives and allocation of water from EPCWID.

**Row 11:** During maintenance of the Rio Grande levee system and other work, the US-IBWC uses water pumped from the American Canal Extension.

**Row 12:** The Jonathan Rogers WTP diverts water from the Riverside Canal upstream of the Riverside Canal metering station. The amount of water diverted is measured by the City of El Paso and Reported to EPCWID. The gross amount of the measured volume is used as the allocation charge.

**Row 13:** The American Canal Extension terminates in the Riverside Canal. EPCWID measures the amount of water in the Riverside Canal immediately downstream of the City of El Paso's diversion point for the Jonathan Rogers WTP. The amount of water diverted is measured by EPCWID. The gross amount of the measured volume is used as the allocation charge.

**Row 14:** In accordance with the 2001 Implement Agreement among the United States, EPCWID, and the City of El Paso, EPCWID receives credit for non-project water discharged into the American Canal Extension by the City of El Paso at their Haskell Street WWTP upstream of the Riverside Canal and downstream of the Franklin Canal Heading. The amount of water discharge is measured by the City of El Paso and reported to EPCWID.

**Row 15:** Tables B-2 and B-3 contain measurements and calculations required to determine the volume of credit to be applied to EPCWID allocation charges for water diverted into the Franklin

or Riverside canals that is greater than the amount of water ordered by EPCWID for diversion and is not used by EPCWID. Details of the calculations are provided in the section regarding Tables B-2 and B-3 below.

**Row 16:** The total diversion allocation charges equal the sum of rows 7 through 15.

**Row 17:** Reclamation, in accordance with this manual and the Operating Agreement, provides EPCWID with its total diversion allocation.

**Row 18:** The maximum amount of diversion allocation that is eligible for determining the American Canal Extension Conservation Credit is 376,863 acre-feet per year.

**Row 19:** The estimated annual American Canal Extension Conservation Credit is calculated using the following formula:

> **[(-0.7908 x 0.8 x Estimated Annual Division / 376,840)$^2$**
>
> **+ (1.6477 x 0.8 x Estimated Annual Diversion / 376,840)+0.1431] x 20,052**
>
> **Where the Estimated Annual Diversion equals the Diversion Allocation for Conservation Credit – Estimate of Balance of Allocation at End-of-Year; that is, (Row 18 – Row 23)**

**Row 20:** The accrued annual American Canal Extension Conservation Credit is calculated using the following formula:

> **Total Allotment Diversions Charge / Diversion Allocation for Conservation Credit x Estimated Annual Conservation Credit Diversion Allocation; that is, (Row 16 / Row 18 x Row 19)**

**Row 21:** The total diversion allocation for EPCWID equals the sum of rows 17 and 20.

**Row 22:** EPCWID's end-of-month allocation balance equals Row 21 minus Row 16.

**Row 23:** At various times during the Primary Irrigation Season, EPCWID estimates the District Allocation Balance at the end-of-year. This estimate is subject to the limitation on the amount of Project Water that can be carried over from one year to the next as set forth in the Operating Agreement.

**<u>Table B-2: Average Daily CFS and Allocation Charges by Diversion Site</u>**

**La Union East Canal (Texas Portion):** The determination of EPCWID allocation charges for La Union East Canal (LUE) is complex and requires 11 columns of measured or calculated values. The complex calculations are a result of the fact that the LUE canal services land in both Texas and New Mexico. Also, water flows in the LUE canal for bypass to the Rio Grande

through WW32 and downstream diversion into the American Canal, and WW32 is used to discharge excess flow from EBID. In general the allocations charges for LUE are based on the net amount of water measured by EPCWID at the LUE metering station multiplied (prorated) by the ratio of the EPCWID order to the total order for LUE. The net amount of water measured at LUE is equal to the gross amount of water metered at LUE minus the gross amount of water metered at WW32.

**La Union West Canal (Texas Portion):** EPCWID allocation charges for La Union West Canal are equal to the gross amount of water measured by EBID at the LUW metering station multiplied (prorated) by the ratio of EPCWID LUW order to the total order for LUW.

**Three Saints Lateral Canal (Texas Portion):** EPCWID's allocation charges for the Three Saints Lateral (TSL) are equal to net amount of water measured by EBID at the TSL metering station multiplied (prorated) by the ratio of EPCWID TSL order to the total order for TSL. The net amount of water measured at TSL is equal to the gross amount of water metered at TSL minus the gross amount of water metered at WW23A. If there is no order for water at TSL and the gross amount of flow at TSL is less than or equal to 5 cfs, then the gross amount of flow is assumed to be equal to zero.

**Umbenhaur-Robertson WTP:** The values in this column are the daily gross amount of water metered by the City of El Paso as it is diverted from the American Canal Extension for the Umbenhaur-Robertson WTP.

**Franklin Canal:** The values in this column are the daily gross amount of water metered by EPCWID as it is diverted from the American Canal Extension.

**Jonathan Rogers WTP:** The values in this column are the daily gross amount of water metered by the City of El Paso as it is diverted from the Riverside Canal for the Jonathan Rogers WTP.

**Riverside Canal:** The values in this column are the daily gross amount of water metered by EPCWID flowing in the Riverside Canal immediately downstream of the Jonathan Rogers WTP.

**Haskell Street WWTP Water Credit:** The values in this column are the daily gross amount of water metered by the City of El Paso as it is discharged into the American Canal Extension from the Haskell Street WWTP.

**Total El Paso Valley Order:** The values in this column are equal to the sum of the orders and diversion for all of the diversion sites described above.

**Table B-3: EPCWID El Paso Valley Daily Spills**

**Riverside WW1:** The estimate of the amount of flow discharged from the Riverside Canal through WW1 to the Rio Grande. The estimate is made based on cfs per inch of gate setting and the duration of flow. Normally all gates at WW1 are closed.

**Riverside WW2:** The estimate of the amount of flow discharge from the Riverside Canal through WW2 to the Rio Grande. The estimate is made based on cfs per inch of gate setting and the duration of flow. Normally all gates at WW2 are closed.

**Fabens Waste Drain:** The flow in Fabens Waste Drain has both agricultural drain water (groundwater water) and water discharge through upstream wasteways. The amount of waste water varies from hour to hour while the amount of drain flow is more steady and varies from week to week. The drain flow is estimated by inspection of the flow hydrographs. The Fabens Waste Drain flows into the Fabens Waste Channel.

**Fabens Waste Channel:** The Fabens Waste Channel flow includes both wasteway water and the Fabens Waste Drain drainage water. The net spill water is calculated by subtracting the Fabens Waste Drain agricultural drainage flow from the gross measure flow for the Fabens Waste Channel.

**Tornillo WW2:** Tornillo WW2 is near the El Paso / Hudspeth County Line and at the terminus of the Tornillo Canal. The waste flow is measured by EPCWID.

**Total Spills:** The values in this column equal the sum of the flows at Riverside WW1, Riverside WW2, Fabens Waste Channel, and Tornillo WW2.

**Adjustment for Bustamante and Haskell WWTP:** The sum of the gross amount of water discharged into the American Canal Extension from the Haskell WWTP and the gross amount of water discharged into the Riverside Canal from the Bustamante WWTP.

**EP Valley Spills:** This column equals the Total Spills minus the Adjustment for Bustamante and Haskell WWTP.

## APPENDIX B – EXAMPLE OF EPCWID'S MONTHLY CHARGES (cont.)

Table B-1: EPCWID Diversion Allocation Charges Summary

| Row | EPCWID Diversion Allocation Charges for May 2008 | | | | | |
|---|---|---|---|---|---|---|
| 2 | Diversion Location | Metered Volume | Adjustment for Conveyance Losses for NM Deliveries | Diversion Allocation Charges for Month | Beginning-of-Month Totals | End-of-Month Totals |
| 3 | | ac-ft | ac-ft | ac-ft | ac-ft | ac-ft |
| 4 | L U E Canal - TX | 2,542 | 95% | 2,414 | 5,338 | 7,752 |
| 5 | L U W Canal - TX | 971 | 95% | 923 | 2,140 | 3,063 |
| 6 | Three Saints Lateral | 184 | 100% | 184 | 308 | 493 |
| 7 | Total Mesilla Valley (Texas) | | | 3,521 | 7,786 | 11,308 |
| 8 | Umbenhauer/Robertson Water Treatment Plant | 3,592 | 100% | 3,592 | 5,114 | 8,707 |
| 9 | Franklin Canal | 6,415 | 100% | 6,415 | 12,738 | 19,153 |
| 10 | United States - Ysleta del Sur Agreement | 0 | 100% | 0 | 0 | 0 |
| 11 | United States Section - IBWC (Construction Water) | 0 | 100% | 0 | 0 | 0 |
| 12 | Jonathan W. Rogers Water Treatment Plant | 4,631 | 100% | 4,631 | 6,895 | 11,525 |
| 13 | Riverside Canal | 19,105 | 100% | 19,105 | 44,006 | 63,111 |
| 14 | Haskell R. Street WWTP Effluent | -1,460 | 100% | -1,460 | -3,058 | -4,519 |
| 15 | Credit for Diversions greater than Orders (El Paso Valley) | -163 | 100% | -163 | -814 | -977 |
| 16 | **Total Allotment Diversions Charges** | | | **35,641** | **72,667** | **108,308** |
| 17 | Diversion Allocation | | | | 300,239 | 380,012 |
| 18 | Diversion Allocation for Conservation Credit | | | | | 376,863 |
| 19 | Est. Annual Conservation Credit Diversion Allocation | | | | | 19,008 |
| 20 | Accrued Conservation Credit Diversion Allocation | | | | | 5,463 |
| 21 | Total Diversion Allocation | | | | 300,239 | 385,475 |
| 22 | **District Allotment Balance** | | | | **227,572** | **277,167** |
| 23 | Estimate of Balance of 2008 Allocation at End-of-Year | | | | | 8,612 |

## APPENDIX B – EXAMPLE OF EPCWID'S MONTHLY CHARGES (cont.)

Table B-2: Average Daily CFS and Allocation Charges by Diversion Site

**EL PASO COUNTY WATER IMPROVEMENT DISTRICT Diversion Allocation Charges May 08**

| | La Union East Canal (Texas Portion) | | | | | | | | | | | La Union West Canal (Texas Portion) | | | | Three Saints Lateral Canal (Texas Portion) | | | | | | Umbenhaur-Robertson WTP | | | Franklin Canal | | | Jonathan Rogers WTP | | | Riverside Canal | | | Haskell Street WWTP Water Credit | | Total El Paso Valley Order | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | NM Order | TX Order | WW32 Bypass | Total Order + Bypass | LUE Avg. CFS | Excess Flow | WW32 Avg. CFS | WW32 Spill | WW32 Spill Charge | Net. Avg. CFS | Alloc. Charge | NM Order | TX Order | Avg. CFS | Alloc. Charge | NM Order | TX Order | Avg. CFS | WW23A | Net CFS | Alloc. Charge | Order | Avg. CFS | Alloc. Charge | Order | Avg. CFS | Alloc. Charge | Order | Avg. CFS | Alloc. Charge | Order | Avg. CFS | Alloc. Charge | Avg. CFS | Credit | Order | Project Water | Potetial Credit | Spill | Actual Credit |
| 1 | 15 | 25 | 60 | 100 | 106 | 6 | 56 | 0 | 0 | 50 | 31 | 30 | 10 | 46 | 12 | 15 | 0 | 17 | 6 | 11 | 0 | 43 | 56 | 56 | 70 | 71 | 71 | 65 | 67 | 67 | 330 | 322 | 322 | 24 | 24 | 508 | 492 | 0 | 0 | 0 |
| 2 | 15 | 25 | 30 | 70 | 76 | 6 | 59 | 29 | 23 | 17 | 25 | 30 | 10 | 40 | 10 | 0 | 0 | 6 | 6 | 0 | 0 | 43 | 56 | 56 | 50 | 75 | 75 | 59 | 66 | 66 | 290 | 268 | 268 | 25 | 25 | 442 | 441 | 0 | 0 | 0 |
| 3 | 0 | 0 | 70 | 70 | 75 | 5 | 69 | 0 | 0 | 6 | 6 | 30 | 10 | 31 | 8 | 0 | 0 | 3 | 3 | 0 | 0 | 43 | 57 | 57 | 50 | 71 | 71 | 59 | 66 | 66 | 290 | 285 | 285 | 23 | 23 | 442 | 456 | 14 | 22 | 14 |
| 4 | 0 | 0 | 70 | 70 | 79 | 9 | 66 | 0 | 0 | 13 | 13 | 40 | 0 | 41 | 0 | 0 | 0 | 4 | 4 | 0 | 0 | 43 | 56 | 56 | 50 | 53 | 53 | 59 | 67 | 67 | 290 | 320 | 320 | 23 | 23 | 442 | 472 | 30 | 0 | 0 |
| 5 | 0 | 0 | 70 | 70 | 66 | 0 | 58 | 0 | 0 | 8 | 8 | 40 | 0 | 40 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 46 | 57 | 57 | 60 | 83 | 83 | 65 | 68 | 68 | 380 | 381 | 381 | 23 | 23 | 551 | 567 | 16 | 0 | 0 |
| 6 | 0 | 0 | 70 | 70 | 75 | 5 | 15 | 0 | 0 | 60 | 60 | 40 | 0 | 41 | 0 | 0 | 0 | 11 | 2 | 9 | 0 | 46 | 56 | 56 | 60 | 105 | 105 | 65 | 70 | 70 | 380 | 335 | 335 | 25 | 25 | 551 | 540 | 0 | 0 | 0 |
| 7 | 20 | 40 | 40 | 100 | 109 | 9 | 16 | 0 | 0 | 93 | 62 | 50 | 10 | 39 | 7 | 10 | 15 | 22 | 0 | 22 | 13 | 46 | 58 | 58 | 60 | 103 | 103 | 65 | 70 | 70 | 380 | 294 | 294 | 25 | 25 | 551 | 500 | 0 | 0 | 0 |
| 8 | 20 | 40 | 40 | 100 | 114 | 14 | 2 | 0 | 0 | 112 | 75 | 50 | 10 | 57 | 10 | 10 | 15 | 27 | 2 | 25 | 16 | 46 | 56 | 56 | 60 | 127 | 127 | 65 | 71 | 71 | 380 | 263 | 263 | 24 | 24 | 551 | 493 | 0 | 0 | 0 |
| 9 | 30 | 60 | 10 | 100 | 99 | 0 | 0 | 0 | 0 | 99 | 66 | 50 | 10 | 55 | 9 | 10 | 15 | 10 | 6 | 4 | 6 | 51 | 54 | 54 | 160 | 142 | 142 | 68 | 70 | 70 | 370 | 337 | 337 | 25 | 25 | 649 | 577 | 0 | 0 | 0 |
| 10 | 30 | 60 | 10 | 100 | 100 | 0 | 0 | 0 | 0 | 100 | 67 | 50 | 10 | 59 | 10 | 0 | 0 | 10 | 8 | 2 | 0 | 51 | 59 | 59 | 160 | 125 | 125 | 68 | 73 | 73 | 330 | 305 | 305 | 24 | 24 | 609 | 538 | 0 | 0 | 0 |
| 11 | 20 | 40 | 60 | 120 | 100 | 0 | 7 | 0 | 0 | 93 | 62 | 50 | 20 | 56 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 51 | 58 | 58 | 60 | 99 | 99 | 68 | 72 | 72 | 330 | 279 | 279 | 23 | 23 | 509 | 486 | 0 | 0 | 0 |
| 12 | 20 | 40 | 60 | 120 | 112 | 0 | 40 | 0 | 0 | 72 | 48 | 50 | 20 | 51 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 51 | 59 | 59 | 60 | 73 | 73 | 68 | 74 | 74 | 360 | 325 | 325 | 23 | 23 | 539 | 508 | 0 | 0 | 0 |
| 13 | 20 | 40 | 60 | 120 | 121 | 1 | 43 | 0 | 0 | 78 | 52 | 50 | 20 | 51 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 51 | 58 | 58 | 60 | 107 | 107 | 68 | 73 | 73 | 420 | 365 | 365 | 23 | 23 | 599 | 581 | 0 | 0 | 0 |
| 14 | 20 | 40 | 60 | 120 | 116 | 0 | 39 | 0 | 0 | 77 | 51 | 50 | 20 | 61 | 17 | 0 | 0 | 3 | 1 | 2 | 0 | 51 | 58 | 58 | 60 | 100 | 100 | 68 | 71 | 71 | 420 | 370 | 370 | 23 | 23 | 599 | 576 | 0 | 29 | 0 |
| 15 | 30 | 60 | 30 | 120 | 108 | 0 | 31 | 1 | 1 | 77 | 52 | 40 | 40 | 57 | 29 | 0 | 0 | 7 | 3 | 4 | 0 | 51 | 58 | 58 | 60 | 102 | 102 | 68 | 71 | 71 | 420 | 356 | 356 | 24 | 24 | 599 | 563 | 0 | 109 | 0 |
| 16 | 30 | 60 | 30 | 120 | 118 | 0 | 32 | 2 | 2 | 86 | 59 | 40 | 40 | 70 | 35 | 0 | 0 | 5 | 4 | 1 | 0 | 51 | 54 | 54 | 160 | 151 | 151 | 68 | 70 | 70 | 300 | 337 | 337 | 25 | 25 | 579 | 587 | 8 | 85 | 8 |
| 17 | 30 | 60 | 30 | 120 | 117 | 0 | 27 | 0 | 0 | 90 | 60 | 40 | 40 | 66 | 33 | 0 | 0 | 10 | 3 | 7 | 0 | 51 | 47 | 47 | 160 | 141 | 141 | 68 | 68 | 68 | 300 | 323 | 323 | 23 | 23 | 579 | 556 | 0 | 69 | 0 |
| 18 | 20 | 30 | 70 | 120 | 124 | 4 | 28 | 0 | 0 | 96 | 58 | 30 | 50 | 63 | 39 | 15 | 0 | 18 | 18 | 0 | 0 | 51 | 48 | 48 | 60 | 102 | 102 | 68 | 69 | 69 | 240 | 256 | 256 | 23 | 23 | 419 | 453 | 34 | 64 | 34 |
| 19 | 20 | 30 | 70 | 120 | 124 | 4 | 58 | 0 | 0 | 66 | 40 | 20 | 20 | 66 | 33 | 0 | 0 | 12 | 12 | 0 | 0 | 51 | 56 | 56 | 70 | 100 | 100 | 68 | 69 | 69 | 315 | 372 | 372 | 23 | 23 | 504 | 574 | 70 | 15 | 15 |
| 20 | 20 | 30 | 70 | 120 | 121 | 1 | 66 | 0 | 0 | 55 | 33 | 20 | 20 | 70 | 35 | 0 | 0 | 13 | 10 | 3 | 0 | 51 | 59 | 59 | 70 | 101 | 101 | 68 | 70 | 70 | 315 | 341 | 341 | 23 | 23 | 504 | 547 | 43 | 0 | 0 |
| 21 | 20 | 30 | 70 | 120 | 117 | 0 | 75 | 5 | 5 | 42 | 28 | 20 | 20 | 50 | 25 | 0 | 0 | 11 | 13 | 0 | 0 | 51 | 62 | 62 | 70 | 101 | 101 | 68 | 71 | 71 | 315 | 289 | 289 | 24 | 24 | 504 | 499 | 0 | 49 | 0 |
| 22 | 20 | 20 | 80 | 120 | 115 | 0 | 75 | 0 | 0 | 40 | 20 | 20 | 20 | 48 | 24 | 0 | 15 | 17 | 10 | 7 | 17 | 51 | 64 | 64 | 70 | 103 | 103 | 68 | 82 | 82 | 315 | 243 | 243 | 24 | 24 | 504 | 468 | 0 | 0 | 0 |
| 23 | 20 | 20 | 80 | 120 | 121 | 1 | 62 | 0 | 0 | 59 | 30 | 50 | 10 | 68 | 11 | 0 | 0 | 8 | 4 | 4 | 0 | 51 | 64 | 64 | 50 | 97 | 97 | 68 | 90 | 90 | 270 | 200 | 200 | 23 | 23 | 439 | 428 | 0 | 0 | 0 |
| 24 | 20 | 20 | 80 | 120 | 120 | 0 | 63 | 0 | 0 | 57 | 29 | 50 | 10 | 76 | 13 | 0 | 0 | 9 | 5 | 4 | 0 | 51 | 63 | 63 | 50 | 78 | 78 | 68 | 90 | 90 | 270 | 231 | 231 | 23 | 23 | 439 | 439 | 0 | 30 | 0 |
| 25 | 20 | 20 | 80 | 120 | 120 | 0 | 65 | 0 | 0 | 55 | 28 | 50 | 10 | 67 | 11 | 0 | 0 | 10 | 5 | 5 | 0 | 51 | 61 | 61 | 50 | 77 | 77 | 68 | 90 | 90 | 270 | 246 | 246 | 23 | 23 | 439 | 451 | 12 | 33 | 12 |
| 26 | 20 | 20 | 80 | 120 | 125 | 5 | 50 | 0 | 0 | 75 | 38 | 50 | 10 | 68 | 11 | 0 | 0 | 9 | 2 | 7 | 0 | 54 | 63 | 63 | 60 | 84 | 84 | 73 | 89 | 89 | 450 | 388 | 388 | 25 | 25 | 637 | 600 | 0 | 0 | 0 |
| 27 | 20 | 20 | 80 | 120 | 116 | 0 | 66 | 0 | 0 | 50 | 25 | 50 | 10 | 64 | 11 | 0 | 0 | 1 | 0 | 1 | 0 | 54 | 63 | 63 | 60 | 115 | 115 | 73 | 78 | 78 | 450 | 403 | 403 | 25 | 25 | 637 | 634 | 0 | 0 | 0 |
| 28 | 20 | 20 | 80 | 120 | 113 | 0 | 59 | 0 | 0 | 54 | 27 | 50 | 10 | 60 | 10 | 0 | 0 | 4 | 1 | 3 | 0 | 54 | 62 | 62 | 60 | 129 | 129 | 73 | 87 | 87 | 450 | 390 | 390 | 26 | 26 | 637 | 643 | 6 | 0 | 0 |
| 29 | 20 | 20 | 80 | 120 | 108 | 0 | 49 | 0 | 0 | 59 | 30 | 50 | 10 | 58 | 10 | 15 | 15 | 33 | 1 | 32 | 17 | 54 | 63 | 63 | 60 | 129 | 129 | 73 | 86 | 86 | 450 | 322 | 322 | 24 | 24 | 637 | 576 | 0 | 0 | 0 |
| 30 | 30 | 50 | 40 | 120 | 126 | 6 | 43 | 3 | 0 | 83 | 52 | 50 | 20 | 58 | 17 | 15 | 15 | 33 | 7 | 26 | 17 | 56 | 63 | 63 | 160 | 155 | 155 | 85 | 87 | 87 | 305 | 264 | 264 | 25 | 25 | 606 | 544 | 0 | 0 | 0 |
| 31 | 30 | 50 | 40 | 120 | 115 | 0 | 35 | 0 | 0 | 80 | 50 | 50 | 20 | 58 | 17 | 15 | 15 | 15 | 15 | 0 | 8 | 56 | 62 | 62 | 160 | 135 | 135 | 85 | 88 | 88 | 250 | 222 | 222 | 21 | 21 | 551 | 487 | 0 | 0 | 0 |
| SFD | 600 | 970 | 1,800 | 3,370 | 3,356 | 76 | 1,354 | 40 | 31 | 2,002 | 1,281 | 1,290 | 510 | 1,735 | 490 | 105 | 105 | 330 | 153 | 179 | 93 | 1,551 | 1,811 | 1,811 | 2,450 | 3,234 | 3,234 | 2,120 | 2,335 | 2,335 | 10,635 | 9,632 | 9,632 | 736 | 736 | 16,756 | 16,275 | 232 | 505 | 82 |
| AF | 1,190 | 1,924 | 3,570 | 6,684 | 6,657 | 151 | 2,686 | 79 | 61 | 3,971 | 2,542 | 2,559 | 1,012 | 3,441 | 971 | 208 | 208 | 655 | 303 | 355 | 184 | 3,076 | 3,592 | 3,592 | 4,860 | 6,415 | 6,415 | 4,205 | 4,631 | 4,631 | 21,095 | 19,105 | 19,105 | 1,460 | 1,460 | 33,236 | 32,282 | 460 | 1,002 | 163 |

## APPENDIX B – EXAMPLE OF EPCWID MONTHLY CHARGES (cont.)

Table B-3: EPCWID El Paso Valley Daily Spills

**EL PASO COUNTY WATER IMPROVEMENT DISTRICT Diversion Allocation May 08**

| | Riverside WW1 | | Riverside WW2 | | Fabens Waste Drain | | Fabens Waste Channel | | Tornillo WW2 | | Total Spills | Adjustment for Bustamonte and Haskill WWTP | EP Valley Spills |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | Avg CFS | Spill | Avg CFS | Spill | Avg CFS | Drain Flow | Avg CFS | Spill | Avg CFS | Spill | Avg CFS | Avg CFS | Avg CFS |
| 1 | 0 | 0 | | 0 | 64 | 40 | 56 | 0 | 45 | 45 | 45 | 65 | 0 |
| 2 | 0 | 0 | | 0 | 45 | 40 | 48 | 8 | 44 | 44 | 52 | 65 | 0 |
| 3 | 0 | 0 | | 0 | 44 | 44 | 42 | 0 | 16 | 16 | 16 | 65 | 0 |
| 4 | 0 | 0 | | 0 | 56 | 40 | 90 | 50 | 37 | 37 | 87 | 65 | 22 |
| 5 | 0 | 0 | | 0 | 43 | 40 | 74 | 34 | 29 | 29 | 63 | 65 | 0 |
| 6 | 0 | 0 | | 0 | 44 | 45 | 48 | 3 | 3 | 3 | 6 | 65 | 0 |
| 7 | 0 | 0 | | 0 | 37 | 45 | 48 | 3 | 5 | 5 | 8 | 65 | 0 |
| 8 | 0 | 0 | | 0 | 41 | 45 | 51 | 6 | 2 | 2 | 8 | 65 | 0 |
| 9 | 0 | 0 | | 0 | 49 | 45 | 52 | 7 | 0 | 0 | 7 | 65 | 0 |
| 10 | 0 | 0 | | 0 | 62 | 45 | 59 | 14 | 14 | 14 | 28 | 65 | 0 |
| 11 | 0 | 0 | | 0 | 64 | 45 | 63 | 18 | 27 | 27 | 45 | 65 | 0 |
| 12 | 0 | 0 | | 0 | 56 | 45 | 57 | 12 | 4 | 4 | 16 | 65 | 0 |
| 13 | 0 | 0 | | 0 | 47 | 45 | 52 | 7 | 3 | 3 | 10 | 65 | 0 |
| 14 | 0 | 0 | | 0 | 46 | 45 | 57 | 12 | 4 | 4 | 16 | 65 | 0 |
| 15 | 0 | 0 | | 0 | 46 | 45 | 117 | 72 | 22 | 22 | 94 | 65 | 29 |
| 16 | 0 | 0 | | 0 | 46 | 45 | 178 | 133 | 41 | 41 | 174 | 65 | 109 |
| 17 | 0 | 0 | | 0 | 46 | 45 | 153 | 108 | 42 | 42 | 150 | 65 | 85 |
| 18 | 0 | 0 | | 0 | 46 | 45 | 117 | 72 | 62 | 62 | 134 | 65 | 69 |
| 19 | 0 | 0 | | 0 | 46 | 45 | 118 | 73 | 56 | 56 | 129 | 65 | 64 |
| 20 | 0 | 0 | | 0 | 82 | 45 | 104 | 59 | 21 | 21 | 80 | 65 | 15 |
| 21 | 0 | 0 | | 0 | 64 | 45 | 78 | 33 | 30 | 30 | 63 | 65 | 0 |
| 22 | 0 | 0 | | 0 | 77 | 45 | 109 | 64 | 50 | 50 | 114 | 65 | 49 |
| 23 | 0 | 0 | | 0 | 46 | 45 | 46 | 1 | 28 | 28 | 29 | 65 | 0 |
| 24 | 0 | 0 | | 0 | 60 | 45 | 57 | 12 | 26 | 26 | 38 | 65 | 0 |
| 25 | 0 | 0 | | 0 | 72 | 45 | 98 | 53 | 42 | 42 | 95 | 65 | 30 |
| 26 | 0 | 0 | | 0 | 76 | 45 | 106 | 61 | 37 | 37 | 98 | 65 | 33 |
| 27 | 0 | 0 | | 0 | 53 | 45 | 58 | 13 | 15 | 15 | 28 | 65 | 0 |
| 28 | 0 | 0 | | 0 | 51 | 45 | 69 | 24 | 10 | 10 | 34 | 65 | 0 |
| 29 | 0 | 0 | | 0 | 54 | 45 | 65 | 20 | 5 | 5 | 25 | 65 | 0 |
| 30 | 0 | 0 | | 0 | 55 | 45 | 52 | 7 | 2 | 2 | 9 | 65 | 0 |
| 31 | 0 | 0 | | 0 | 54 | 45 | 53 | 8 | 5 | 5 | 13 | 65 | 0 |
| 1 | 0 | 0 | | 0 | 54 | 45 | 53 | 8 | 5 | 5 | 13 | 65 | 0 |
| CFS | 0 | 0 | 0 | 0 | 1,672 | 1,374 | 2,375 | 987 | 727 | 727 | 1,714 | 2,015 | 505 |
| AF | 0 | 0 | 0 | 0 | 3,316 | 2,725 | 4,711 | 1,958 | 1,442 | 1,442 | 3,400 | 3,997 | 1,002 |

## APPENDIX C – EXAMPLE OF EBID'S MONTHLY CHARGES

The following descriptions are provided for convenience only. The actual equations, procedures, and representations contained in the electronic spreadsheet named EBID_Charges_2008.xls and attached to this document as Exhibit 1 shall be used for determining EBID charges.

**Description of Calculations used to determine EBID's Allocation Charges**

Overview: EBID monthly allocation charge are calculated using information from Table C-1 – Monthly Summary, Table C-2 – Westside Canal Charge Summary, Table C-3 – Eastside Canal Charge summary, Table C-4 La Union West Charge Summary, Table C-5 – La Union East Charge Summary, Table C-6 - Bypass Summary, Table C-7 – Actual Charge Summary and Table C-8-Daily Flows. Each of the seven tables is specific for each month of the year and a single spreadsheet file (MS-EXCEL) shall be distributed by EBID to the other parties each month that contains the tables. Table C-1 is linked to Tables C-2, C-3, C-4, C-5, C-6, C-7, C-8 and previous monthly tables to provide the summary of the allocation charges and a running balance of the amount of Project Water available for diversion by EBID. Table C-8 contains the daily flow (average cfs) values for each of the flow metering sites that is used in the calculations of charges and the respective amount of water ordered by EBID and EBID and EPCWID at La Union East, La Union West, and Three Saints irrigation canals. Table C-6 contains the daily volumes of water flowing out of EBID designated Spillways and water ordered for Bypass. Table C-6 is used to determine the amount of water that is eligible for an allocation credit to EBID. The purpose of the allocation credit is to provide an accounting procedure that promotes conservation by allowing EBID to attempt to use bypass water within EBID's order to manage its total release efficiently.

**Table C-1: EBID Diversion Allocation Charges Summary**

The Total Order for EBID is the sum of the orders for diversion from the Rio Grande at Arrey Canal, Percha Lateral, Leasburg Canal, Eastside Canal, Westside Canal, Del Rio Lateral, California Extension, and the Greenwood, Duran, Roundtree, Dulin, Dorser, and Thurston pumps located in the Rincon Valley. The orders for each heading are lagged in time from release based on the estimated travel times. The order listed for a given diversion point is for diversion on the day that it is listed. Changes in diversion orders after the corresponding release is made shall be documented with a change order, and diverted after the appropriate travel time from the release.

The daily diversion for EBID is the sum of the actual diversions from the above listed diversion points. The minimum daily charge to EBID is 95 percent of the Total Order for the given day. The actual daily charge to EBID is the larger of the daily diversion and the minimum daily charge. The monthly charge to EBID is the sum for the month of the actual daily charges to EBID.

**Row 1:** Total actual diversion acre feet for the current month and the year to date at the Arrey Canal Diversion.

**Row 2:** Total actual diversion acre feet for the current month and the year to date at the Percha Lateral.

**Row 3:** Total actual diversion acre feet for the current month and the year to date at the Leasburg Canal Diversion.

**Row 4:** Total actual diversion acre feet for the current month and the year to date at the California Extension Lateral.

**Row 5:** Total actual diversion acre feet for the current month and the year to date at the Eastside Canal Diversion. Row 5 also contains the State line diversion totals for the EPCWID at the Three Saints East Lateral. EBID charge is the Gross Total column subtracting out the Diverted to Texas column. The amount diverted to EPCWID at the Three Saints East Lateral is determined in Table C- 3. Detailed equation that determines the amount Diverted to Texas is described in the Table C-3 Summary detail.

**Row 6:** Total actual diversion acre feet for the current month and the year to date at the Del Rio Lateral.

**Row 7:** Total actual diversion acre feet for the current month and the year to date at the Westside Canal Diversion. Row 7 also contains the State line diversions totals to EPCWID at the La Union East and La Union West Canals. EBID charge is the Gross Total column subtracting

out the Diverted to Texas column. The amount diverted to EPCWID in the La Union East Canal is determined in Table C-5 and the amount diverted to EPCWID in the La Union West Canal is determined in Table C- 4. Detailed equation that determines the amount Diverted to Texas is described in the Table C-2 Summary detail.

**Row 8:** Total actual diversion acre feet for the current month and the year to date for the River Pumps.

**Row 9:** Totals for Gross and Net diversions for Rows 1 through 8.

**Row 10:** Totals for Net diversion current month and year to date.

**Row 11:** Bypass water through designated spillways from the Arrey Canal Diversion. Totals come from Table C-6 Bypass Summary.

**Row 12:** Bypass water through designated spillways from the Leasburg Canal Diversion. Totals come from Table C-6 Bypass Summary.

**Row 13:** Adjustment for Diversion vs Delivery. This value is the difference of the Actual Monthly charge and the Actual Monthly Diversion.

**Row 14:** Total monthly and year to date allotment charge. This value is the sum of Rows 10, 11, 12 and 13.

**Row 15:** Reclamation, in accordance with this manual and the Operating Agreement, provides EBID with its total diversion allocation.

**Row 16:** EBID end of month allotment balance. Row 15 minus Row 14

**Table C-2: Average Daily CFS and Allocation Charges Westside Canal Texas and New Mexico Portions**

EBID's Allocation charge for the Westside canal is determined in this table. In order to determine the New Mexico Portion of the diversion, Texas calculations occur in Tables C-4 and C-5. The Westside canal delivers water to Texas lands through both the La Union West and the La Union East. The Texas portions are calculated in both Table C-4 for the La Union West and Table C-5 for the La Union West. Totals for each day from both Canals are added together and then a 15% carriage charge is applied. This amount is subtracted from the Westside diversion for that same day. This table also calculates the Texas Spillway 32 bypass amount. Spillway 32 initial calculation occurs in Table C-5. The initial calculation evaluates the amount of water ordered for bypass, the amount actually bypassed and the amount delivered to the La Union East. This evaluation results in the amount of water to be charged to Texas. A 15% carriage charge is also applied, then subtracted from the Westside Canal.

**Table C-3: Average Daily CFS and Allocation Charges for Eastside Canal and the Three Saints East Lateral Texas Portion**

EBID allocation charge for the Eastside Canal is determined in this table. In order to determine New Mexico portion of the diversion Texas portions are calculated in this table as well. EBID delivers water to Texas lands through the Three Saints East Canal. EPCWID's allocation charges (Texas Portion) for the Three Saints Lateral (TSL) are equal to net amount of water measured by EPCWID at the TSL metering station multiplied (prorated) by the ratio of EPCWID TSL order to the total order for TSL. The net amount of water measured at TSL is equal to the gross amount of water metered at TSL minus the gross amount of water metered at WW23A. If there is no order for water at TSL and the gross amount of flow at TSL is less than or equal to 5 cfs, then the gross amount of flow is assumed to be equal to zero. Once the Texas Portion is determined a 20% carriage charge is applied, then subtracted from the Eastside Canal Diversion leaving only the New Mexico Portion.

**Table C-4: Average Daily CFS and Allocation Charges La Union West Diversion Site**

La Union West Canal (Texas Portion): This table is used to determine the Texas Portion of the La Union West Order and Diversion. EPCWID allocation charges for La Union West Canal are equal to the gross amount of water measured by EBID at the LUW metering station multiplied (prorated) by the ratio of EBID LUW order to the total order for LUW. This prorated amount is then added to the La Union East total for the same day and displayed in Table C-2 Westside canal. These totals will be used to determine the total Diverted to Texas where it will then be subtracted from the Westside Canal Diversion leaving only the New Mexico Portion.

**Table C-5: Average Daily CFS and Allocation Charges La Union East Diversion Site**

La Union East Canal (Texas Portion): This table is used to determine the Texas Portion of the La Union East Canal. The determination of EPCWID allocation charges for La Union East Canal (LUE) is complex and requires 11 columns of measured or calculated values. The complex calculations are a result of the fact that the LUE canal services land in both Texas and New Mexico. Also, water flows in the LUE canal for bypass to the Rio Grande through WW32 and downstream diversion into the American Canal, and WW32 is used to discharge excess flow from EPCWID. In general the allocations charges for LUE are based on the net amount of water measured by EPCWID at the LUE metering station multiplied (prorated) by the ratio of the EPCWID order to the total order for LUE. The net amount of water measured at LUE is equal to the gross amount of water metered at LUE minus the gross amount of water metered at WW32. This prorated is then added to the La Union West total for the same day and displayed in Table C-2 Westside canal. These totals are used to determine the total Diverted to Texas where it will then be subtracted from the Westside Canal Diversion leaving only the New Mexico Portion.

**Table C-6: Average Daily CFS and Bypass Credit Summary**

This table contains the Amount of Bypass Ordered and Diverted for designated spillways in the Arrey and Leasburg Canals. Bypass is only a credit when an order for Bypass is made. Credit is limited to the amount of the bypass ordered. A travel time for the order is applied, then the actual diversion is used to determine whether a credit for bypass is applied. The Monthly total is used in Table C-1 if a credit is due.

**Table C-7: Actual charge**

This table contains each of the EBID diversion sites. Each site has the amount ordered and the actual amount diverted. The Total Order for EBID is the sum of the orders for diversion at Arrey Canal, Percha Lateral, Leasburg Canal, Eastside Canal, Westside Canal, Del Rio Lateral, California Extension, and the Greenwood, Duran, Roundtree, Dulin, Dorser, and Thurston pumps that divert water from the Rio Grande in the Rincon Valley. The orders for each heading are lagged in time from release based on the estimated travel times. The order listed for a given diversion point is for diversion on the day that it is listed. The daily diversion for EBID is the sum of the actual diversions from the above listed diversion points. The minimum daily charge to EBID is 95 percent of the Total Order for the given day. The actual daily charge to EBID is the larger of the daily diversion and the minimum daily charge. The monthly charge to EBID is the sum for the month of the actual daily charges to EBID. The Actual Charge is subtracted from the Total Diversion to determine the adjustment amount Row 13 of Table C-1.

**Table C-8: Average Daily CFS Daily Flows**

This contains the daily flow (average cfs) values for each of the flow metering sites that is used in the calculations of charges and the respective amount of water ordered by EBID and EBID and EPCWID at La Union East, La Union West, and Three Saints irrigation canals.

Table C-1 EBID Allocation Charges Summary

# ELEPHANT BUTTE IRRIGATION DISTRICT

WATER ALLOTMENT CHARGES

**May-08**

SUBJECT TO REVISION

| Row | | GROSS DIVERSIONS | (AC-FT) TO DATE | DIVERTED TO TEXAS | (AC-FT) TO DATE | NET DIVERSIONS | (AC-FT) TO DATE |
|---|---|---|---|---|---|---|---|
| 1 | **ARREY CANAL** | 12700 | 34941 | | | 12700 | 34941 |
| 2 | PERCHA LATERAL | 115 | 186 | | | 115 | 186 |
| 3 | **LEASBURG CANAL** | 14884 | 33594 | | | 14884 | 33594 |
| 4 | CALIFORNIA EXTENTION | **0** | 0 | | | 0 | 0 |
| 5 | **EASTSIDE CANAL** | 8519 | 20473 | -363 | -877 | 8156 | 19597 |
| 6 | **DEL RIO LATERAL** | 496 | 1319 | | | 496 | 1319 |
| 7 | **WESTSIDE CANAL** | 22534 | 60563 | -6811 | -19830 | 15723 | 40733 |
| 8 | PUMPED FROM RIVER** | **0** | 0 | | | 0 | 0 |
| 9 | GROSS TOTAL | 59248 | 151077 | -7174 | -20707 | 52074 | 130370 |

| | | NET DIVERSION | TO DATE |
|---|---|---|---|
| 10 | TOTAL CHARGES (AC-FT) | **52078** | **130370** |
| 11 | CREDIT AT ARREY (-) | **0** | **-763** |
| 12 | CREDIT AT LEASBURG (-) | **-28** | **-115** |
| 13 | ADJUSTMENT FOR CHARGE AT HEADING (+) | **10** | **10** |
| 14 | NET ALLOTMENT CHARGE | **52,060** | **129,502** |
| 15 | DISTRICT ALLOTMENT | | **280,764** |
| 16 | DISTRICT BALANCE | | **151,262** |

** GREENWOOD, DURAN, ROUNTREE, DULIN, DORSAR AND THURSTON RIVER PUMPS (EBID DATA)

Table C-2 Westside Canal Diversion Charge Summary

**WESTSIDE DIVERSION CHARGE SUMMARY** EBID

**May-08**

| DAY | WESTSIDE CANAL (1) | TX CHARGE LUE+LUW (2) | W.W. 32 SFD*1.15 (3) | 115% OF 2 (4) | EBID WATER [1-(3+4)] |
|---|---|---|---|---|---|
| 1 | 297 | 43 | 64 | 49 | 183 |
| 2 | 263 | 35 | 35 | 40 | 188 |
| 3 | 307 | 6 | 79 | 7 | 221 |
| 4 | 292 | 0 | 76 | 0 | 216 |
| 5 | 292 | 0 | 67 | 0 | 225 |
| 6 | 310 | 0 | 17 | 0 | 293 |
| 7 | 340 | 63 | 18 | 72 | 249 |
| 8 | 327 | 85 | 2 | 98 | 227 |
| 9 | 327 | 75 | 0 | 86 | 241 |
| 10 | 327 | 77 | 0 | 89 | 238 |
| 11 | 320 | 73 | 8 | 84 | 228 |
| 12 | 314 | 58 | 46 | 67 | 201 |
| 13 | 376 | 62 | 49 | 71 | 255 |
| 14 | 406 | 68 | 45 | 78 | 283 |
| 15 | 438 | 68 | 35 | 78 | 325 |
| 16 | 502 | 94 | 35 | 108 | 359 |
| 17 | 465 | 93 | 31 | 107 | 327 |
| 18 | 444 | 97 | 32 | 112 | 300 |
| 19 | 453 | 81 | 67 | 93 | 293 |
| 20 | 418 | 77 | 76 | 89 | 254 |
| 21 | 398 | 53 | 81 | 61 | 257 |
| 22 | 406 | 44 | 86 | 51 | 269 |
| 23 | 406 | 41 | 71 | 47 | 288 |
| 24 | 401 | 42 | 72 | 48 | 280 |
| 25 | 317 | 39 | 75 | 45 | 197 |
| 26 | 317 | 49 | 58 | 56 | 203 |
| 27 | 312 | 36 | 76 | 41 | 195 |
| 28 | 307 | 37 | 68 | 43 | 197 |
| 29 | 370 | 40 | 56 | 46 | 268 |
| 30 | 444 | 69 | 46 | 79 | 319 |
| 31 | 465 | 67 | 40 | 77 | 348 |
| SFD | 11361 | 1672 | 1511 | 1923 | 7927 |
| AC-FT | 22534 | 3316 | 2997 | 3814 | 15723 |

Table C-3 Eastside Canal Diversion Charge Summary

**EASTSIDE DIVERSION CHARGE SUMMARY** EBID

**May-08**

| DAY | EASTSIDE CANAL SFD | 3 SAINTS E SFD | W.W. 23 SFD | ADJUSTED SFD | 3 SAINTS E TX-ORDER | 3 SAINTS E. NM-ORDER | % TX | TX CHARGE *1.20% | EBID WATER |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 122 | 17 | 6 | 15 | **0** | **15** | 0% | 0 | 122 |
| 2 | 146 | 6 | 6 | 0 | **0** | **0** | 0% | 0 | 146 |
| 3 | 124 | 3 | 3 | 0 | **0** | **0** | 0% | 0 | 124 |
| 4 | 80 | 4 | 4 | 0 | **0** | **0** | 0% | 0 | 80 |
| 5 | 80 | 2 | 2 | 0 | **0** | **0** | 0% | 0 | 80 |
| 6 | 107 | 11 | 2 | 9 | **0** | **0** | 0% | 11 | 96 |
| 7 | 163 | 22 | 0 | 22 | **15** | **10** | 60% | 16 | 147 |
| 8 | 172 | 27 | 2 | 25 | **15** | **10** | 60% | 18 | 154 |
| 9 | 195 | 10 | 6 | 10 | **15** | **10** | 60% | 7 | 188 |
| 10 | 171 | 10 | 8 | 2 | **0** | **0** | 0% | 2 | 169 |
| 11 | 160 | 0 | 0 | 0 | **0** | **0** | 0% | 0 | 160 |
| 12 | 159 | 0 | 0 | 0 | **0** | **0** | 0% | 0 | 159 |
| 13 | 125 | 0 | 0 | 0 | **0** | **0** | 0% | 0 | 125 |
| 14 | 96 | 3 | 1 | 2 | **0** | **0** | 0% | 2 | 94 |
| 15 | 132 | 7 | 3 | 4 | **0** | **0** | 0% | 5 | 127 |
| 16 | 160 | 5 | 4 | 1 | **0** | **0** | 0% | 1 | 159 |
| 17 | 154 | 10 | 3 | 7 | **0** | **0** | 0% | 8 | 146 |
| 18 | 136 | 18 | 18 | 15 | **0** | **15** | 0% | 18 | 118 |
| 19 | 132 | 12 | 12 | 0 | **0** | **0** | 0% | 0 | 132 |
| 20 | 130 | 13 | 10 | 3 | **0** | **0** | 0% | 4 | 126 |
| 21 | 143 | 11 | 13 | 0 | **0** | **0** | 0% | 0 | 143 |
| 22 | 150 | 17 | 10 | 15 | **15** | **0** | 100% | 18 | 132 |
| 23 | 148 | 8 | 4 | 4 | **0** | **0** | 0% | 5 | 143 |
| 24 | 136 | 9 | 5 | 4 | **0** | **0** | 0% | 5 | 131 |
| 25 | 109 | 10 | 5 | 5 | **0** | **0** | 0% | 6 | 103 |
| 26 | 108 | 9 | 2 | 7 | **0** | **0** | 0% | 8 | 100 |
| 27 | 110 | 1 | 0 | 1 | **0** | **0** | 0% | 1 | 109 |
| 28 | 136 | 4 | 1 | 4 | **15** | **15** | 50% | 2 | 134 |
| 29 | 163 | 33 | 1 | 32 | **15** | **15** | 50% | 19 | 144 |
| 30 | 193 | 33 | 7 | 30 | **15** | **15** | 50% | 18 | 175 |
| 31 | 155 | 15 | 15 | 15 | **15** | **15** | 50% | 9 | 146 |
| SFD | 4295 | 330 | 153 | 232 | 120 | 120 | 50% | 183 | 4112 |
| AC-FT | 8519 | 655 | 303 | 460 | 238 | 238 | | 363 | 8156 |

**ADJUSTED SFD=TOTAL ORDER OR 3SE SFD, WHICHEVER IS LESS

Table C-4 La Union West Canal Diversion Charge Summary

**LA UNION WEST ORDER, DIVERSION, AND CHARGE SUMMARY** EBID

**May-08**

| DAY | N.M. ORDER | TEXAS ORDER | TOTAL ORDER | % N.M. | % TEX | LA UNION W. SFD | N.M. CHARGE | TEXAS CHARGE |
|---|---|---|---|---|---|---|---|---|
| 1 | **30** | **10** | 40 | 75% | 25% | 46 | 35 | 12 |
| 2 | **30** | **10** | 40 | 75% | 25% | 40 | 30 | 10 |
| 3 | **40** | **10** | 50 | 80% | 20% | 31 | 25 | 6 |
| 4 | **60** | **0** | 60 | 100% | 0% | 41 | 41 | 0 |
| 5 | **60** | **0** | 60 | 100% | 0% | 40 | 40 | 0 |
| 6 | **60** | **0** | 60 | 100% | 0% | 41 | 41 | 0 |
| 7 | **50** | **10** | 60 | 83% | 17% | 39 | 33 | 7 |
| 8 | **50** | **10** | 60 | 83% | 17% | 57 | 48 | 10 |
| 9 | **50** | **10** | 60 | 83% | 17% | 55 | 46 | 9 |
| 10 | **50** | **10** | 60 | 83% | 17% | 59 | 49 | 10 |
| 11 | **40** | **10** | 50 | 80% | 20% | 56 | 45 | 11 |
| 12 | **40** | **10** | 50 | 80% | 20% | 51 | 41 | 10 |
| 13 | **40** | **10** | 50 | 80% | 20% | 51 | 41 | 10 |
| 14 | **50** | **20** | 70 | 71% | 29% | 61 | 44 | 17 |
| 15 | **50** | **20** | 70 | 71% | 29% | 57 | 41 | 16 |
| 16 | **40** | **40** | 80 | 50% | 50% | 70 | 35 | 35 |
| 17 | **40** | **40** | 80 | 50% | 50% | 66 | 33 | 33 |
| 18 | **30** | **50** | 80 | 38% | 63% | 63 | 24 | 39 |
| 19 | **30** | **50** | 80 | 38% | 63% | 66 | 25 | 41 |
| 20 | **30** | **50** | 80 | 38% | 63% | 70 | 26 | 44 |
| 21 | **20** | **20** | 40 | 50% | 50% | 50 | 25 | 25 |
| 22 | **20** | **20** | 40 | 50% | 50% | 48 | 24 | 24 |
| 23 | **50** | **10** | 60 | 83% | 17% | 68 | 57 | 11 |
| 24 | **50** | **10** | 60 | 83% | 17% | 76 | 63 | 13 |
| 25 | **50** | **10** | 60 | 83% | 17% | 67 | 56 | 11 |
| 26 | **50** | **10** | 60 | 83% | 17% | 68 | 57 | 11 |
| 27 | **50** | **10** | 60 | 83% | 17% | 64 | 53 | 11 |
| 28 | **50** | **10** | 60 | 83% | 17% | 60 | 50 | 10 |
| 29 | **50** | **10** | 60 | 83% | 17% | 58 | 48 | 10 |
| 30 | **50** | **20** | 70 | 71% | 29% | 58 | 41 | 17 |
| 31 | **50** | **20** | 70 | 71% | 29% | 58 | 41 | 17 |
| OTAL SFD | 1360 | 520 | 1880 | 72% | 28% | 1735 | 1258 | 480 |
| TOTAL AF | 2698 | 1031 | 3729 | | | 3441 | 2495 | 952 |

Table C-5 La Union East Canal Diversion Charge Summary

**LA UNION EAST ORDER, DIVERSION, BYPASS, AND CHARGE SUMMARY** EBID

**May-08**

| | N.M. ORDER | TEXAS ORDER | BYPASS ORDER | TOTAL ORDER | _A UNION E SFD | W.W. 32 SFD | NET DELIVERY | % N.M. | % TEX | N.M. CHARGE | TEXAS CHARGE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | **15** | **25** | **60** | 100 | 106 | 56 | 50 | 38% | 63% | 19 | 31 |
| 2 | **15** | **25** | **30** | 70 | 76 | 59 | 40 | 38% | 63% | 15 | 25 |
| 3 | **0** | **0** | **70** | 70 | 75 | 69 | 6 | 0% | 0% | 0 | 0 |
| 4 | **0** | **0** | **70** | 70 | 79 | 66 | 13 | 0% | 0% | 0 | 0 |
| 5 | **0** | **0** | **70** | 70 | 66 | 58 | 8 | 0% | 0% | 0 | 0 |
| 6 | **0** | **0** | **70** | 70 | 75 | 15 | 60 | 0% | 0% | 0 | 0 |
| 7 | **20** | **40** | **40** | 100 | 100 | 16 | 84 | 33% | 67% | 28 | 56 |
| 8 | **20** | **40** | **40** | 100 | 114 | 2 | 112 | 33% | 67% | 37 | 75 |
| 9 | **30** | **60** | **10** | 100 | 99 | 0 | 99 | 33% | 67% | 33 | 66 |
| 10 | **30** | **60** | **10** | 100 | 100 | 0 | 100 | 33% | 67% | 33 | 67 |
| 11 | **20** | **40** | **60** | 120 | 100 | 7 | 93 | 33% | 67% | 31 | 62 |
| 12 | **20** | **40** | **60** | 120 | 112 | 40 | 72 | 33% | 67% | 24 | 48 |
| 13 | **20** | **40** | **60** | 120 | 121 | 43 | 78 | 33% | 67% | 26 | 52 |
| 14 | **20** | **40** | **60** | 120 | 116 | 39 | 77 | 33% | 67% | 26 | 51 |
| 15 | **30** | **60** | **30** | 120 | 108 | 31 | 78 | 33% | 67% | 26 | 52 |
| 16 | **30** | **60** | **30** | 120 | 118 | 32 | 88 | 33% | 67% | 29 | 59 |
| 17 | **30** | **60** | **30** | 120 | 117 | 27 | 90 | 33% | 67% | 30 | 60 |
| 18 | **20** | **30** | **70** | 120 | 124 | 28 | 96 | 40% | 60% | 38 | 58 |
| 19 | **20** | **30** | **70** | 120 | 124 | 58 | 66 | 40% | 60% | 26 | 40 |
| 20 | **20** | **30** | **70** | 120 | 121 | 66 | 55 | 40% | 60% | 22 | 33 |
| 21 | **20** | **30** | **70** | 120 | 117 | 75 | 47 | 40% | 60% | 19 | 28 |
| 22 | **20** | **20** | **80** | 120 | 115 | 75 | 40 | 50% | 50% | 20 | 20 |
| 23 | **20** | **20** | **80** | 120 | 121 | 62 | 59 | 50% | 50% | 30 | 30 |
| 24 | **20** | **20** | **80** | 120 | 120 | 63 | 57 | 50% | 50% | 29 | 29 |
| 25 | **20** | **20** | **80** | 120 | 120 | 65 | 55 | 50% | 50% | 28 | 28 |
| 26 | **20** | **20** | **80** | 120 | 125 | 50 | 75 | 50% | 50% | 38 | 38 |
| 27 | **20** | **20** | **80** | 120 | 116 | 66 | 50 | 50% | 50% | 25 | 25 |
| 28 | **20** | **20** | **80** | 120 | 113 | 59 | 54 | 50% | 50% | 27 | 27 |
| 29 | **20** | **20** | **80** | 120 | 108 | 49 | 59 | 50% | 50% | 30 | 30 |
| 30 | **30** | **50** | **40** | 120 | 126 | 43 | 83 | 38% | 63% | 31 | 52 |
| 31 | **30** | **50** | **40** | 120 | 115 | 35 | 80 | 38% | 63% | 30 | 50 |
| SFD | 600 | 970 | 1800 | 3370 | 3347 | 1354 | 2024 | 38% | 62% | 750 | 1192 |
| AC-FT | 1190 | 1924 | 3570 | 6684 | 6639 | 2686 | 4015 | | | 1488 | 2364 |

Table C-6 Bypass Credit Summary

**ELEPHANT BUTTE IRRIGATION BYPASS SUMMARY**

**BYPASS SUMMARY**

**May-08**

| Day | Ordered Arrey Bypass | Arrey W.W. 5 | Arrey W.W. 16 | Actual Arrey Bypass | Arrey Spill | Ordered Leasburg Bypass | Leasburg W.W. 8 | Actual Leasburg Bypass | Actual Leasburg Spill | Ordered Eastside Bypass | Eastside W.W. 18 | Actual Eastside Bypass | Actual Eastside Spill | Ordered Westside Bypass | Westside W.W. 31 | Actual Westside Bypass | Actual Westside Spill |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 3 | 0 | 4 | 0 | 5 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 1 | 3 | 0 | 4 | 0 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 1 | 3 | 0 | 4 | 0 | 7 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 1 | 1 | 0 | 2 | 0 | 23 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 0 | 1 | 3 | 0 | 4 | 0 | 20 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 1 | 2 | 0 | 3 | 0 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 0 | 1 | 2 | 0 | 3 | 0 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 1 | 2 | 0 | 3 | 30 | 14 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 0 | 1 | 1 | 0 | 2 | 0 | 15 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 0 | 1 | 1 | 0 | 2 | 0 | 8 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 1 | 2 | 0 | 3 | 0 | 16 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 0 | 1 | 2 | 0 | 3 | 0 | 5 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 1 | 1 | 0 | 2 | 0 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 14 | 0 | 1 | 1 | 0 | 2 | 0 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 0 | 1 | 1 | 0 | 2 | 0 | 6 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16 | 0 | 1 | 1 | 0 | 2 | 0 | 9 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | 0 | 1 | 1 | 0 | 2 | 0 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | 0 | 1 | 1 | 0 | 2 | 0 | 7 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | 0 | 0 | 1 | 0 | 1 | 0 | 12 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | 0 | 0 | 1 | 0 | 1 | 0 | 10 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | 0 | 0 | 1 | 0 | 1 | 0 | 5 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | 0 | 0 | 1 | 0 | 1 | 0 | 5 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | 0 | 1 | 0 | 0 | 1 | 0 | 6 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 25 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 27 | 0 | 5 | 0 | 0 | 5 | 0 | 9 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28 | 0 | 5 | 0 | 0 | 5 | 0 | 7 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29 | 0 | 1 | 0 | 0 | 1 | 0 | 5 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 31 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SFD | 0 | 30 | 35 | 0 | 65 | 30 | 244 | 14 | 230 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ACFT | 0 | 60 | 69 | 0 | 129 | 60 | 484 | 28 | 456 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

# Table C-7 Allocation Charges Adjustment for Amount of Water Ordered

EBID Actual Charges for May 2008

| | Orders | | | | | | | | | Diversions | | | | | | | | | Minimum | Actual | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Arrey | Percha | Leasburg | Eastside | Westside | Del Rio | California | Pumpers | Total | Arrey | Percha | Leasburg | Eastside | Westside | Del Rio | California | Pumpers | Total | Charge | Charge | |
| 1 | 200 | 0 | 252 | 100 | 285 | 0 | 0 | 0 | 837 | 202 | 1 | 254 | 122 | 297 | 24 | 0 | 0 | 900 | 795 | 900 | |
| 2 | 165 | 0 | 260 | 139 | 268 | 0 | 0 | 0 | 832 | 156 | 0 | 275 | 146 | 263 | 0 | 0 | 0 | 840 | 790 | 840 | |
| 3 | 130 | 0 | 238 | 144 | 332 | 0 | 0 | 0 | 844 | 134 | 0 | 246 | 124 | 307 | 0 | 0 | 0 | 811 | 802 | 811 | |
| 4 | 130 | 0 | 230 | 80 | 280 | 0 | 0 | 0 | 720 | 134 | 0 | 232 | 80 | 292 | 0 | 0 | 0 | 738 | 684 | 738 | |
| 5 | 145 | 0 | 230 | 80 | 280 | 0 | 0 | 0 | 735 | 153 | 0 | 226 | 80 | 292 | 0 | 0 | 0 | 751 | 698 | 751 | |
| 6 | 160 | 0 | 192 | 101 | 292 | 0 | 0 | 0 | 745 | 168 | 4 | 192 | 107 | 310 | 0 | 0 | 0 | 781 | 708 | 781 | |
| 7 | 190 | 0 | 180 | 165 | 330 | 0 | 0 | 0 | 865 | 202 | 3 | 185 | 163 | 340 | 24 | 0 | 0 | 917 | 822 | 917 | |
| 8 | 220 | 0 | 232 | 174 | 330 | 0 | 0 | 0 | 956 | 216 | 2 | 226 | 172 | 327 | 0 | 0 | 0 | 943 | 908 | 943 | |
| 9 | 220 | 0 | 250 | 194 | 330 | 0 | 0 | 0 | 994 | 206 | 8 | 239 | 195 | 327 | 0 | 0 | 0 | 975 | 944 | 975 | |
| 10 | 220 | 0 | 250 | 172 | 328 | 0 | 0 | 0 | 970 | 212 | 5 | 245 | 171 | 327 | 0 | 0 | 0 | 960 | 922 | 960 | |
| 11 | 220 | 0 | 205 | 165 | 320 | 0 | 0 | 0 | 910 | 215 | 5 | 215 | 160 | 320 | 0 | 0 | 0 | 915 | 865 | 915 | |
| 12 | 220 | 0 | 190 | 165 | 320 | 0 | 0 | 0 | 895 | 218 | 0 | 200 | 159 | 314 | 20 | 0 | 0 | 911 | 850 | 911 | |
| 13 | 220 | 0 | 212 | 150 | 344 | 0 | 0 | 0 | 926 | 219 | 0 | 221 | 125 | 376 | 0 | 0 | 0 | 941 | 880 | 941 | |
| 14 | 220 | 0 | 220 | 105 | 415 | 0 | 0 | 0 | 960 | 226 | 2 | 229 | 96 | 406 | 0 | 0 | 0 | 959 | 912 | 959 | |
| 15 | 220 | 0 | 265 | 118 | 435 | 0 | 0 | 0 | 1,038 | 223 | 0 | 264 | 132 | 438 | 23 | 0 | 0 | 1,080 | 986 | 1,080 | |
| 16 | 185 | 0 | 280 | 155 | 495 | 0 | 0 | 0 | 1,115 | 153 | 7 | 285 | 160 | 502 | 23 | 0 | 0 | 1,130 | 1,059 | 1,130 | |
| 17 | 150 | 0 | 242 | 152 | 481 | 0 | 0 | 0 | 1,025 | 157 | 0 | 254 | 154 | 465 | 0 | 0 | 0 | 1,030 | 974 | 1,030 | |
| 18 | 150 | 0 | 230 | 141 | 440 | 0 | 0 | 0 | 961 | 157 | 0 | 241 | 136 | 444 | 0 | 0 | 0 | 978 | 913 | 978 | |
| 19 | 215 | 0 | 230 | 130 | 440 | 0 | 0 | 0 | 1,015 | 252 | 4 | 243 | 132 | 453 | 0 | 0 | 0 | 1,084 | 964 | 1,084 | |
| 20 | 280 | 0 | 230 | 130 | 422 | 0 | 0 | 0 | 1,062 | 287 | 3 | 246 | 130 | 418 | 10 | 0 | 0 | 1,094 | 1,009 | 1,094 | |
| 21 | 280 | 0 | 230 | 134 | 370 | 0 | 0 | 0 | 1,014 | 272 | 3 | 244 | 143 | 398 | 26 | 0 | 0 | 1,086 | 963 | 1,086 | |
| 22 | 280 | 0 | 282 | 146 | 375 | 0 | 0 | 0 | 1,083 | 272 | 4 | 268 | 150 | 406 | 26 | 0 | 0 | 1,126 | 1,029 | 1,126 | |
| 23 | 245 | 0 | 300 | 150 | 390 | 0 | 0 | 0 | 1,085 | 273 | 0 | 287 | 148 | 406 | 13 | 0 | 0 | 1,127 | 1,031 | 1,127 | |
| 24 | 210 | 0 | 278 | 140 | 375 | 0 | 0 | 0 | 1,003 | 206 | 0 | 269 | 136 | 401 | 0 | 0 | 0 | 1,012 | 953 | 1,012 | |
| 25 | 210 | 0 | 270 | 110 | 330 | 0 | 0 | 0 | 920 | 191 | 3 | 249 | 109 | 317 | 0 | 0 | 0 | 869 | 874 | 874 | |
| 26 | 210 | 0 | 270 | 110 | 330 | 0 | 0 | 0 | 920 | 191 | 4 | 255 | 108 | 317 | 13 | 0 | 0 | 888 | 874 | 888 | |
| 27 | 210 | 0 | 270 | 110 | 330 | 0 | 0 | 0 | 920 | 189 | 0 | 260 | 110 | 312 | 8 | 0 | 0 | 879 | 874 | 879 | |
| 28 | 205 | 0 | 270 | 118 | 330 | 0 | 0 | 0 | 923 | 190 | 0 | 259 | 136 | 307 | 8 | 0 | 0 | 900 | 877 | 900 | |
| 29 | 210 | 0 | 232 | 152 | 371 | 0 | 0 | 0 | 965 | 221 | 0 | 229 | 163 | 370 | 25 | 0 | 0 | 1,008 | 917 | 1,008 | |
| 30 | 235 | 0 | 220 | 190 | 495 | 0 | 0 | 0 | 1,140 | 253 | 0 | 211 | 193 | 444 | 2 | 0 | 0 | 1,103 | 1,083 | 1,103 | |
| 31 | 250 | 0 | 250 | 172 | 490 | 0 | 0 | 0 | 1,162 | 255 | 0 | 255 | 155 | 465 | 5 | 0 | 0 | 1,135 | 1,104 | 1,135 | Adjustment |
| | | | | | | | | | | | | | | | | | SFD: | 29,871 | | 29,876 | 5 |
| | | | | | | | | | | | | | | | | | Acre-feet | 59,248 | | 59,258 | 10 |

Table C-8 EBID Allocation Charge Summary

# ELEPHANT BUTTE IRRIGATION DISTRICT

**DAILY FLOW FOR MAY-07**

| DAY | PERCHA EBID | ARREY EFAS | LEASBURG EBID | DEL RIO EBID | EASTSIDE EFAS | WESTSIDE EFAS | L.U.EAST EBID | L.U.WEST EBID |
|---|---|---|---|---|---|---|---|---|
| **1** | 1 | 202 | 254 | 24 | 122 | 297 | 106 | 46 |
| **2** | 0 | 156 | 275 | 0 | 146 | 263 | 76 | 40 |
| **3** | 0 | 134 | 246 | 0 | 124 | 307 | 75 | 31 |
| **4** | 0 | 134 | 232 | 0 | 80 | 292 | 79 | 41 |
| **5** | 0 | 153 | 226 | 0 | 80 | 292 | 66 | 40 |
| **6** | 4 | 168 | 192 | 0 | 107 | 310 | 75 | 41 |
| **7** | 3 | 202 | 185 | 24 | 163 | 340 | 100 | 39 |
| **8** | 2 | 216 | 226 | 0 | 172 | 327 | 114 | 57 |
| **9** | 8 | 206 | 239 | 0 | 195 | 327 | 99 | 55 |
| **10** | 5 | 212 | 245 | 0 | 171 | 327 | 100 | 59 |
| **11** | 5 | 215 | 215 | 0 | 160 | 320 | 100 | 56 |
| **12** | 0 | 218 | 200 | 20 | 159 | 314 | 112 | 51 |
| **13** | 0 | 219 | 221 | 0 | 125 | 376 | 121 | 51 |
| **14** | 2 | 226 | 229 | 0 | 96 | 406 | 116 | 61 |
| **15** | 0 | 223 | 264 | 23 | 132 | 438 | 108 | 57 |
| **16** | 7 | 153 | 285 | 23 | 160 | 502 | 118 | 70 |
| **17** | 0 | 157 | 254 | 0 | 154 | 465 | 117 | 66 |
| **18** | 0 | 157 | 241 | 0 | 136 | 444 | 124 | 63 |
| **19** | 4 | 252 | 243 | 0 | 132 | 453 | 124 | 66 |
| **20** | 3 | 287 | 246 | 10 | 130 | 418 | 121 | 70 |
| **21** | 3 | 272 | 244 | 26 | 143 | 398 | 117 | 50 |
| **22** | 4 | 272 | 268 | 26 | 150 | 406 | 115 | 48 |
| **23** | 0 | 273 | 287 | 13 | 148 | 406 | 121 | 68 |
| **24** | 0 | 206 | 269 | 0 | 136 | 401 | 120 | 76 |
| **25** | 3 | 191 | 249 | 0 | 109 | 317 | 120 | 67 |
| **26** | 4 | 191 | 255 | 13 | 108 | 317 | 125 | 68 |
| **27** | 0 | 189 | 260 | 8 | 110 | 312 | 116 | 64 |
| **28** | 0 | 190 | 259 | 8 | 136 | 307 | 113 | 60 |
| **29** | 0 | 221 | 229 | 25 | 163 | 370 | 108 | 58 |
| **30** | 0 | 253 | 211 | 2 | 193 | 444 | 126 | 58 |
| **31** | 0 | 255 | 255 | 5 | 155 | 465 | 115 | 58 |
| SFD | 58 | 6403 | 7504 | 250 | 4295 | 11361 | 3347 | 1735 |
| AC-FT | 115 | 12700 | 14884 | 496 | 8519 | 22534 | 6639 | 3441 |

## APPENDIX D – Flow Regulation Calibration at Caballo Dam

**(See Excel File)**

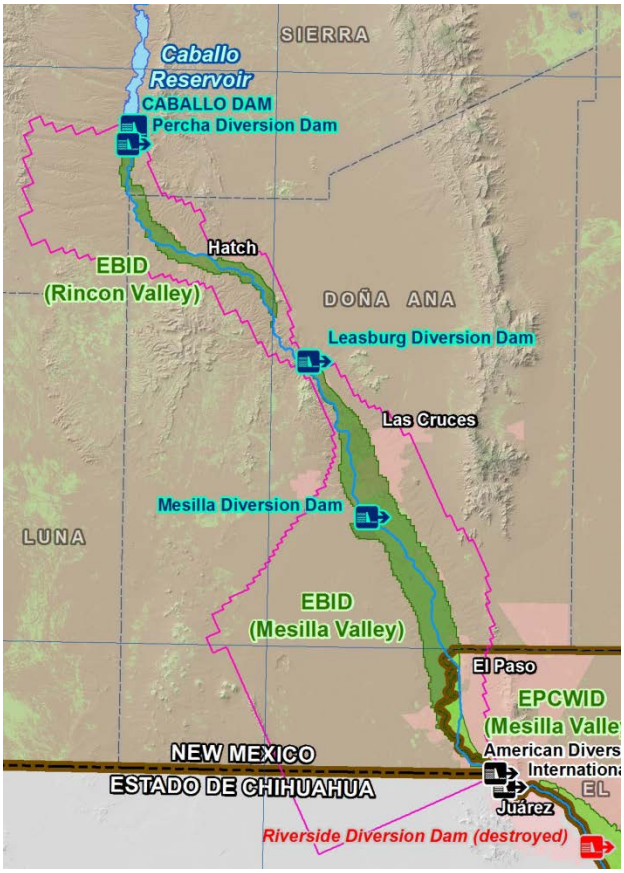
RECLAMATION

*Managing Water in the West*

**Technical Memorandum No. 86-68210–2015-05**

# Simulation of Rio Grande Project Operations in the Rincon and Mesilla Basins:

## Summary of Model Configuration and Results





**U.S. Department of the Interior**
**Bureau of Reclamation**
**Technical Service Center**
**Denver, Colorado**



**April 2015**
**Revised December 2015**

# Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

**Technical Memorandum No. 86-68210–2015-05**

# Simulation of Rio Grande Project Operations in the Rincon and Mesilla Basins:

## Summary of Model Configuration and Results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**U.S. Department of the Interior**
**Bureau of Reclamation**
**Technical Service Center**
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**April 2015**
**Revised December 2015**

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**U.S. Department of the Interior**
**Bureau of Reclamation**
**Technical Service Center**
**Denver, Colorado**

**April 2015**
**Revised December 2015**

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## Appendices

**Appendix A.** Formatted Model Results for Selected Operational and Hydrologic Parameters (Digital Appendix)

**Appendix B.** Model Files and Unformatted Model Output (Digital Appendix)

# 1 Introduction

The Bureau of Reclamation (Reclamation) is currently preparing an Environmental Impact Statement (EIS) to analyze the environmental effects from continuing to implement the Rio Grande Project (Project) Operating Agreement (OA; Reclamation et al. 2008) through the remainder of its term. In addition, Reclamation will use this EIS to evaluate the environmental effects of renewing San Juan-Chama Project (SJC Project) contracts for storage in Elephant Butte Reservoir. The EIS is being prepared by Reclamation and six cooperating agencies: Elephant Butte Irrigation District (EBID); El Paso County Water Improvement District No. 1 (EPCWID); City of Santa Fe Water Division; Colorado Division of Water Resources; Texas Commissioner to the Rio Grande Compact Commission; and U.S. Section of the International Boundary and Water Commission (US-IBWC).

In support of the EIS, Reclamation, in collaboration with the United States Geological Survey (USGS), has developed a detailed hydrologic and water operations model of the Rincon and Mesilla Basins and used this model to simulate Project operations, and corresponding surface-water and groundwater conditions within the Basins, under alternative operating procedures. This technical memorandum summarizes the modeling approach used to simulate projected future Project operations under alternative operating procedures and climate scenarios in support of the EIS.

Section 2 of this technical memorandum summarizes the objectives of this modeling effort in support of the EIS. Section 3 briefly describes the study area considered in this modeling effort. Sections 4 and 5 provide an overview of Project operations and proposed alternative operating procedures under consideration in the EIS. Section 6 summarizes the modeling approach used in this study, and Section 7 summarizes model outputs provided as a digital appendix to this technical memorandum.

Selected model results relevant to the analyses being performed for this EIS are provided, in graphical and tabular form, as a digital appendix to this memorandum (Appendix A), along with complete model files and unformatted outputs for each simulation described here (Appendix B). The results provided here may be used for evaluation of the effects of the alternative operating procedures under consideration in the EIS on the human environment and endangered species. Detailed analysis of model results will be performed as part of the EIS and is beyond the scope of this memorandum.

# 2 Modeling Objectives

The objective of this modeling effort is to provide projections of potential future surface water and groundwater conditions in the Rincon and Mesilla Basins under alternative operating procedures of the Project, and under a range of projected future climate and hydrologic conditions, in support of the EIS.

# 3 Study Area: Rio Grande Project and the Rincon and Mesilla Basins

The Project serves irrigated lands in the Rincon, Mesilla, and El Paso[1] Valleys, as well as providing water to the City of El Paso for municipal and industrial uses. The Project also delivers water to International Dam for diversion to Mexico.

The extent of the Project and key Project facilities are illustrated in Figure 1. The Project includes two storage dams and reservoirs, one hydropower generation facility, five diversion dams, and a complex network of conveyance and drainage channels, including canals, laterals, and open drains. The Project begins at Elephant Butte Reservoir, located near Elephant Butte, NM. Diversion dams and conveyance and drainage channels are located in the Rincon Valley of New Mexico (Percha Dam), the Mesilla Valley of New Mexico and Texas (Leasburg Dam, Mesilla Dam, and American Dam), and the El Paso Valley of Texas (International Dam). The Project terminates in Hudspeth County, TX near the town of Fort Hancock.

The Rio Grande and Project lands are underlain by an alluvial aquifer system, which is in turn underlain by deeper basin-fill aquifers (Hawley et al. 2001, Hawley and Kennedy 2004). Groundwater from these aquifers is the primary supply for municipal and domestic uses in the region and for irrigation outside the Project. In addition, irrigators within both the New Mexico and Texas portions of the Project often supplement Project surface-water deliveries with groundwater from privately-owned wells. Supplemental groundwater pumping is authorized and managed by the States, independently of the Federal Project. As a result, surface-water management in the Rincon and Mesilla Valleys—including Project operations—is carried out independently of groundwater regulation and management.

Groundwater use in Texas is governed by the so called “rule of capture” (Texas Water Code Section 36.002), which states that a landowner owns the groundwater beneath the surface of his or her land as real property, and may pump that water so long as that pumping does not cause waste or malicious drainage of other property or negligently cause subsidence. The area served by the Project lies within Texas’s Groundwater Management Area 5 (GMA 5); GMA 5 has not developed groundwater conservation districts or taken other steps to limit groundwater pumping within the GMA (Texas Water Development Board 2015). As a result, Project farmers in Texas are free to pump groundwater from privately-owned wells on their lands to supplement Project surface-water supplies.

[1] The El Paso Valley extends from Paso del Norte (also known as El Paso Narrows) southeast to approximately Fort Quitman, TX. The name El Paso Valley commonly refers to the United States portion of the topographic valley; the Mexican portion of the valley is commonly referred to as Juarez Valley.

The rights of Project farmers in New Mexico to supplement Project surface-water supplies with groundwater from privately-owned wells are subject to regulation and administration by the State of New Mexico. In 1980, the New Mexico Office of the State Engineer declared the Lower Rio Grande Underground Basin, within which permits would be required for any further groundwater development. Groundwater use that was initiated prior to the declaration of the underground basin was allowed to continue. The amount of water that can be pumped using pre-basin groundwater rights is currently being determined through a basin adjudication process by the State of New Mexico (Judicial Branch of New Mexico, 2015). In a settlement agreement associated with this ongoing water-rights adjudication, New Mexico allocated a Farm Delivery Requirement (FDR) of 5.5 AF/year and a Consumptive Irrigation Requirement (CIR) of 4.0 AF/year for pecan crops irrigated from a groundwater source established prior to the declaration of the groundwater basin. A final decree has not yet been issued in the adjudication; therefore, the adjudication does not yet form a basis for water-rights administration.

In the interim, the New Mexico Office of the State Engineer has the authority to administer water rights under its Active Water Resource Management (AWRM) program. However, basin-specific AWRM rules and regulations have not yet been finalized (New Mexico Office of the State Engineer / Interstate Stream Commission 2015). AWRM therefore does not yet provide a tool for administration of groundwater rights in the Rincon and Mesilla Basins. In 2004, the New Mexico State Engineer issued an Order (D'Antonio 2004) requiring metering of all groundwater diversions from the Lower Rio Grande Watermaster District by March 1, 2006. Although metering requirements are in effect per this Order, it has not been used to limit groundwater pumping. Therefore, as in Texas, Project farmers in New Mexico are free to pump groundwater from privately-owned wells on their lands to supplement Project surface-water supplies.

Previous studies indicate a strong hydraulic connection between the Rio Grande and the underlying groundwater aquifers in the areas served by the Project, particularly in the Rincon and Mesilla Basins (Conover 1954, Haywood and Yager 2003, SSPA 2007, Hanson et al. 2013). Groundwater pumping in the Rincon and Mesilla Basins results in capture (depletion) of Project surface-water supplies, which in turn affects the quantity of Project surface-water that can be delivered to authorized points of diversion. Conversely, Project operations affect the timing, distribution, and volume of groundwater recharge that occurs as seepage from surface-water channels, including the Rio Grande and unlined canals and laterals, and as deep percolation of applied irrigation water. Project operations also affect the timing, distribution, and volume of surface-water deliveries within the Project, which in turn affect incentives for groundwater pumping, as authorized by the States. Increased groundwater demand in the Rincon and Mesilla Basins over recent decades has been documented (e.g., D'Antonio 2005) and is expected to continue in the future, especially during periods of low Project surface water deliveries.

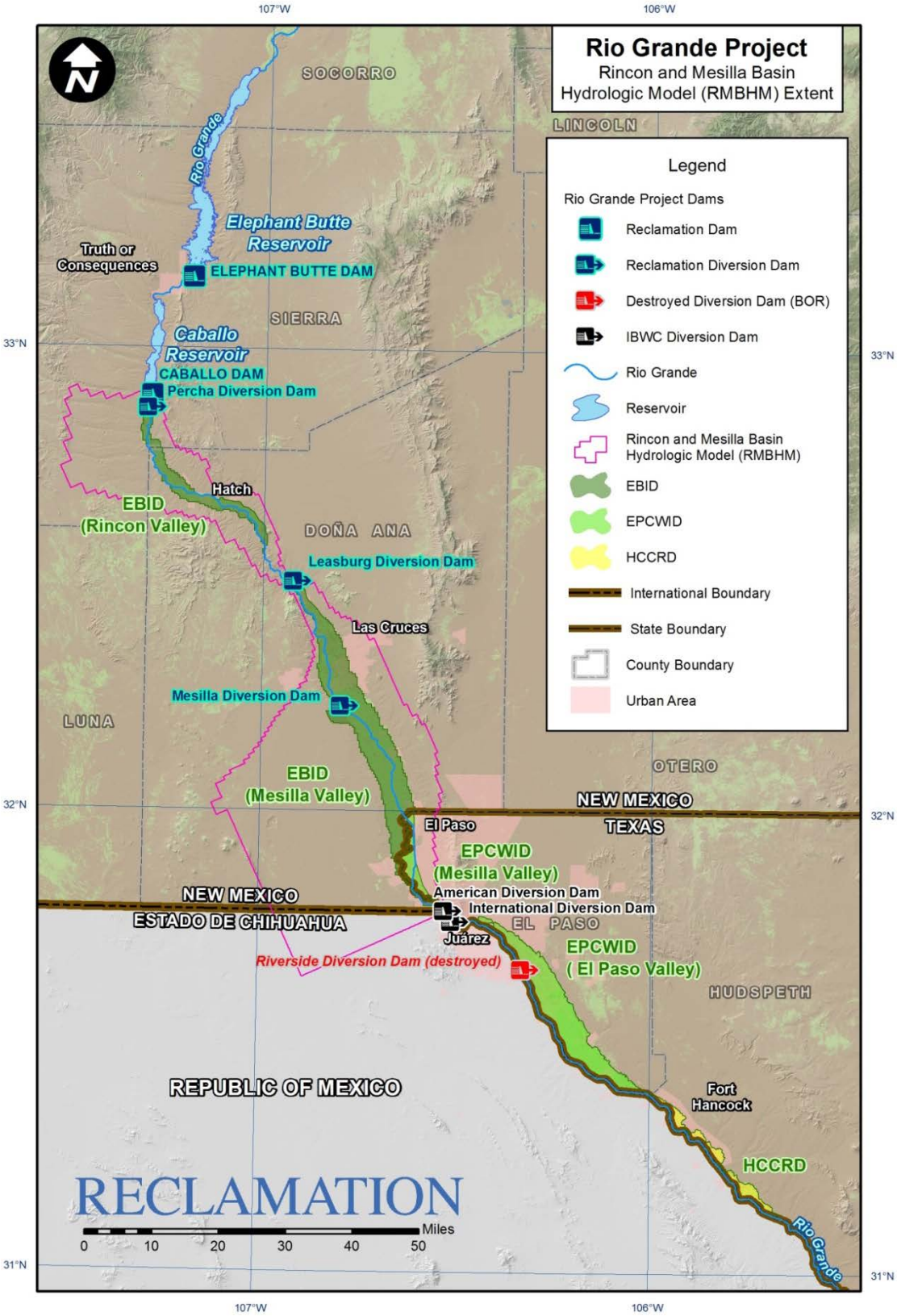


Figure 1: Overview of Rio Grande Project geographical extent and major facilities with outline of RMBHM model extent (active model grid cells).

# 4 Overview of Rio Grande Project Operations

The Project provides surface water for irrigation in southern New Mexico, and for irrigation, municipal, and industrial uses in western Texas. It also provides for the delivery of surface water to the Republic of Mexico under the 1906 Convention (United States of America and Republic of Mexico 1906). The Project also provides hydropower generation as a secondary function.

Operation of the Project involves four primary functions:

- Capture and storage of Rio Grande streamflow in Elephant Butte and Caballo Reservoirs;
- Allocation of Project water to EBID, EPCWID, and Mexico;
- Release of Project water to satisfy delivery orders from EBID, EPCWID, and the US IBWC on behalf of Mexico; and
- Diversion[2] of Project water from the Rio Grande and delivery[3] of Project water to individual farms and municipal water treatment facilities for beneficial use.

In addition to these primary functions, Project operations include monitoring of river flows, diversions, and return flows at locations throughout the Project and accounting for charges and credits to Project allocation balances. The Project also provides flood control benefits, and Elephant Butte Reservoir serves as an accounting point for the Rio Grande Compact. Lastly, Reclamation allows storage of SJC Project water in Elephant Butte Reservoir under agreements with the Albuquerque-Bernalillo County Water Authority (Authority) and City of Santa Fe.

It should be noted that in addition to allocation, diversion, and delivery of Project surface-water to EBID, EPCWID, and Mexico, seepage and drainage water from Project lands in El Paso Valley is delivered to Hudspeth County Conservation and Reclamation District No. 1 (HCCRD)[4]. Because HCCRD only receives seepage

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[2] Throughout this document, the term *diversion* refers to specifically the withdrawal of Project surface-water from the Rio Grande into an authorized Project conveyance facility at its heading.
[3] Throughout this document, the term *delivery* refers specifically to the withdrawal of Project surface-water from an authorized Project conveyance facility at a point of beneficial use (e.g., farm head gate or municipal water treatment plant intake).
[4] The United States and HCCRD entered into a Warren Act Contract in 1924, and amended in 1951, which provides for the use of Project Water by the HCCRD. The Warren Act Contract originally provided that "[t]he United States will deliver to [HCCRD] at the terminus of the Tornillo Main canal, during the irrigation season of 1925 and thereafter during each irrigation season as established on the Rio Grande project, such water from the project as may be available at said terminus *without the use of storage from Elephant Butte reservoir*" (emphasis added). The

and drainage water from EPCWID and does not receive a direct allocation of Project water, deliveries to HCCRD do not affect primary Project operations. The modeling and analysis described here therefore does not consider delivery to HCCRD.

The usable water available to the Project is determined according the accounting procedures specified in the Rio Grande Compact. Project releases, diversions, and deliveries depend on the usable water available to the Project as well as water demands within the Project, and are subject to limits specified by various statutory controls.

From 1916 through 1979, Reclamation operated all aspects of the Project. Reclamation determined the annual allotment of Project water per acre of authorized land and delivered the annual allotment to farm gates. In 1979 and 1980, Reclamation entered into contracts with EBID and EPCWID (collectively, the Districts), respectively, which transferred operation and maintenance responsibilities for Project conveyance and drainage systems to the Districts. Beginning in 1980, Reclamation determined annual diversion allocations to each district and delivered water to the respective authorized points of diversion; the Districts were then responsible for conveying water from the point of diversion to individual water users.

In the early 1980s, Reclamation developed a procedure to determine annual diversion allocations to EBID, EPCWID, and Mexico based on two linear regression relationships between Project releases and Project diversions and deliveries, respectively. The D-1 Curve is a linear regression relationship between annual Project releases from Caballo Dam and annual Project deliveries to lands within the US and to the heading of the Acequia Madre for diversion to Mexico. The D-2 Curve is a linear regression relationship between annual Project releases from Caballo Dam and annual gross Project diversions from river headings. Both relationships were developed based on Project operations data for the period 1951-1978 (inclusive).

During the period 1980-2007, annual Project diversion allocations to Mexico, EBID, and EPCWID were determined each year from the total amount of usable water in Project storage available for release during that year based on the D-1 and D-2 Curves. The D-1 Curve was used to estimate the total available annual delivery to Project lands in the United States and to the heading of the Acequia Madre from the usable water available for release; the D-2 Curve was used to estimate the total available annual diversion at Project diversion points from the usable water available for release.

Pursuant to the 1906 Convention, the annual allocation to Mexico during this period was 60,000 acre-feet (AF)/year, except under extraordinary drought

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1951 amendments to the Warren Act Contract added language specifying that the United States could deliver seepage or drainage water from land irrigated within the EPCWID, via canal, to HCCRD.

conditions. During extraordinary drought conditions, Mexico received a diversion allocation equal to 11.3486% of the sum of the total quantity of water delivered to lands within the United States plus delivery to the heading of the Acequia Madre. Between 1939 and 2014, Project allocations and deliveries to Mexico were reduced in approximately 30% of years, including significant reductions in 2012, 2013, and 2014 (Congressional Research Service 2015). Annual diversion allocations to EBID and EPCWID were then calculated from the quantity of water available for diversion after delivery obligations to Mexico were fully satisfied. Calculation of the allocation to each district was based on the percentage of authorized acreage within each district, or 88/155$^{ths}$ [57%] of the estimated available annual Project diversion allocated to EBID and 67/155$^{ths}$ [43%] to EPCWID. Reclamation made adjustments to annual diversion allocations in some years as needed to optimize Project operations and meet Project needs in response to actual Project performance (i.e., actual quantity of water available for diversion under current-year hydrologic conditions). Reclamation informed both districts of any adjustment made to the annual allocation procedure.

Beginning in 2008, Project operations have been carried out based on the procedures detailed in the Project OA (Reclamation et al. 2008) and corresponding Project Operations Manual (Reclamation et al. 2012). The OA is a written description of the procedures by which Reclamation operates the Rio Grande Project, including allocation of Project water to EBID, EPCWID, and Mexico; release of Project water from storage; delivery of Project water to authorized points of diversion; and accounting of allocation charges and credits. The Operations Manual further defines the procedures outlined within the OA for day-to-day operation of the Project. The OA and Operations Manual are reviewed annually and updated as needed to optimize Project operations consistent with applicable water rights, state and federal laws, and international treaties. Revision of the OA or Operations Manual requires unanimous consent of the Rio Grande Project Allocation Committee, which consists of one representative each from Reclamation, EBID, and EPCWID.

Operating procedures defined in the OA are largely consistent with prior operating practices during the period 1980-2007. The procedure used to determine the annual diversion allocation to Mexico is identical under the OA and prior operating practices. Similarly, the quantity of water available for diversion at Project diversion points each year is calculated from the estimated annual release of Project water according to the D-2 Curve, and the annual diversion allocations to EBID and EPCWID are calculated from the estimated water available for diversion after delivery obligations to Mexico are fully satisfied.

Two key provisions of the OA, however, deviate from prior operating practices. First, the OA provides carryover accounting for the unused balance of annual diversion allocation to EBID and EPCWID. Under prior operating practices, annual diversion allocations were calculated based only on the estimated release

of Project water for the current year; the unused balance of each districts annual diversion allocation, if any, was implicitly relinquished at the end of each calendar year. Under the OA, the unused balance of each district's annual diversion allocation, if any, is carried over and becomes part of the district's total diversion allocation the following year. The OA specifies that carryover balance may be accumulated by either district up to 60% of each district's respective full annual allocation, or up to 305,918 AF for EBID and 232,915 AF for EPCWID; carryover balance in excess of this limit is transferred to the other district. The carryover provision is intended to encourage water conservation within the Project by allowing each district to maintain its unused allocation balance up to a specified limit.

Second, the OA provides for adjustment of annual diversion allocations to EBID and EPCWID to account for changes in annual Project performance—i.e., changes in the amount of water actually available for diversion compared to the estimated available diversion based on the D-2 Curve. The OA represents Project performance using the diversion ratio, which is calculated as the ratio of total annual Project allocation charges to total annual Project release. The diversion ratio adjustment provision of the OA allows for adjustment of the annual Project allocations to EBID and EPCWID so as to maintain district diversion allocations to EPCWID at a level consistent with historical Project performance as represented by the D-2 Curve. When the actual diversion ratio is greater than the D-2 Curve, EBID receives an increase in annual allocation compared to prior operating practices; when the diversion ratio is less than the D-2 Curve, EBID receives a decrease in allocation. The diversion ratio adjustment provision of the OA therefore mitigates potential negative effects of changes in Project performance, which result predominately from the actions of individual landowners within EBID, by ensuring that Project allocations and deliveries to EPCWID remain consistent with historical Project performance."

Project water accounting under the OA is consistent with water accounting under prior operating practices. Project water accounting involves the calculation of charges against the Project allocation balances of EBID, EPCWID, and Mexico, as well as credits to the allocations balances of EBID and EPCWID, consistent with each entity's use of Rio Grande surface water. Allocation charges reflect the amount of surface water diverted from the Rio Grande, and allocation credits reflect the amount of water bypassed or returned to the Rio Grande and available for diversion at a downstream diversion point. In general, allocation charges are computed as the greater of the amount of water ordered for diversion at a specified diversion point and the amount of water actually diverted, whereas allocation credits are computed as the lesser of the amount of water ordered or bypassed at specified bypass points and the actual amount of water bypassed or returned to the Rio Grande. Dependence of allocation charges and credits on corresponding Project water orders promotes efficient operation of the Project by creating an incentive to divert all water ordered.

Specific exceptions to these general accounting procedures are summarized below.

First, charges to EBID and EPCWID for water diverted to Eastside and Westside Canals depend on whether one or both districts have ordered water. EPCWID receives water in Mesilla Valley as bypass from EBID via the Eastside and Westside Canal systems. If only EBID has ordered water, EBID is charged as described above. If both districts have ordered water, EBID is charged for water diverted at the canal heading as described above and is credited for water bypassed to EPCWID in addition to water bypassed to the Rio Grande. EPCWID is then charged for water received as bypass from EBID; EPCWID is credited for water bypassed to the Rio Grande from the Westside Canal system at a designated location on the La Union East Canal (Reclamation et al. 2008), which contributes to the water available for diversion downstream at American and International Dams. Lastly, if only EPCWID has ordered water, EPCWID is charged at the canal heading, rather than at the district boundary, and is credited for water bypassed to the Rio Grande.

Second, charges to EPCWID for water diverted at American Dam for use in El Paso Valley are not determined at the heading of American Canal. For consistency with historical water distribution and accounting practices, charges are determined at four locations that receive water from American Canal: the intakes to the Umbenhaurer-Robertson and Jonathon W. Rogers water treatment facilities and the headings of Riverside and Franklin Canals. In order to promote maximal use of Project water available to the United States, EPCWID is encouraged to divert all flow reaching American Dam that is not allocated for delivery to Mexico. EPCWID is then charged for all water reaching the four accounting locations listed above, regardless of corresponding diversion orders. In the event that diversions to American Canal exceed the district's diversion order, EPCWID is credited for the unused portion of water diverted in excess of its order. Unused water in excess of EPCWID's order is computed by analysis of hydrographs of flow exiting the downstream end of the district.

Third, in addition to credit for water bypassed to the Rio Grande from the Eastside and Westside systems and for unused diversion in excess of its order at American Dam, EPCWID receives a credit towards their Project allocation balance for water savings associated with construction of the American Canal Extension. The original American Canal, completed in 1938, conveys water from American Dam approximately two miles south to Franklin Canal; the American Canal Extension, completed in 1998, carries water from the original terminus of the American Canal approximately 12 miles further south to Riverside Canal. Historically, water was diverted from the Rio Grande to Riverside Canal at Riverside Dam. The American Canal Extension is concrete lined and provides for surface-water savings through reduced seepage losses compared to historical conveyance in the Rio Grande and diversion of water at Riverside Dam. The annual credit towards EPCWID's allocation balance for water savings from the

American Canal Extension is calculated based on annual flow in the American Canal.

Lastly, in the event that only one district or Mexico has ordered water, the charge against that entity's Project allocation balance is equal to the greater of the amount of water released from Caballo Dam or the amount of water diverted at the specified diversion point(s).

In addition to storing and releasing water for the Project, Reclamation also allows storage of SJC Project water in Elephant Butte Reservoir. In 1983, Reclamation and the Authority entered into a 25-year agreement (Contract No. 3-CS-53-01510) to allow the Authority to store up to 50,000 acre-feet of water in Elephant Butte Reservoir. The amount accounted as non-Project inflow to Elephant Butte Reservoir is equal to the amount released from upstream minus agreed-upon transport losses for the conveyance of non-Project water to the reservoir, unless that water was moved downstream for reasons that benefit Reclamation (such as to support riverine habitat for endangered species). The amount accounted as non-Project water stored by the Authority is then calculated as the Authority's previous non-Project storage, plus non-Project inflows, and minus evaporation of non-Project water from storage.

The 1983 agreement between Reclamation and the Authority expired in 2008. Since then, water storage in Elephant Butte Reservoir by the Authority has been managed under annual contract extensions, with the intent to execute another long-term agreement. Current storage is under an extension that allows storage through February 2016, ending on March 1, 2016.

In recent years, the City of Santa Fe (City) has also stored water in Elephant Butte, first under a sublease to the Authority's agreement, and then under annual agreements of its own. Since the spring of 2014, Santa Fe has not had water in Elephant Butte. The City has not requested future storage.

# 5 Summary of Proposed Alternatives Simulated in Support of EIS

The EIS will analyze environmental effects associated with continuing to implement OA for the remainder of its term through December 31, 2050, and associated with the renewal of SJC Project storage contracts that provide for storage of up to 50,000 acre-feet of SJC Project water in Elephant Butte Reservoir. The EIS will consider five alternatives, including a No Action alternative and four action alternatives. The No Action alternative reflects continuation of current operating procedures, as defined by the OA (Reclamation et al. 2008) and current Project Operations Manual (Reclamation et al. 2012), and with renewal of contracts for storage of up to 50,000 acre-feet of SJC Project water in Elephant Butte Reservoir. Action alternatives reflect potential changes in Project operating procedures and/or storage of SJC Project water in Elephant Butte. Alternatives are summarized below in Table 1.

Each alternative is simulated using two tools: a detailed hydrologic and water operations model of the Rincon and Mesilla Basins (Basins), which simulates Project operations and surface-water and groundwater conditions within the Basins; and a spreadsheet post-processing tool, which computes total storage in Elephant Butte Reservoir, including Project water, Rio Grande Compact Credit water and SJC Project water. Each alternative operating procedure is simulated by implementing a consistent set of Project allocation and accounting procedures within the Rincon and Mesilla Basins Hydrologic Model (RMBHM; see Section 6). RMBHM simulates Project operations and corresponding surface-water and groundwater conditions under projected future climate and hydrologic conditions according to the specified procedures. In the simulations carried out in support of the EIS, RMBHM does not account for SJC Project water in Elephant Butte Reservoir. SJC Project water and total storage in Elephant Butte Reservoir under each alternative are computed using a post-processing tool which calculates available storage for SJC Project water.

Unique simulations with RMBHM and the associated post-processing tool were carried out for Alternatives 1, 3, 4, and 5. Alternative 2 does not include storage of SJC Project water in Elephant Butte Reservoir; Alternative 2 is therefore represented by the RMBHM results from Alternative 1, without applying the post-processing tool for calculation of SJC Project water.

Table 1: Summary of Project Operating Alternatives Simulated In Support of the EIS

| Alt. | Name | Description |
|---|---|---|
| 1 | No Action | • Continue to implement the diversion ratio adjustment provision of the OA in computing annual diversion allocations;<br>• Continue to implement the carryover accounting provision of the OA allowing carryover of unused allotment balance from one year to the next;<br>• Continue to store up to 50,000 acre-feet per year of SJC Project water in Elephant Butte Reservoir. |
| 2 | No Action without SJC Project Storage | • Continue to implement the diversion ratio adjustment provision of the OA in computing annual diversion allocations;<br>• Continue to implement the carryover accounting provision of the OA allowing carryover of unused allotment balance from one year to the next;<br>• Do not store SJC Project water in Elephant Butte Reservoir. |
| 3 | No Action without Carryover Provision | • Continue to implement the diversion ratio adjustment provision of the OA in computing annual diversion allocations;<br>• Do not implement the carryover accounting provision of the OA – relinquish unused allotment balance at the end of each calendar year and eliminate carryover allocations;<br>• Continue to store up to 50,000 acre-feet per year of SJC Project water in Elephant Butte Reservoir. |
| 4 | No Action without Diversion Ratio Adjustment | • Do not implement the diversion ratio adjustment provision of the OA – compute annual diversion allocations based only on the D1 and D2 regression equations without adjustment for variations in Project performance;<br>• Continue to implement the carryover accounting provision of the OA allowing carryover of unused allotment balance from one year to the next;<br>• Continue to store up to 50,000 acre-feet per year of SJC Project water in Elephant Butte Reservoir. |
| 5 | Prior Operating Practices | • Do not implement the diversion ratio adjustment provision of the OA – compute annual diversion allocations based only on the D1 and D2 regression equations without adjustment for variations in Project performance;<br>• Do not implement the carryover accounting provision of the OA – relinquish unused allotment balance at the end of each calendar year and eliminate carryover allocations;<br>• Continue to store up to 50,000 acre-feet per year of SJC Project water in Elephant Butte Reservoir. |

# 6 Summary of Modeling Approach

Modeling software was selected and configured to simulate Project operations and hydrology, including surface-water and groundwater conditions, in the Rincon and Mesilla Basins under each of the alternative operating procedures proposed for the EIS. For each alternative, simulations were carried out under a range of projected future climate conditions. Model results were post-processed and compiled to facilitate comparison of Project operations and surface-water and groundwater resources under the No Action Alternative to conditions under each action alternative. Parameters provided by the model output and post-processing analysis include:

- Project storage, non-Project storage, and total storage in Elephant Butte and Caballo Reservoirs;
- Water surface elevation and area of Elephant Butte Reservoir;
- Reservoir releases from Caballo Dam;
- Diversion of Project surface-water to EBID, EPCWID, and Mexico;
- Delivery of Project surface-water to irrigated lands within EBID and to irrigated lands in the Mesilla Valley portion of EPCWID;
- Groundwater pumping for irrigation of groundwater-only irrigated lands in New Mexico and for supplemental irrigation of irrigated lands within EBID and irrigated lands in the Mesilla Valley portion of EPCWID;
- Changes in groundwater storage and water table elevations in Rincon and Mesilla Valleys.

In addition to analysis of surface-water resources, model results also provide a basis for analysis of potential effects of proposed alternatives on the human environment and socioeconomics, ecological conditions, and other environmental resources.

## 6.1 Model Selection

Simulation of Project operations requires a hydrologic modeling approach that accounts for interactions and feedbacks between surface-water and groundwater management and use. In response to this requirement, Reclamation, in collaboration with the USGS, developed the RMBHM to simulate Project operations and corresponding surface-water and groundwater conditions in the Rincon and Mesilla Basins. RMBHM builds on previous hydrologic models developed by the (NMOSE; SSPA 2007) and the USGS (Hanson et al. 2013).

RMBHM uses integrated hydrologic modeling software that is based on the USGS Modular Groundwater Model, MODFLOW. This software, the One Water Hydrologic Flow Model (MF-OWHM; Hanson et al. 2014), has been enhanced with additional software features developed and implemented by Reclamation in collaboration with USGS (Ferguson et al. 2014). New software features implemented by Reclamation provide the capability to simulate Project surface-water operations, including Project storage, allocation, release, diversion, delivery, and water accounting. New features are linked to existing features of MF-OWHM, including the Farm Process (FMP) and streamflow routing package (SFR), to allow dynamic simulation of both surface-water and groundwater management and use, including the coupled use and movement of surface water based on reservoir supply, agricultural demand, and specified Project operating procedures.

RMBHM simulates interactions and feedbacks between Project surface-water operations and groundwater recharge, incentives for groundwater pumping for supplemental irrigation, and groundwater/surface-water interactions in the Rincon and Mesilla Basins. Dynamic representation of these interactions and feedbacks is necessary to accurately represent Project operations and potential effects of alternative operating procedures on groundwater and surface-water resources.

## 6.2 Model Configuration

RMBHM utilizes the most recent release of the MF-OWHM (Hanson et al. 2014), with additional software features developed and implemented by Reclamation in collaboration with USGS. RMBHM was developed by configuring MF-OWHM to represent the physical and hydraulic properties specific to the groundwater and surface-water systems of the Rincon and Mesilla Basins and the operating procedures of the Project. Model configuration includes the extent and discretization of the simulated area (spatial domain) and simulation period (temporal domain), as well as the physical and hydraulic properties (constant parameters) of the Rincon and Mesilla Basins.

The RMBHM spatial domain is identical to that of previous model versions[5] developed by NMOSE and USGS (SSPA 2007; Hansen et al. 2013). The spatial domain encompasses the Rincon Valley of New Mexico and the Mesilla Valley of New Mexico and Texas, including all authorized Project lands within the Arrey, Leasburg, Eastside, and Westside Canal service areas. The model domain includes the Rio Grande, Project conveyance facilities (canals and laterals), and Project drainage facilities between Caballo Dam and Paso del Norte (El Paso Narrows), as well as all diversion points serving Project users in the United States: Percha Dam, Leasburg Dam, Mesilla Dam, and American Dam. It should

[5] The term “model version” refers here to the specific combination of modeling software and its implementation (configuration) to simulate surface-water and groundwater hydrology of a given area.

be noted that the model spatial domain does not include International Dam, where Project water is diverted from the Rio Grande for use in Mexico. International Dam is located approximately 1.5 miles downstream of American Dam; Project diversions to Mexico are approximated based on simulated flow in the Rio Grande out of the model domain.

Consistent with previous model versions, the RMBHM spatial domain is discretized on a uniform grid with lateral resolution of one quarter mile (1320 ft) in both the X- and Y-dimensions: each model grid cell is a square covering an area one quarter mile by one quarter mile, equal to 40 acres. The model grid is rotated 24 degrees counter-clockwise from the local meridian to align with the dominant orientation of topographic and hydrogeological features of the Rincon and Mesilla Basins. In the vertical dimension, the aquifer system is represented by five model layers of varying thickness and extent. The uppermost layer represents the Rio Grande alluvial aquifer system within the Rincon and Mesilla Valleys, and lower layers represent deeper basin-fill deposits. The vertical discretization of RMBHM was adopted directly from previous model versions and is based on the hydrogeologic framework developed by Hawley and Kennedy (2004).

RMBHM represents surface-water channels within the model spatial domain—including the Rio Grande, canals and laterals, wasteways, and open drains—as a discrete network of channel segments and reaches using the SFR package in MF-OWHM. The network of canals, laterals, wasteways, and drains represented in RMBHM was adopted from previous model versions, where previous modeling teams selected channels primarily based on their rated capacity and acreage served (SSPA 2007). As in previous model versions, RMBHM explicitly represents the majority of larger canals and laterals within the model domain, while excluding smaller laterals that generally have rated capacities less than 40 cfs and/or serve relative small areas (refer to SSPA 2007, Appendix M, for details). RMBHM utilizes the lumped representation of surface-water deliveries developed by NMOSE for a previous model version, with surface-water deliveries to Project lands occurring at 30 locations throughout the conveyance network (SSPA 2007). Calibration and sensitivity analysis carried out during previous modeling efforts demonstrate that the simplified and lumped representation of the surface-water conveyance and drainage network was sufficient to represent surface-water operations and surface-water/groundwater interactions within the Rincon and Mesilla Basins (SSPA 2007, Hanson et al. 2013).

It should be noted that the model domain does not encompass Project lands in El Paso Valley, downstream of Paso del Norte (also known as El Paso Narrows). As summarized above, previous studies indicate significant interaction and feedbacks between Project operations and groundwater storage and use in the Rincon and Mesilla Valleys. By contrast, Project water delivered to EPCWID for use in El Paso Valley is diverted at American Dam, located at the southern end of Mesilla Valley upstream of Paso del Norte. Water diverted at American Dam is conveyed

to Project accounting points in El Paso Valley[6] via the American Canal, which is concrete-lined and therefore assumed not to interact with the underlying groundwater aquifer. Drainage and return flows from EPCWID in El Paso Valley do not contribute to downstream Project diversions and therefore do not affect Project diversion orders or accounting. While groundwater/surface-water interactions in El Paso Valley may affect surface-water deliveries and return flows within EPCWID and the availability of Project seepage and drainage water to HCCRD, these interactions do not affect the quantity or quality of Project water available for diversion, accounting of Project charges and credits, nor the allocation of project surface-water supplies between EBID, EPCWID, and Mexico. For these reasons, Project deliveries to EPCWID lands in El Paso Valley are not explicitly represented in the model domain. Instead, Project demands and deliveries in El Paso Valley are represented by a specified diversion demand at American Canal (see Section 6.5).

In order to support comparison of proposed operating alternatives for the EIS, the RMBHM temporal domain encompasses the full term of the OA, from 2008-2050. The simulation period extends from the start of the 2007-2008 non-irrigation season (November 1, 2007) through the end of the 2050 irrigation season (October 31, 2050). The temporal domain is discretized into seasonal stress periods and approximately monthly time steps. Each simulated year contains two seasonal stress periods: a non-irrigation season stress period from November through February (120.25 days), and an irrigation season stress period from March through October (245 days). Irrigation stress periods are divided into eight nominally monthly time steps of 30.625 days each and non-irrigation stress periods are divided into four nominally monthly time steps of 30.0625 days each.

Subsurface and channel hydraulic properties are held constant throughout the model simulation. Hydraulic properties were largely adopted from previous model versions, which were subjected to extensive calibration and verification; however, selected parameters were adjusted during development and evaluation of RMBHM to improve simulation of Project surface-water operations (see Section 6.3 below). Subsurface hydraulic properties include horizontal hydraulic conductivity, the ratio between horizontal and vertical hydraulic conductivity, specific storage, and specific yield; channel hydraulic properties include channel bed hydraulic conductivity as well as channel geometry, slope, and roughness, which affect stream stage (head) and wetted perimeter, and thus seepage across the channel bed.

RMBHM simulates the transient groundwater and surface-water responses to spatially and temporally varying hydrologic stresses, including Project surface-water releases and diversions and both agricultural and non-agricultural groundwater pumping within the model domain (see Section 6.4 below). As in

[6] Project allocation charges in El Paso Valley are computed at the following locations: Umbenhaurer-Robertson Water Treatment Plant intake, intake to Jonathon W. Rogers Water Treatment Plant intake, Franklin Canal heading, and Riverside Canal heading.

previous model versions, non-agricultural groundwater stresses such as domestic and municipal well groundwater pumping rates and mountain-front recharge are specified as seasonally-varying inputs[7]. By contrast, irrigation-related stresses such as Project releases, diversions, and deliveries, farm well pumping rates, and farm net recharge are simulated dynamically by RMBHM and updated at each time step. Irrigation stresses are calculated based on specified crop irrigation requirements and simulated Project surface-water operations. The crop irrigation requirements for each Project service area in the Rincon and Mesilla Basins are specified for each stress period as a time-varying input; Project storage is simulated for each time step based on specified monthly reservoir inflows, precipitation and evaporation rates, non-Project water in storage, and simulated Project releases; and groundwater pumping for irrigation is calculated as the difference between the total farm delivery requirement and simulated surface-water delivery.

## 6.3 Constant Model Parameters

In addition to configuration of the model's spatial and temporal domain, RMBHM requires parameters representing the physical and hydraulic properties throughout its spatial domain. Parameters representing physical and hydraulic properties are held constant throughout the model simulation period. Constant model parameters include:

- Subsurface Properties:
  - aquifer hydraulic conductivity (horizontal and vertical)
  - specific storage
  - specific yield

- Channel Properties:
  - hydraulic conductivity of channel beds
  - channel geometry, slope, and roughness of channels

- Vegetation Related Parameters:
  - root profiles of riparian vegetation
  - soil capillary fringe depth
  - on-farm irrigation efficiency
  - fractional distribution crop consumptive use between evaporation and transpiration

The RMBHM spatial domain—including the model's spatial extent, spatial discretization, hydrogeologic framework, and surface channel network—is

[7] Seasonally-varying inputs vary between irrigation and non-irrigation stress periods, but do not vary between years; for example, a seasonally varying input has a single value for all irrigation stress periods and a single value for all non-irrigation stress periods, but may differ between irrigation and non-irrigation stress periods.

identical to the spatial domain used in previous model versions (SSPA 2007, Hanson et al. 2013). Similarly, the initial parameter set for RMBHM was adopted directly from Hanson et al. (2013). Initial parameter values for subsurface properties were developed by SSPA (2007) and adopted by Hanson et al. (2013). Parameter values were developed through a combination of manual (trial-and-error) calibration and parameter estimation simulations using PEST, a model-independent parameter optimization software (Watermark Numerical Computing 2005); calibration was carried out with respect to observed historical groundwater heads at monitoring well locations throughout the model domain and drain flows at selected Project drains where sufficient data were available (SSPA 2007). Initial parameters defining channel properties were developed by Hanson et al. (2013) based on further sensitivity analysis with respect to observed historical surface water flows.

The initial parameters set adopted from Hanson et al. (2013) was evaluated by simulating Project operations under historical hydrology, climate, and cropping conditions for the period 1960-2009 and comparing simulation results to observed historical conditions during this period. For evaluation purposes, historical Project operations were represented by implementing a consistent set of Project allocation and accounting procedures representative of historical operations for the period 1990-2006. Historical hydrology and climate conditions were represented through time-varying model inputs, including historical inflows to Elephant Butte Reservoir, historical reservoir precipitation and evaporation rates, and crop irrigation requirement computed based on historical meteorology, crop distribution, and irrigated acreage data. RMBHM uses a fixed set of operating rules representative of Project allocation and accounting practices during this period, whereas actual operations during the evaluation period varied from year to year; simulated operations are therefore not expected to match historical measurements perfectly.

Model results were compared to historical records of Project storage, releases, diversions, and flow in the Rio Grande below Caballo Dam and at El Paso, and to previous estimates of Project surface-water deliveries and groundwater deliveries for supplemental irrigation for Project service areas in the Rincon and Mesilla Valleys. The model evaluation and sensitivity analysis conducted with RMBHM did not re-evaluate simulated groundwater heads and drain flows. Model results using the initial parameter set adopted from Hanson et al. (2013) exhibit surface-water releases and diversions consistent with historical observations; however simulated surface-water deliveries were higher than historical observations and simulated groundwater deliveries were lower than previous historical estimates. Results suggest that the initial parameter set overestimates conveyance efficiency of Project canals and laterals, resulting in underestimated groundwater pumping for supplemental irrigation.

In response to these evaluation results, a limited sensitivity analysis was carried out to assess model sensitivity to selected parameters and to identify a preferred parameter set for simulations conducted in support of the EIS. A large number of

simulations were carried out with varying parameter values for selected parameters, including subsurface and channel bed hydraulic conductivities, aquifer specific storage and specific yield, capillary fringe depth, and on-farm irrigation efficiency. Sensitivity results revealed that simulated Project storage, allocations, releases, and diversions are weakly sensitive (less than 10% change) to all model parameters. Simulated surface-water and groundwater deliveries to irrigated lands in Rincon and Mesilla Valleys were found to be moderately sensitive (between 10% and 20% change) to changes in the hydraulic conductivity of canal beds, which affects canal seepage losses; capillary fringe depth, which affects direct uptake of groundwater by crops; and on-farm irrigation efficiency, which affects the total delivery requirement to farms.

A preferred parameter set was selected based on comparison of historical and simulated Project storage, releases, diversions, and surface-water deliveries. With the selected parameter set, Project operations simulated by RMBHM closely match historical Project records. As illustrated in Figure 2, simulated total Project storage is well correlated with observed historical storage ($R^2 = 0.94$) and exhibits little systematic bias. Similarly, Figure 3 shows that simulated annual releases from Caballo Dam also agree well with observed historical releases. The simulated average annual Project release is within one percent of the historical average, and the simulated average annual total Project diversion from the Rio Grande is within 5% of the historical average. Simulated surface-water and groundwater deliveries to irrigated lands in the Rincon and Mesilla valleys also agree well with previous estimates developed by NMOSE (SSPA 2007).

Strong agreement of RMBHM with historical records suggests that RMBHM captures the key operational and hydrologic factors that drive surface-water and groundwater management and use in the Rincon and Mesilla Basins. Discrepancies between simulated and observed Project operations likely reflect uncertainties in the historical data used to develop model inputs, including historical records of inflows to Elephant Butte Reservoir, meteorological conditions throughout the study area, and cropping patterns, irrigated acreage, and on-farm irrigation efficiencies in the Rincon and Mesilla valleys. Simplifications required to simulate Project operations also contribute to discrepancies between simulated and observed conditions. Key simplifications include the spatial and temporal discretization of RMBHM and the use of a consistent set of operation procedures throughout the simulation, in contrast to actual operating procedures which evolved over time, especially between 1980 and 2008. Key simplifications and assumptions are discussed in Section 6.5.

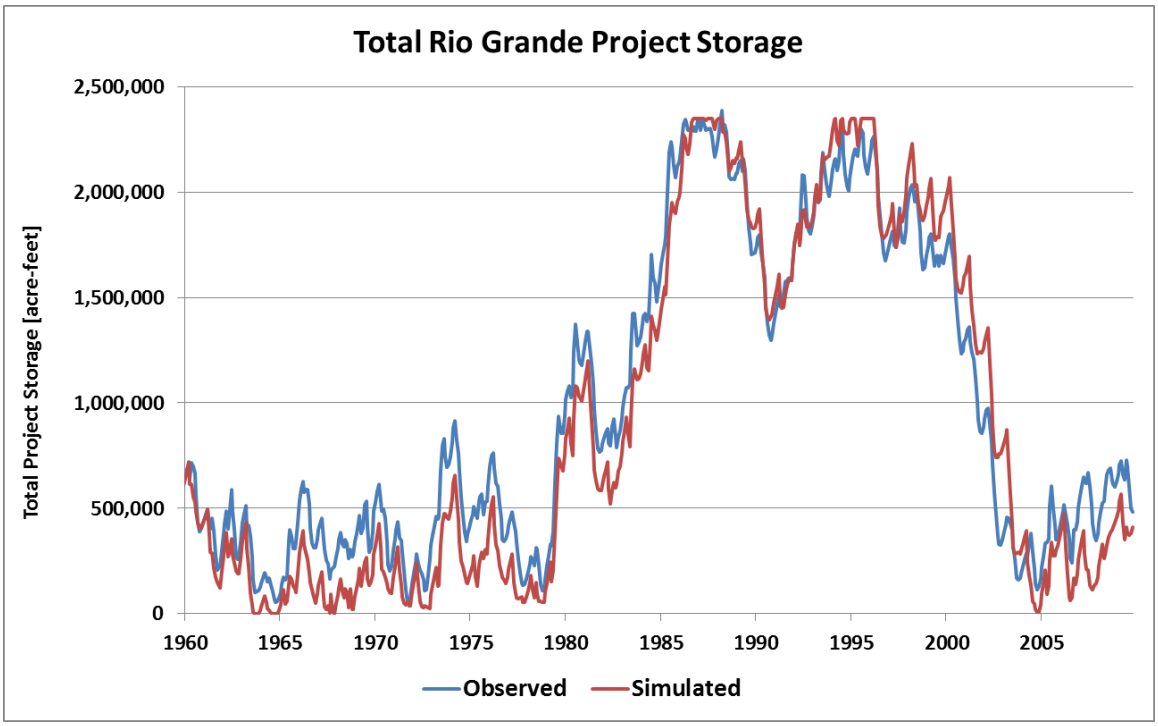



Figure 2: Observed and simulated monthly total Rio Grande Project storage in Elephant Butte and Caballo Reservoirs (acre-feet) for the period 1960-2010.

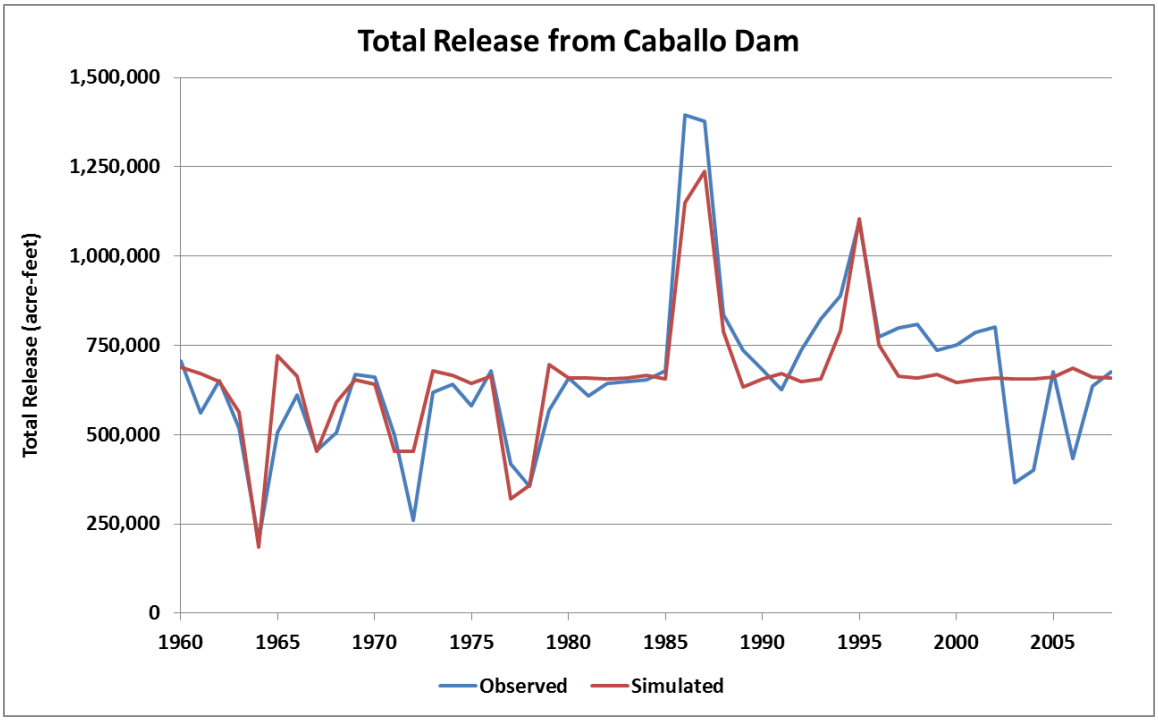



Figure 3: Observed and simulated annual release from Caballo Dam (acre-feet) for the period 1960-2010.

## 6.4 Time-Varying Model Inputs

In order to simulate transient conditions over the simulation period (November 2007 – October 2050), RMBHM requires time-varying inputs representing projected hydrologic, climatic, and anthropogenic stresses to the surface-water and groundwater systems of the Rincon and Mesilla Basins over this period. Hydrologic stresses represented in RMBHM include surface-water inflows to Project storage; climatic stresses include reservoir precipitation and evaporation rates and reference evapotranspiration in the Rincon and Mesilla Valleys; and anthropogenic stresses include cropping patterns, irrigated acreage, and on-farm irrigation efficiency of agricultural lands, municipal and domestic groundwater pumping rates and locations, and discharge of treated effluent from municipal wastewater treatment facilities. In addition, the storage and relinquishment of Rio Grande Compact credit waters in Elephant Butte Reservoir is represented as a time-varying input.

Hydrology and climate inputs to RMBHM for simulations carried out in support of the EIS are based on a combination of recent historical conditions and projections of future conditions, including projected effects of climate change. Projected future inflows to Elephant Butte Reservoir, reservoir precipitation and evaporation rates, and precipitation and temperature conditions in Rincon and Mesilla Valleys were obtained from previous analyses carried out by Reclamation and others as part of the West Wide Climate Risk Assessment (WWCRA; Reclamation 2011a, Reclamation 2011b) and Upper Rio Grande Impact Assessment (URGIA; Reclamation 2011a, Reclamation 2013).

Projections of future climate and hydrologic conditions were developed through a multi-phase modeling approach (Reclamation 2013). The three primary modeling phases are summarized below:

- Downscale temperature and precipitation projections from global climate models to a spatial scale relevant for regional analysis.

- Perform hydrologic modeling to develop projections of future streamflow at selected locations within the Rio Grande Basin.

- Use the downscaled projections of temperature, precipitation, and streamflow as inputs to a local monthly operations model, the Upper Rio Grande Simulation Model (URGSiM; see Reclamation 2013, Appendix E), to simulate future operations of Reclamation projects and related Federal and non-Federal activities and infrastructure in the basin under projected future climate and hydrologic conditions.

Climate and hydrologic projections used here are based on an ensemble of 112 projections of 21$^{st}$ century climate developed and archived as part of the World Climate Research Programme (WCRP) Coupled Model Inter-comparison Project Phase 3 (CMIP3) (Meehl et al. 2007) and Intergovernmental Panel on Climate

Change (IPCC) Fourth Assessment Report (IPCC 2007). The CMIP3 ensemble includes projections from 16 global climate models (GCMs; also referred to as general circulation models) and representing a variety of initial conditions of global ocean-atmosphere system and future scenarios regarding the evolution of atmospheric greenhouse gas concentrations over the 21st century (see Meehl et al. 2007, IPCC 2000, and IPCC 2007 for details).

Reclamation, in cooperation with Lawrence Livermore National Laboratory, Santa Clara University, Climate Central, and the Institute for Climate Change and its Societal Impacts, performed Bias Correction and Spatial Disaggregation (BCSD) of the 112 projections of future temperature and precipitation using the statistical technique of Wood et al (2004). The resulting BCSD dataset includes 112 projections of monthly temperature and precipitation over the continental United States at 1/8 degree spatial resolution (12 km) for the period from 1950 through 2099 (see Reclamation 2011a for details). Reclamation then used the BCSD precipitation and temperature projections as input to the Variable Infiltration Capacity (VIC) hydrology model (Liang et al. 1994, Liang et al. 1996, and Nijssen et al. 1997) to develop projections of future hydrologic conditions over the western United States, including simulated natural streamflow variability for the period 1950-2099 (see Reclamation 2011a for details). Projected streamflow at selected locations within the Rio Grande basins were then bias corrected[8] to remove systematic biases between simulated and observed streamflow and to ensure that projected flows are consistent with long-term statistics of observed streamflow in the basin (see Reclamation 2013, Appendix D, for details).

Finally, projections of future water operations in the Upper Rio Grande Basin were developed using the URGSiM (Reclamation 2013, Appendix E), including reservoir storage and releases, groundwater/surface-water interactions, municipal and agricultural water deliveries, and agricultural and riparian consumptive use. URGSiM simulates water operations from the San Luis Valley in southern Colorado to Caballo Reservoir in southern New Mexico based on specified operating rules and time-varying inputs of monthly streamflow, precipitation, and maximum and minimum temperatures. URGSiM simulates storage, releases, flows, and deliveries on the Rio Grande mainstem, the Rio Chama and Jemez River tributary systems, and the Española, Albuquerque, and Socorro regional groundwater basins, including:

- Operations of nine dams
- Interbasin transfers from the Colorado River Basin to the Rio Grande Basin (via Reclamation's San Juan-Chama project)

[8] Bias correction was carried out using the quantile-mapping bias correction technique detailed in Wood et al. 2004.

- Agricultural diversions and depletions in the Chama, Española, and Middle Rio Grande Valleys (most of which occur via irrigation infrastructure originally built by Reclamation as part of the Middle Rio Grande Project)

- Evapotranspiration (ET) i.e., the evaporation plus water use by riparian plants and crops

For the purposes of the EIS, projected inflows, Rio Grande Compact credit water, and evaporation and precipitation rates for Elephant Butte Reservoir were obtained from URGSiM results for the URGIA "Base Case" operating scenario. The Base Case operating scenario represents changes in water supply, demand, and operations resulting directly from projected changes in the climate, assuming no change in infrastructure, operations, population, irrigated acreage and cropping patterns, and other non-climate-related parameters. In addition, Base Case operating scenario assumes that Colorado and New Mexico meet their respective surface-water delivery requirements under the Rio Grande Compact. Water shortages in each state are managed by decreasing water use in the San Luis valley in Colorado and the Middle Rio Grande Valley in New Mexico, respectively, so that accumulated debits do not exceed 100,000 AF. Compact credits are allowed to accumulate, but are relinquished to Texas when credits exceed 70,000 AF. A total of 112 Base Case simulations were conducted as part of URGIA, corresponding to the suite of 112 BCSD climate projections.

Three of the 112 Base Case simulations were selected as inputs to RMBHM to represent the range of projected future hydrologic conditions in the basin. Simulations were selected based on projected future surface-water availability as characterized by projected average annual inflow to Elephant Butte Reservoir over the EIS simulation period (2007-2050). Selected simulations represent a drier scenario corresponding to the URGSiM simulation with the 25$^{th}$ percentile average annual inflow (Scenario P25), a central tendency scenario corresponding to the simulation with the 50$^{th}$ percentile (median) annual inflow (Scenario P50), and a wetter scenario corresponding to the simulation with the 75$^{th}$ percentile inflow (Scenario P75) relative to the ensemble of 112 simulations. Average annual inflows to Elephant Butte Reservoir are illustrated in Figure 4 for observed historical conditions (average over period 1950-2010) and for each of the three selected climate scenarios (average over period 2007-2050).

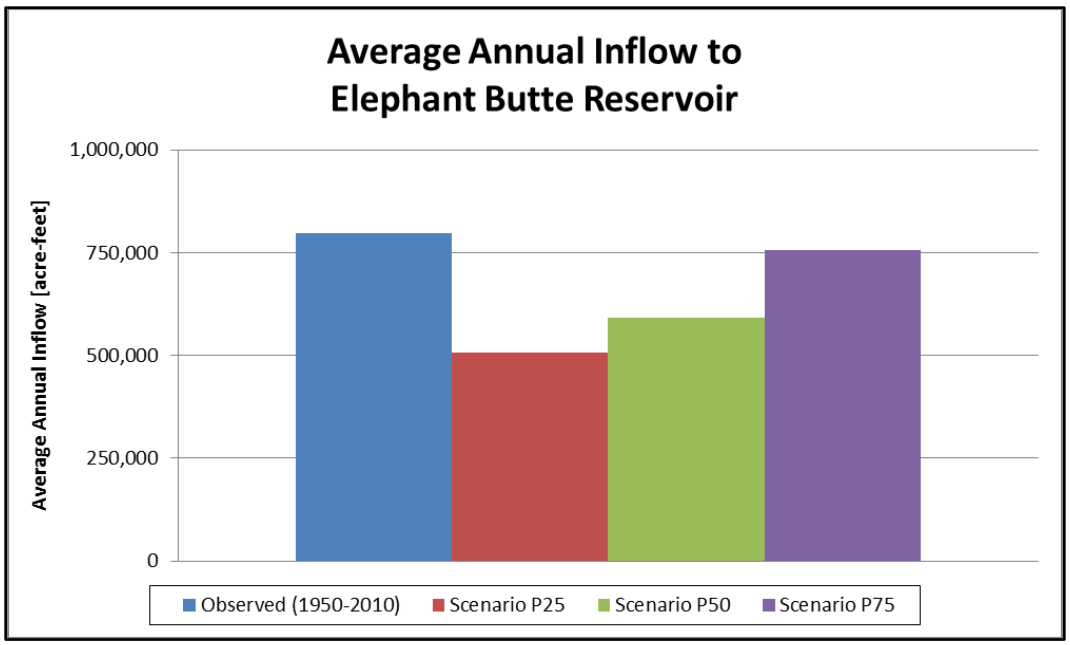



Figure 4: Observed historical average annual inflow to Elephant Butte Reservoir during the period 1950-2010 (acre-feet) and projected future average annual inflow to Elephant Butte Reservoir during the simulation period (2007-2050) for the climate scenarios considered in support of the Rio Grande Project Operating Agreement EIS.

For each scenario, time-varying climate and hydrologic inputs were developed from URGSiM results and corresponding BCSD climate projections. RMBHM inputs of monthly inflows to Elephant Butte Reservoir, monthly reservoir precipitation and evaporation rates, and monthly Rio Grande Compact credit water in Elephant Butte Reservoir over the simulation period were adopted directly from URGSiM model outputs. Seasonal crop irrigation requirement (CIR) inputs to RMBHM for each Rio Grande Project service area in the Rincon and Mesilla valleys were developed by adjusting calculated historical crop evapotranspiration for a selected base year according to the projected change in reference evapotranspiration (reference ET) between the base and future years. Projected future reference ET was calculated using the Hargreaves-Samani method (Hargreaves and Samani 1985) based on projected future temperatures from the BCSD climate projections corresponding to the selected URGSiM simulations. Seasonal CIR was then calculated by subtracting effective precipitation during the irrigation season from calculated crop evapotranspiration, with precipitation taken from the corresponding BCSD climate projections and effective precipitation calculated using the USDA Soil Conservation Service method (Dastane 1978). Monthly average precipitation, temperature, and reference ET at weather stations in Hatch, NM and Las Cruces, NM are illustrated in Figures 5-7, respectively, for observed historical conditions (average over period 1950-2010) and for each of the three selected climate scenarios (average over period 2007-2050).

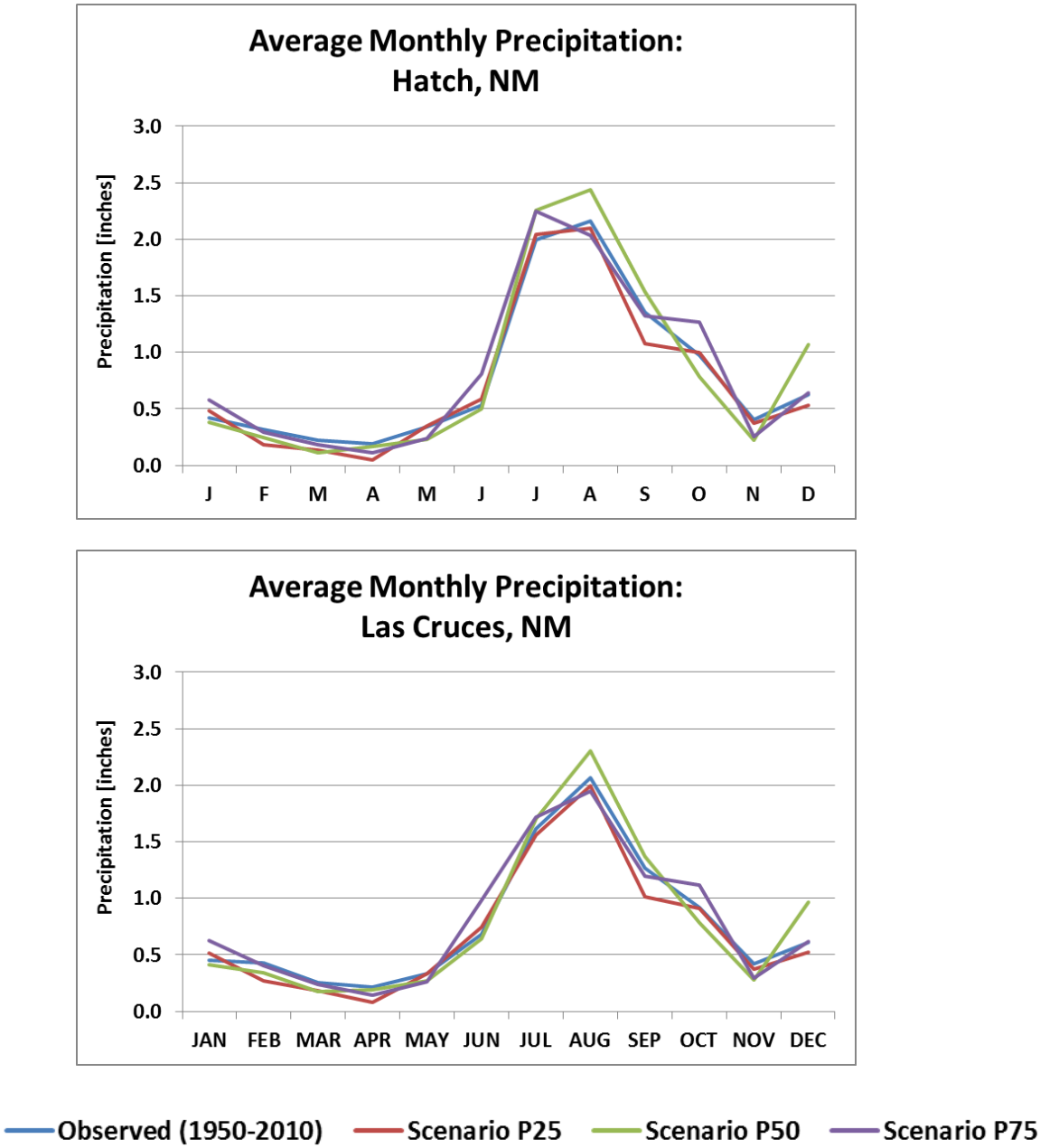
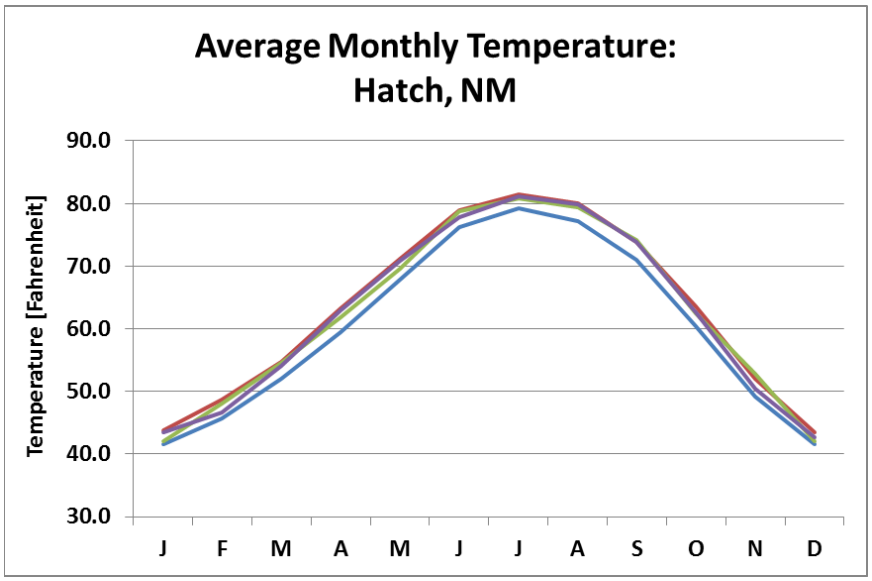
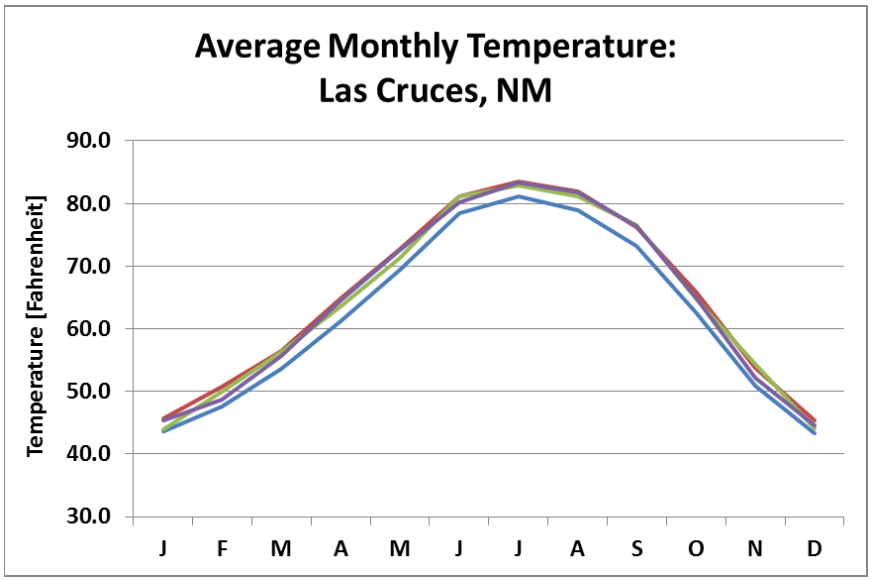



Figure 5: Observed historical average monthly precipitation at Hatch, NM and Las Cruces, NM during the period 1950-2010 (inches) and projected future historical average monthly precipitation during the simulation period (2007-2050) for climate scenarios considered in support of the Rio Grande Project Operating Agreement EIS.




Observed (1950-2010) Scenario P25 Scenario P50 Scenario P75

Figure 6: Observed historical average monthly mean temperature at Hatch, NM and Las Cruces, NM during the period 1950-2010 (inches) and projected future historical average monthly precipitation during the simulation period (2007-2050) for climate scenarios considered in support of the Rio Grande Project Operating Agreement EIS.

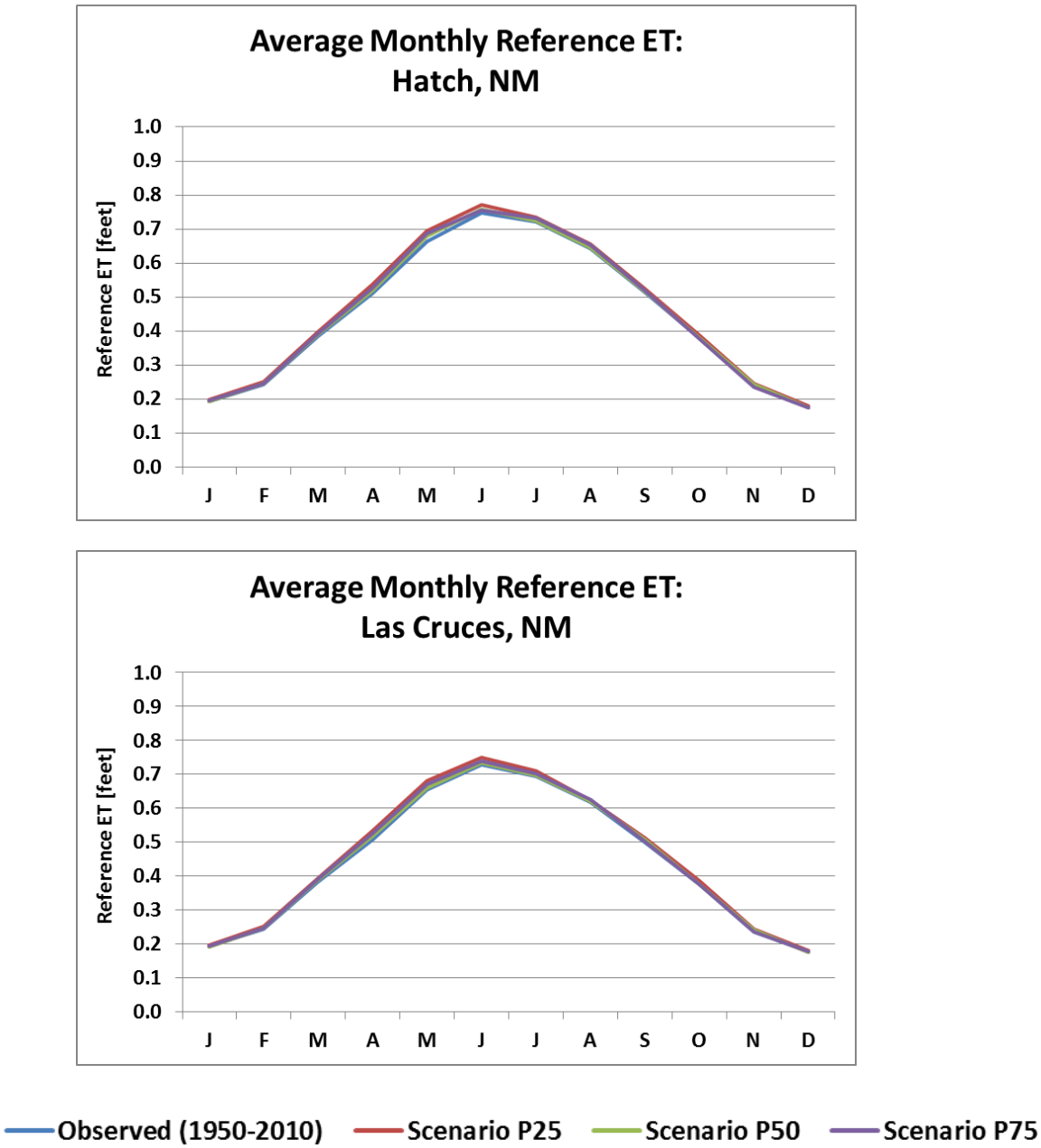



Figure 7: Observed historical average monthly mean temperature at Hatch, NM and Las Cruces, NM during the period 1950-2010 (inches) and projected future historical average monthly precipitation during the simulation period (2007-2050) for climate scenarios considered in support of the Rio Grande Project Operating Agreement EIS.

## 6.5 Model Assumptions

Simulation of future Project operations and corresponding surface-water and groundwater conditions in the Rincon and Mesilla Basins requires several assumptions regarding future conditions, including future climate and hydrology, cropping and irrigation practices, and non-agricultural water uses. Additional assumptions are required to approximate day-to-day operational decisions by Reclamation, EBID, EPCWID, and individual irrigators that are not specified in the OA or Operations Manual. Important assumptions used to represent Project operations in RMBHM are briefly summarized below.

- *Irrigation Water Demands in Rincon and Mesilla Valleys*

  As described above, time-varying (seasonal) crop irrigation requirement for irrigated lands within the Rincon and Mesilla Basins is a required model input. In order to develop projections of future crop irrigation requirement for the model simulation period, it was necessary to make assumptions regarding future cropping patterns, irrigated acreage, and irrigation response to surface-water deficiencies.

  The cropping pattern for each service area within the model domain was based on cropping data available for the year 2000. Crop evapotranspiration was first calculated for each canal service area for the year-2000 irrigation season, based on previous analysis conducted by NMOSE. Projected seasonal reference evapotranspiration was then calculated for each year in the model simulation period, and projected crop evapotranspiration over the simulation period was calculated by adjusting the year-2000 crop evapotranspiration in accordance with projected variations in annual reference evapotranspiration. Crop irrigation requirement was then calculated by subtracting effective precipitation during the irrigation season from calculated crop evapotranspiration. This approach assumes constant cropping pattern, acreage, and crop coefficients over the simulation period, with variations in crop evapotranspiration driven only by to variations in reference evapotranspiration.

  The distribution of irrigated lands within the model domain is based on geospatial data available for the year 2000 and was held constant over the simulation period. This approach assumes that irrigated lands remain in production for the duration of the simulation and therefore are independent of Project surface-water supply.

  For simulations performed in support of the EIS, it is assumed that all irrigated lands have physically and legally unrestricted access to sufficient supplemental groundwater to fully meet the consumptive irrigation requirement on the land, and therefore that crop irrigation requirement is fully met throughout the simulation period. This approach allows the model to compute groundwater pumping for irrigation as the difference between

the total farm delivery required to meet the crop irrigation requirement and the actual quantity of Project surface-water delivered to farms. The assumption that crop irrigation requirement is fully met throughout the simulation period is consistent with assumptions used in previous analyses (SSPA 2007, Hanson et al. 2013). This assumption may over-estimate groundwater deliveries in cases where actual well locations and capacities limit actual groundwater use.

- *Non-Irrigation Water Demands in Rincon and Mesilla Valleys*

  Non-irrigation water uses in Rincon and Mesilla Valleys include municipal, industrial, and domestic uses by the City of El Paso, City of Las Cruces, the Santa Teresa development, several smaller mutual domestic associations and local water agencies, and individual domestic water users. Non-irrigation water demands in the Rincon and Mesilla Valleys are met exclusively from groundwater. In order to develop projections of future groundwater withdrawals for non-irrigation purposes over the model simulation period, it was necessary to make assumptions regarding the location and quantity of groundwater extracted for municipal, industrial, and domestic uses.

  For simulations performed in support of the EIS, it is assumed that the location and quantity of groundwater pumping for non-irrigation uses over the simulation period will be consistent with historical uses over the period 1995-2004. Time-varying model inputs for non-irrigation groundwater pumping were developed based on model inputs for the period 1995-2004 in a previous model version developed by NMOSE (SSPA 2007). Locations of non-irrigation wells were adopted directly from the previous model version, and the seasonal pumping rate for each non-irrigation well was set equal to the well's average seasonal pumping rate during the period 1995-2004 for irrigation and non-irrigation seasons, respectively. Seasonal non-irrigation pumping rates were held constant over the simulation period. This assumption implies that any population and economic growth during the simulation period will be accompanied by reductions in per capita water demand such that total non-irrigation demands remain constant at average 1995-2004 levels.

- *Non-Project Releases from Elephant Butte Reservoir.*

  Releases of non-Project water from Project storage are limited to the direct release from Caballo Dam to Bonita Private Lateral and reservoir spills under flood conditions. Non-Project releases to Bonita Private Lateral serve irrigation demands in the northern Rincon Valley between Caballo Dam and Percha Dam. RMBHM does not simulate demand-driven non-Project releases; rather, non-Project releases are represented as a time-varying input. For simulations performed in support of the EIS, it is assumed that non-Project releases are constant for each season over the model simulation

period. Non-Project releases during the irrigation season were approximated based on the average annual non-Project release during recent years (2001 through 2010); non-Project releases during this period are consistent with the long-term average non-Project releases over the period 1950-2010. Consistent with recent historical records, non-Project releases during the non-irrigation season are assumed to be zero.

- *Project Water Demands in El Paso Valley*

  Project water demands in El Paso Valley are not explicitly simulated in RMBHM. In order to represent Project diversions at American Dam to American Canal, a diversion demand was specified at the heading of American Canal. RMBHM then simulates Project diversions to American Canal based on the specified diversion demand and the simulated diversion allocation available to EPCWID; water diverted to American Canal is subsequently routed out of the model domain. This approach allows RMBHM to simulate Project diversions to American Canal without explicitly simulating water demands and routing of Project surface water to delivery points for use in El Paso Valley, which lies outside of the model spatial domain.

  For simulations performed in support of the EIS, it is assumed that Project demands in the El Paso Valley portion of EPCWID can be adequately represented as a diversion demand at the American Canal heading, as opposed to end-user demands at points of delivery (e.g., farm or municipal delivery requirement). In addition, it was assumed that future diversion demands over the simulation period will be consistent with recent diversions in years when Project allocation to EPCWID was equal to or greater than the district's historical full allocation of 376,842 acre-feet under prior operating practices. The EPCWID diversion demand for American Canal was therefore calculated based on historical gross diversions to American Canal for the years 2007-2010. The diversion demand for American Canal was specified as constant for all irrigation seasons over the simulation period.

  The diversion demand used here represents the expected maximum diversion to American Canal under full-supply conditions. It should be noted that simulated actual diversions to American Canal are curtailed (reduced) when the simulated diversion allocation available to EPCWID is less than full. Simulated diversions are constrained such that for each year, the sum of diversion charges and credits to EPCWID are less than or equal to the district's total diversion allocation for that year.

- *Project Water Demands for Delivery to Mexico*

  Project water demands in Mexico are not explicitly simulated in RMBHM. In order to represent Project deliveries to the heading of the Acequia Madre for diversion to Mexico, a diversion demand was specified at the downstream-most segment of the Rio Grande represented on the model domain, located at Paso del Norte, approximately 1.5 miles upstream of International Dam. RMBHM then simulates Project deliveries to Mexico based on the specified diversion demand and the simulated diversion allocation available to Mexico; water delivered to Paso del Norte for diversion to Mexico is subsequently routed out of the model domain.

  For simulations performed in support of the EIS, it is assumed that Project deliveries to the heading of the Acequia Madre are always equal to the annual Project allocation to Mexico, where the annual allocation to Mexico is calculated based on the D1 Curve as described above in Section 4. In the event of a discrepancy between diversion allocation and actual water available for diversion, delivery to Mexico takes priority over diversions to serve Project lands in the United States. This assumption is consistent with historical operations and ensures that Project obligations to deliver water to the heading of the Acequia Madre according to the 1906 Convention are satisfied.

- *Project Water Accounting for Diversions in Rincon and Mesilla Valleys*

  As summarized in Section 6.2, the surface water network in the Rincon and Mesilla valleys is represented in RMBHM as a network of discrete segments and reaches. Larger channels are represented explicitly in the model, whereas smaller channels are not represented explicitly. As a result, several smaller Project diversions in the Rincon and Mesilla valleys are not explicitly represented in the simulated Project accounting. These smaller diversions include the Del Rio Lateral, which receives water at Mesilla Diversion Dam, and pumping of surface water directly from the Rio Grande at several locations. These smaller diversions and the corresponding accounting charges are lumped with the major diversions represented explicitly in the model (Percha Lateral, Arrey Canal, Leasburg Canal, Eastside Canal, Westside Canal, American Canal, and Acequia Madre).

- *Project Water Accounting for Diversions to El Paso Valley*

  Project water accounting involves the calculation of charges and credits to the Project allocation balances of EBID, EPCWID, and Mexico representing each entity's use of Project surface-water supplies. Allocation charges represent the amount of Project water diverted from the Rio Grande and thus not available for downstream diversion, and allocation credits represent the amount of water returned to the Rio Grande that contributes to the supply available for downstream diversions (see Section 4).

Actual charges and credits to EPCWID's Project allocation balance for water delivered to El Paso Valley are based on water orders and deliveries at four locations served by American Canal: the intakes to the Umbenhaurer-Robertson and Jonathon W. Rogers water treatment facilities and the headings of Riverside and Franklin Canals. RMBHM specifies a diversion demand at American Canal and simulates diversion of Project water at American Dam to the heading of American Canal; however, routing and delivery of Project water to accounting points in El Paso Valley is not explicitly represented (see previous assumption regarding water demands for El Paso Valley).

In order to represent allocation charges and credits to EPCWID for Project water diverted to El Paso Valley, RMBHM approximates allocation charges and credits by multiplying simulated gross diversions to American Canal by a constant charge factor and credit factor, respectively. Charge and credit factors are specified as inputs to RMBHM. The charge factor represents the charge in acre-feet against EPCWID's water allotment balance per acre-foot of water diverted at the heading of the American Canal. Similarly, the credit factor represents the credit, in acre-feet, to EPCWID's water account per acre-foot of water diverted. The use of charge and credit factors allows RMBHM to represent charges and credits to EPCWID for water diverted to El Paso Valley without explicitly routing water to the four delivery locations listed above.

For simulations performed in support of the EIS, charge and credit factors were calculated based on records of gross diversions and charges to EPCWID in El Paso Valley during recent years when the Project diversion allocation to EPCWID was greater than or equal to the district's historical full allocation of 376,842 AF under prior operating practices (2007-2010). The charge factor was calculated as the ratio of total annual Project charges to EPCWID for El Paso Valley divided by the annual gross diversion at American Canal, averaged over the period 2007-2010. Similarly, a credit factor was calculated as the ratio of total annual credits to EPCWID for El Paso Valley divided by the annual gross diversion at American Canal, averaged over the same period. Based on recent Project records, a charge factor of 0.908 and credit factor of 0.086 were used for simulations performed to support the EIS.

- *Surface Water Inflows below Caballo Dam*

Surface water inflows to the Rio Grande within the RMBHM model domain—i.e., between Caballo Dam and Paso del Norte—include storm runoff and treated effluent from wastewater treatment facilities. Storm runoff originates primarily in the mountains bordering the Rincon and Mesilla valleys and reaching the valleys via ephemeral arroyos, with minor contributions from local runoff within the valleys. Neither comprehensive records nor estimates of storm runoff exist within the RMBHM model

domain; however, previous studies suggest that storm runoff accounts for a small fraction of the total water entering the basins (Conover 1954, SSPA 2007). Given the lack of available data, storm runoff is neglected in RMBHM.

Records of treated effluent returned to the river system are available for Las Cruces, NM and Anthony, TX. Previous modeling efforts represented treated effluent as a time-varying inflow to the Rio Grande, with seasonal effluent rates based on historical records (SSPA 2007). For simulations performed to support the EIS, the rate of effluent discharge to the Rio Grande was assumed to be constant over the simulation period (2007-2050), with effluent rates calculated as the average rate over the period 1995-2004. This assumption implies that effluent reaching the Rio Grande will not be affected by potential population and economic growth during the simulation period.

- *Calculation of San Juan-Chama Project Water in Elephant Butte Reservoir*

  The quantity of SJC Project water in Elephant Butte Reservoir is calculated using a spreadsheet post-processing tool. Input to the post-processing tool includes Project storage in Elephant Butte and Caballo reservoirs simulated by RMBHM, as well as Rio Grande Compact credit water and area-capacity-elevation tables for Elephant Butte and Caballo reservoirs used as input to RMBHM. The post-processing tool uses these inputs to compute the amount of SJC Project water in Elephant Butte, which is calculated as the lesser of the available storage (reservoir capacity minus reservoir storage at each time step) and 50,000 AF.

  This post-processing approach is based on two assumptions. First, Rio Grande Project water and Rio Grande Compact credit water in Elephant Butte are not affected by storage of SJC Project water. As a result, the amount of SJC Project water in Elephant Butte Reservoir is limited to the lesser of the contractual storage volume (50,000 acre-feet) and the available storage in Elephant Butte Reservoir. This approach implies that Project water is not released from Elephant Butte to allow for additional storage of SJC Project water in Elephant Butte, even if additional storage is available in Caballo Reservoir. Similarly, this approach implies that Rio Grande Compact credit water is not relinquished or released to allow for storage of SJC Project water.

  Second, this post-processing approach assumes that SJC Project contractors will fully utilize their contractually available storage. Analysis of San Juan-Chama Project operations and availability of SJC Project water for storage in Elephant Butte Reservoir is beyond the scope of the modeling and analysis described here. It is therefore assumed that SJC Project contractors will fully utilize the contractually available storage.

- *Consistent Representation of Project Operating Procedures over Simulation Period*

  Historically, Project operating procedures have been modified and improved over time to reflect changes in operating priorities and responsibilities between Reclamation, EBID, and EPCWID, and to respond to changes in hydrologic, climatic, and regulatory conditions affecting the Project. The OA allows for modification of the operating procedures defined in the OA and corresponding Operations Manual, provided that all parties to the OA agree to the modifications.

  It is not possible to anticipate future modifications to Project operating procedures that may occur during the remaining term of the OA through December 31, 2050. For simulations performed in support of the EIS, it was therefore assumed that operating procedures would remain consistent over the full simulation period.

# 7 Summary of Model Output

RMBHM was used to simulate each of five EIS alternatives (see Section 5) under each of three selected projections of future climate and hydrologic conditions (see Section 6.4). Formatted model outputs for selected hydrologic and operational parameters are provided as Appendix A of this technical memorandum; complete model files and unformatted model outputs are provided as Appendix B.

Model outputs are provided to support analysis of the potential effects of alternative Project operating procedures and SJC Project storage contracts on Project operations and surface-water and groundwater resources in the Rincon and Mesilla Basins as part of the EIS. A brief summary of key findings from the model simulations performed in support of the EIS is provided below. Detailed analysis of model results will be performed as part of the EIS and is beyond the scope of this memorandum.

(1) Project Storage: For each climate scenario, the rate and timing of simulated fluctuations in total storage and Project storage in Elephant Butte and Caballo reservoirs are qualitatively similar across all EIS alternatives. Results suggest that EIS alternatives are not likely to have a strong effect on Project storage or total annual Project releases.

(2) Project Diversions and Deliveries: Project diversions and deliveries to EBID vary between EIS alternatives; by contrast, diversions and deliveries to EPCWID exhibit little sensitivity to alternative allocation and accounting procedures. Differences in Project diversions and deliveries to EBID between EIS alternatives are consistent with the diversion ratio provision of the OA, which maintains the annual Project diversion

allocation to EPCWID based on the D-2 Curve and adjusts the annual Project diversion allocation to EBID to account for changes in Project performance (see Section 4). Results suggest that EIS alternatives are likely to affect the magnitude of surface water depletions due to groundwater pumping in the Rincon and Mesilla Valleys, annual Project performance, the quantity of surface water diversions to EBID, and the distribution of Project diversions between EBID and EPCWID.

(3) Total Farm Deliveries (Surface Water + Groundwater): As discussed in Sections 6.2 and 6.5, simulations carried out in support of the EIS assume that crop irrigation requirements are met in full: irrigation requirement that is not satisfied by Project surface-water deliveries is met through supplemental groundwater deliveries. Groundwater deliveries to irrigated lands represent supplemental groundwater pumping by individual farmers, as authorized by the States; groundwater pumping is neither performed nor authorized by the Federal project, and the model does not represent groundwater pumping by either irrigation district. Combined total delivery of Project surface-water and supplemental groundwater to Project lands in Rincon and Mesilla Valleys is, therefore, nearly identical under all alternatives. However, since the deliveries of Project surface-water vary between alternatives, the portion of total deliveries and consumptive use met by Project surface-water varies accordingly. Results suggest that the proposed alternatives do not affect the total delivery and consumptive use within EBID and the portion of EPCWID in the Mesilla Valley, but do affect the portion of deliveries and consumptive use met by Project surface-water.

(4) Groundwater Levels and Project Performance: Groundwater levels in the Rincon and Mesilla Basins exhibit seasonal declines (drawdown) during the irrigation season and multi-year declines during sustained dry periods under all alternatives, with corresponding seasonal recovery during the non-irrigation season and multi-year recovery during sustained wet periods. Project performance, as represented by the annual diversion ratio, exhibits similar multi-year behavior, with declines during sustained dry spells and recovery during sustained wet spells. Declines in groundwater levels and Project performance are greatest under alternatives that include the diversion ratio adjustment provision of the OA (Alternatives 1, 2, and 3). However, groundwater levels and Project performance recover to approximately the same level during sustained wet spells under all alternatives. Results suggest that the diversion ratio adjustment provision of the OA may result in increased declines in groundwater levels and Project performance during sustained dry periods, but that these effects are temporary and do not results in permanent effects on groundwater resources or Project performance.

(5) Climate Uncertainties: For each EIS alternative, Project storage, releases, diversions, and deliveries vary substantially between the three climate

scenarios. In addition, relative differences in storage, releases, diversions, and deliveries between alternatives also vary between climate scenarios. Results suggest that uncertainties in future Project operations resulting from uncertainties in future climate and hydrologic conditions are substantially larger than the estimated effects of proposed allocation and accounting alternatives.

To support further analysis for the EIS, formatted simulation results for key operational and hydrologic parameters are provided in graphical and tabular form as a digital appendix to this memorandum; operational and hydrologic parameters included in the attached simulation results are briefly described below and are listed in detail in Table 2 (below). All data provided in the digital appendix are RMBHM model output for the operating alternatives and climate scenarios described herein; corresponding historical records for the parameters listed below and in Table 2 are not provided here.

- *Reservoir Storage, Elevation, and Area:*

  Monthly storage in Elephant Butte and Caballo reservoirs, including storage of Project water, Rio Grande Compact credit water, and SJC Project water. Monthly reservoir surface elevation and area for Elephant Butte Reservoir, computed from monthly total storage using the current area-capacity-elevation tables for Elephant Butte Reservoir.

- *Releases:*

  Annual release from Caballo Dam, including releases for Project diversions, spills, and non-Project deliveries to Bonita Private Lateral.

- *Project Diversions:*

  Annual Project surface-water diversions from the Rio Grande, including gross diversions at each Project canal heading and net diversions to each canal service area. Project canal headings include Percha Lateral, Arrey Canal, Leasburg Canal, Eastside Canal, Westside Canal, American Canal, and Acequia Madre. Canal service areas include Percha Lateral, Arrey Canal, Leasburg Canal, Eastside Canal in New Mexico, Westside Canal in New Mexico, Eastside Canal in Texas, Westside Canal in Texas, American Canal, and Acequia Madre

- *Project Deliveries:*

  Annual Project surface-water deliveries to Project lands in EBID and to Project lands in the Mesilla Valley portion of EPCWID.

- *Groundwater Deliveries:*

  Annual Supplemental groundwater deliveries to Project lands in EBID and to Project lands in the Mesilla Valley portion of EPCWID.

- *Project Performance Metrics:*

  Annual Project performance metrics, including the Project diversion ratio and service area delivery efficiencies. The Project diversion ratio is calculated as the sum of gross annual Project allocation charges divided by annual Project releases from Caballo Dam. Service area delivery efficiencies are calculates as the total Project surface-water delivery divided by the net surface-water diversion to each service area.

Model results for the parameters listed above are presented, in graphical and tabular form, in a digital appendix to this memorandum.

Table 2: Summary of Formatted Operational and Hydrologic Parameters Provided in Appendix A

| Parameter Name | Description | Workbook(s) / Worksheet(s) |
|---|---|---|
| **Annual Allocated Water** | Diversion allocations to EBID and EPCWID determined during each year based on usable water available for current year allocation. Annual allocated water is updated each month throughout the year.<br><br>**Alternatives 1, 2, 3**: Annual Allocated Water is computed based on the D1 and D2 equations, adjusted for current-year actual project performance per the diversion ratio provision of the Operating Agreement.<br><br>**Alternatives 4, 5**: Annual Allocated Water is computed based on the D1 and D2 equations, without adjustment. | ALLOCATION.xlsx / EBID Annual<br>ALLOCATION.xlsx / EPCWID Annual |
| **Carryover Water** | Diversion allocations to EBID and EPCWID determined at start of each year based on the allotment balance remaining at the end of the previous year<br><br>**Alternatives 1, 2, 4**: Carryover Water is computed at the start of each water year from each district's unused allocation balance at the end of the previous year per the carryover provision of the Operating Agreement; Carryover Water is then held constant over the year.<br><br>**Alternatives 3, 5**: Carryover Water is equal to zero. | ALLOCATION.xlsx / EBID Carryover<br>ALLOCATION.xlsx / EPCWID Carryover |

| Parameter Name | Description | Workbook(s) / Worksheet(s) |
|---|---|---|
| **Total Diversion Allocation** | Total diversion allocations to EBID, EPCWID, and Mexico each year.<br><br>**Alternatives 1-5**: Total diversion allocations to EBID and EPCWID are equal to the sum of each district's respective Annual Allocated Water and Carryover Water. Total diversion allocation to Mexico is calculated based on the D1 regression equation as specified in the Operating Agreement. | ALLOCATION.xlsx / EBID Total<br>ALLOCATION.xlsx / EPCWID Total<br>ALLOCATION.xlsx / MEXICO Total |
| **Total Storage** | Total volume of water in Elephant Butte and Caballo reservoirs at the end of each month (acre-feet).<br><br>**Alternatives 1, 3, 4, 5**: Total storage computed as sum of Project water, Rio Grande Compact credit water, and San Juan-Chama Project water in Elephant Butte Reservoir and Project water in Caballo Reservoir; Rio Grande Compact credit water adopted from URGIA; Rio Grande Project water simulated by RMBHM; San Juan-Chama water storage computed via post-processing.<br><br>**Alternatives 2**: Total storage computed as sum of Project water and Rio Grande Compact credit water in Elephant Butte Reservoir and Project water in Caballo Reservoir; Rio Grande Compact credit water adopted from URGIA; Rio Grande Project water simulated by RMBHM; no San Juan-Chama Project water is stored in this alternative. | RESERVOIR_STORAGE.xlsx / STORAGE Total |

| Parameter Name | Description | Workbook(s) / Worksheet(s) |
|---|---|---|
| **Project Storage** | Total volume of Project water in Elephant Butte and Caballo reservoirs at the end of each month, exclusive of Rio Grande Compact credit water and San Juan-Chama Project water (acre-feet)<br><br>**Alternatives 1-5**: Total storage computed as sum of Project water in Elephant Butte and in Caballo Reservoirs; Rio Grande Project water simulated by RMBHM. | RESERVOIR_STORAGE.xlsx /<br>STORAGE ElephantButte.Project<br>RESERVOIR_STORAGE.xlsx /<br>STORAGE Caballo.Project |
| **Elephant Butte Storage** | Total volume of water in Elephant Butte Reservoir at the end of each month, including Project water, Rio Grande Compact credit water, and San Juan-Chama Project water (acre-feet)<br><br>**Alternatives 1, 3, 4, 5**: Total Elephant Butte storage computed as sum of Project water, Rio Grande Compact credit water, and San Juan-Chama Project water in Elephant Butte Reservoir; Rio Grande Compact credit water adopted from URGIA; Rio Grande Project water simulated by RMBHM; San Juan-Chama water storage computed via post-processing.<br><br>**Alternative 2**: Total Elephant Butte storage computed as sum of Project water and Rio Grande Compact credit water; Rio Grande Compact credit water adopted from URGIA; Rio Grande Project water simulated by RMBHM; no San Juan-Chama Project water is stored in Elephant Butte Reservoir under Alternative 2. | RESERVOIR_STORAGE.xlsx /<br>STORAGE ElephantButte.Project<br>RESERVOIR_STORAGE.xlsx /<br>STORAGE ElephantButte.RGCC<br>RESERVOIR_STORAGE.xlsx /<br>STORAGE ElephantButte.SJC Project<br>RESERVOIR_STORAGE.xlsx /<br>STORAGE ElephantButte.Total |

| Parameter Name | Description | Workbook(s) / Worksheet(s) |
|---|---|---|
| **Elephant Butte Elevation** | Water surface elevation of Elephant Butte Reservoir at the end of each month (feet above mean sea level).<br><br>**Alternatives 1-5**: Reservoir elevation computed from Elephent Butte storage using Elephant Butte Reservoir area-capacity-elevation relationship (Reclamation 2007, Reclamation 2008a). | RESERVOIR_ELEVATION.xlsx / ELEVATION ElephantButte |
| **Elephant Butte Surface Area** | Reservoir surface area of Elephant Butte Reservoir at the end of each month (acres).<br><br>**Alternatives 1-5**: Reservoir surface area computed from Elephent Butte storage using Elephant Butte Reservoir area-capacity-elevation relationship (Reclamation 2007, Reclamation 2008a). | RESERVOIR_AREA.xlsx / AREA ElephantButte |
| **Project Release** | Total volume of Project water released from Caballo Dam during each year to meet Project diversion demands (acre-feet).<br><br>**Alternatives 1-5**: Project release simulated by RMBHM. | RELEASE.xlsx / RELEASE Project |
| **Non-Project Release** | Total volume of non-Project water released Caballo Dam during each year for non-Project purposes (acre-feet).<br><br>**Alternatives 1-5**: Non-Project release specified as input to RMBHM. | RELEASE.xlsx / RELEASE Non-Project |

| Parameter Name | Description | Workbook(s) / Worksheet(s) |
|---|---|---|
| **Spill Release** | Total volume of water released from Caballo Dam as reservoir spills during each year (acre-feet).<br><br>**Alternatives 1-5**: Project release simulated by RMBHM. | RELEASE.xlsx / RELEASE Spill |
| **River Release** | Total volume of water released from Caballo Dam to the Rio Grande during each year (acre-feet).<br><br>**Alternatives 1-5**: Total Release is calculated as the sum of Project and spill releases; non-Project water is released directly to Bonita Private Lateral. | RELEASE.xlsx / RELEASE RiverTotal |
| **Total Release** | Total volume of water released from Caballo Dam during each year (acre-feet).<br><br>**Alternatives 1-5**: Total Release is calculated as the sum of Project, non-Project, and spill releases. | RELEASE.xlsx / RELEASE Total |

| Parameter Name | Description | Workbook(s) / Worksheet(s) |
|---|---|---|
| **Gross Diversions** | Total volume of Project surface-water diverted from the Rio Grande at canal headings for Percha Canal, Arrey Canal, Leasburg Canal, Eastside Canal, Westside Canal, American Canal, and Acequia Madre and summed over headings; total volume of Project surface-water diverted to EBID at river headings; total volume of water diverted to EPCWID at river headings and bypass locations; total volume of water diverted to Mexico at river headings (acre-feet).<br><br>**Alternatives 1-5**: Gross diversions simulated by RMBHM. | DIVERSION_GROSS.xlsx /<br>Gross Diversion PERCHA LATERAL<br>DIVERSION_GROSS.xlsx /<br>Gross Diversion ARREY CANAL<br>DIVERSION_GROSS.xlsx /<br>Gross Diversion LEASBURG CANAL<br>DIVERSION_GROSS.xlsx /<br>Gross Diversion EASTSIDE CANAL<br>DIVERSION_GROSS.xlsx /<br>Gross Diversion WESTSIDE CANAL<br>DIVERSION_GROSS.xlsx /<br>Gross Diversion AMERICAN CANAL<br>DIVERSION_GROSS.xlsx /<br>Gross Diversion ACEQUIA MADRE<br>DIVERSION_GROSS.xlsx /<br>Gross Diversion EBID<br>DIVERSION_GROSS.xlsx /<br>Gross Diversion EPCWID<br>DIVERSION_GROSS.xlsx /<br>Gross Diversion MEXICO |
| **Net Diversions** | Net surface-water diversion to each district (acre-feet).<br><br>**Alternatives 1-5**: Net diversions calculated for each district as gross diversions minus water bypassed to a downstream district or to the Rio Grande.<br><br>NOTE: Net diversions to EPCWID calculated for Mesilla Valley only. | DIVERSION_NET.xlsx / Net Diversion EBID<br>DIVERSION_NET.xlsx / Net Diversion EPCWID (R&M Only) |

| Parameter Name | Description | Workbook(s) / Worksheet(s) |
|---|---|---|
| **Farm Surface Water Deliveries** | Total volume of surface-water delivered to farms (i.e., take out of conveyance and applied to irrigated lands; acre-feet).<br><br>**Alternatives 1-5**: Farm surface-water deliveries simulated by RMBHM.<br><br>NOTE: Farm surface-water deliveries to EPCWID calculated for Mesilla Valley only. | FARM_SW_DELIVERY.xlsx /<br>SW Delivery EBID<br>FARM_SW_DELIVERY.xlsx /<br>SW Delivery EPCWID (R&M Only) |
| **Farm Groundwater Deliveries** | Total volume of groundwater delivered to farms (i.e., groundwater pumping for supplemental irrigation; acre-feet).<br><br>**Alternatives 1-5**: Farm groundwater deliveries simulated by RMBHM.<br><br>NOTE: Farm groundwater deliveries to EPCWID calculated for Mesilla Valley only. | FARM_GW_DELIVERY.xlsx /<br>GW Delivery EBID<br>FARM_GW_DELIVERY.xlsx /<br>GW Delivery EPCWID (R&M Only) |
| **Farm Consumptive Use** | Total volume of water consumed by irrigated agriculture through evapotranspiration from crops within EBID and EPCWID (acre-feet).<br><br>**Alternatives 1-5**: Farm consumptive use simulated by RMBHM.<br><br>NOTE: Farm consumptive use by EPCWID calculated for Mesilla Valley only. | FARM_CONSUMPTIVE_USE.xlsx /<br>FarmConsumptiveUse EBID<br>FARM_CONSUMPTIVE_USE.xlsx /<br>FarmConsumptiveUse EPWID (R&M) |

| Parameter Name | Description | Workbook(s) / Worksheet(s) |
|---|---|---|
| **Farm Deep Percolation** | Total volume of deep percolation below the root zone in irrigated areas within EBID and EPCWID (acre-feet).<br><br>**Alternatives 1-5**: Farm deep percolation simulated by RMBHM.<br><br>NOTE: Farm deep percolation in EPCWID calculated for Mesilla Valley only. | FARM_DEEP_PERCOLATION.xlsx /<br>FarmDeepPercolation EBID<br>FARM_DEEP_PERCOLATION.xlsx /<br>FarmDeepPercolation EPWID(R&M) |
| **Farm Net Recharge** | Total volume of net recharge below the root zone in irrigated areas within EBID and EPCWID (acre-feet).<br><br>**Alternatives 1-5**: Farm net recharge simulated by RMBHM as deep percolation minus farm well pumping minus direct uptake of groundwater by crops.<br><br>NOTE: Farm net recharge in EPCWID calculated for Mesilla Valley only. | FARM_NET_RECHARGE.xlsx /<br>FarmNetRecharge EBID<br>FARM_NET_RECHARGE.xlsx /<br>FarmNetRecharge EPWID(R&M) |
| **Seepage Recharge** | Total volume of recharge to groundwater from stream seepage within EBID and EPCWID (acre-feet).<br><br>**Alternatives 1-5**: Seepage recharge simulated by RMBHM using SFR package in MODFLOW-OWHN; seepage summed over stream segments within each district.<br><br>NOTE: Seepage recharge within EPCWID calculated for Mesilla Valley only. | SEEPAGE_RECHARGE.xlsx /<br>SEEPAGE RECHARGE EBID<br>SEEPAGE_RECHARGE.xlsx /<br>SEEPAGE RECHARGE EPWID(R&M) |

| Parameter Name | Description | Workbook(s) / Worksheet(s) |
|---|---|---|
| **Groundwater Head (timeseries)** | Monthly groundwater head (water table elevation) at selected locations corresponding to monitoring wells in the Rincon and Mesilla valleys (feet above mean sea level).<br><br>**Alternatives 1-5**: Groundwater head simulated by RMBHM.<br><br>NOTE: See worksheet 'WELL LOCATIONS' for description of well locations, depths, and distance from the Rio Grande. | HEAD.xlsx / <Well-ID> |
| **Groundwater Head (grids)** | Spatially distributed groundwater heads in the upper model layer (layer 1) at selected times throughout the simulation period (feet above mean sea level).<br><br>**Alternatives 1-5**: Groundwater head simulated by RMBHM. | HEAD.Grid_<YEAR>.xlsx / <Alternative>.<Scenario> |
| **Diversion Ratio** | Annual diversion ratio for Rio Grande Project, computed as total annual Project diversions at river headings divided by total annual Project release (dimensionless).<br><br>**Alternatives 1-5**: Calculated from sum of simulated annual gross diversions and annual releases. | CONVEYANCE.xlsx / DivRatio |

| Parameter Name | Description | Workbook(s) / Worksheet(s) |
|---|---|---|
| **Delivery Efficiency** | Annual delivery efficiency for each district, computed as total annual Project surface-water delivery divided by total net surface-water diversion for each district (dimensionless).<br><br>**Alternatives 1-5**: Calculated from sum of simulated annual surface-water deliveries and net diversions.<br><br>NOTE: Delivery efficiency for EPCWID calculated for Mesilla Valley only. | CONVEYANCE.xlsx / DeliveryEfficiency EBID<br>CONVEYANCE.xlsx / DeliveryEfficiency EPCWID (R&M) |

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# Appendix A:

## Formatted Model Results for Selected Operational and Hydrologic Parameters

Digital Appendix File List:

ALLOCATION.xlsx
CONVEYANCE.xlsx
DIVERSION_GROSS.xlsx
DIVERSION_NET.xlsx
FARM_CONSUMPTIVE_USE.xlsx
FARM_DEEP_PERCOLATION.xlsx
FARM_GW_DELIVERY.xlsx
FARM_NET_RECHARGE.xlsx
FARM_SW_DELIVERY.xlsx
HEAD.xlsx
RELEASE.xlsx
RESERVOIR_AREA.xlsx
RESERVOIR_ELEVATION.xlsx
RESERVOIR_STORAGE.xlsx
SEEPAGE_RECHARGE.xlsx
HEAD.GRID_2010.xlsx
HEAD.GRID_2020.xlsx
HEAD.GRID_2030.xlsx
HEAD.GRID_2040.xlsx
HEAD.GRID_2050.xlsx

# Appendix B:

## Model Files and Unformatted Model Output

Digital Appendix File List[9]:

EIS.Alt1.ScenarioP25.zip
EIS.Alt1.ScenarioP50.zip
EIS.Alt1.ScenarioP75.zip
EIS.Alt3.ScenarioP25.zip
EIS.Alt3.ScenarioP50.zip
EIS.Alt3.ScenarioP75.zip
EIS.Alt4.ScenarioP25.zip
EIS.Alt4.ScenarioP50.zip
EIS.Alt4.ScenarioP75.zip
EIS.Alt5.ScenarioP25.zip
EIS.Alt5.ScenarioP50.zip
EIS.Alt5.ScenarioP75.zip

[9] Alternatives 1 and 2 utilize the same Rio Grande Project operating procedures and differ only with respect to storage of SJC Project water (see Section 5). RMBHM model files and unformatted output for Alternative 1 are used to evaluate Alternative 2; differences between Alternative 1 and Alternative 2 occur during post-processing of SJC Project water in Elephant Butte Reservoir. Post-processed storage results for Alternatives 1 and 2 are provided in Appendix A.

# Addendum:

## Additional Documentation of Model Software

This addendum provides additional documentation of the integrated hydrologic modeling software used by RMBHM.

As summarized in Section 6.1 of this technical memorandum, RMBHM uses a version of the MODFLOW One Water Hydrologic Flow Model (MODFLOW-OWHM) that has been enhanced with additional software features developed and implemented by Reclamation in collaboration with USGS. These new software features provide the capability to simulate Rio Grande Project (Project) surface-water operations, including Project storage, allocation, release, diversion, delivery, and water accounting. New features are linked to existing features of MF-OWHM, including the Farm Process (FMP) and streamflow routing package (SFR), to allow dynamic simulation of both surface-water and groundwater management and use.

The new software features used by RMBHM to simulate Project surface-water operations are the basis of the newly developed Surface Water Operations Process (SWO) for MODFLOW-OWHM (Reclamation 2015)[1]. SWO was developed as a collaborative effort between the Reclamation and USGS to allow dynamic simulation of large-scale surface-water management within MODFLOW-based hydrologic models. By simulating large-scale water management within the integrated hydrologic framework of MODFLOW-OWHM, SWO allows for simulation and analysis of two-way feedbacks between groundwater and surface-water management and use. As summarized in Section 6.1, the new features provided by SWO allow for analysis of the effects of reservoir operations and surface-water distribution on groundwater recharge and demand, as well as effects of groundwater use on surface-water availability, conveyance, and management. Detailed documentation of SWO is provided by Reclamation (2015).

As described in Section 3.5 of Reclamation (2015), SWO requires the user to specify a project-specific allocation procedure in the form of a Fortran subroutine compiled with the MODFLOW-OWHM source code. Four allocation subroutines were developed for RMBHM corresponding to each of the four allocation alternatives considered in the Rio Grande Project Operating Agreement EIS (see Section 5 of this technical memorandum). The allocation procedure for Alternative 1 calculates annual diversion allocations to EBID, EPCWID, and

[1] Reclamation (2015). User Guide to the Surface Water Operations Process: An Integrated Approach to Simulating Large-Scale Surface Water Management in MODFLOW-Based Hydrologic Models. U.S. Department of the Interior, Bureau of Reclamation, Technical Memorandum No. 86-68210-2016-02; Denver, CO; December 2015.

Mexico according to the procedures specified in the Rio Grande Project Operating Agreement (Reclamation et al. 2008) and the corresponding Operations Manual (Reclamation et al. 2012). The allocation procedure was subsequently modified for Alternatives 3, 4, and 5 as summarized in Section 5 of this technical memorandum.

In addition to the allocation subroutines developed for each alternative, the version of SWO used by RMBHM exhibits minor differences compared to the description provided by Reclamation (2015). These differences are summarized below.

***Changes to SWO Input Files***:
The version of SWO used by RMBHM exhibits minor changes to the SWO inputs compared to the detailed description provided by Reclamation (2015). These changes do not affect the calculations performed by SWO. Changes to inputs include:

- **SWO Key Word**
  Reclamation (2015) describes the SWO input file as being read from the MODFLOW name file. The version of SWO used by RMBHM instead reads the SWO input file from within the input file for the Farm Process (FMP). In this version, SWO is activated by specifying the key word "SWOPS" in the FMP input file following the list of surface-water flags in Item 2(c) (see Hanson et al. 2014, Appendix A). If the key word "SWOPS" is included in the FMP file, then the file path and filename of the SWO input file are read from the following line of the file.

- **SWO Input Items**
  The version of SWO used by RMBHM includes several input items that are not included in the description provided by Reclamation (2015). These inputs were anticipated to be used by SWO in surface-water allocation and accounting calculations. The final version of SWO, however, did not actually use these inputs in any calculations; the inputs were therefore removed from the general SWO input file described by Reclamation (2015). These inputs are present in the input files for RMBHM used in support of the EIS and are therefore described below. These input items do not affect any of the calculations performed by SWO as described by Reclamation (2015).

  <u>Input Item 8: Allocation Options</u>
  Chapter 5 of Reclamation et al. (2015) defines Item 8 of the SWO input file as consisting of a single allocation option **AllocDate** that specifies the day of year for the first day of the water year as a decimal date. The RMBHM input file includes two input flag in Item 8, read from the same line. The additional option in the RMBHM input file is read as an integer value before **AllocDate** (i.e., the unused option is the first item on this line

of the SWO input file). This item was intended to specify the allocation type used in a given simulation; however, SWO ultimately requires that the allocation procedure be specified by the user as a Fortran subroutine. As a result, this option is not used. However, this option must be present in the SWO input files for RMBHM or an error will occur when reading the input file.

Input Item 9: SWO Reservoir Dimensions

Chapter 5 of Reclamation (2015) defines Item 9 of the SWO input file as consisting of a single list of integers **IRESFL(NPROJ)** specifying the number of reservoirs for each project. The RMBHM input file includes a second input list in Item 9, read from the line following **IRESFL(NPROJ)**. The second list was intended to specify whether a given reservoir is linked to the General Head Boundary Package (GHB) to a head boundary corresponding to the reservoir surface elevation. The linkage between SWO and GHB was not implemented in the initial version of SWO described by Reclamation (2015) and is therefore not described in Chapter 5 of that document. However, this option must be present in the SWO input files for RMBHM or an error will occur when reading the input file.

Input Item between Item 9 and Item 10: Grid Index Arrays

The RMBHM input file includes four additional input items between Items 9 and 10 described by Reclamation (2015), each read from a separate line of the SWO input file. Each of the four inputs between Items 9 and 10 is a two-dimensional array of integer index values. These arrays were intended to define which grid cells in the model are associated with each *project*, *division*, *unit*, and FMP-linked *beneficiary* defined in the model (see Reclamation (2015), Chapter 2). These index arrays ultimately are not used by SWO in any calculations; as a result, they were removed from the SWO input file described by Reclamation (2015). However, all four arrays must be present in the SWO input files for RMBHM or an error will occur when reading the input file.

***Changes to SWO Output Files***:

The version of SWO used by RMBHM includes one additional output file that is not included in the general version of SWO described by Reclamation (2015). The additional input file is similar to the *service area* output file described in Chapter 6 of Reclamation (2015), which provides detailed information of surface-water demands, delivery and diversion orders, and actual diversions and deliveries for each *service area* represented in a given model. The additional output file in the version of SWO used by RMBHM, however, provides similar information for all conveyance network junctions within all *service areas* represented in the model. This additional output file was added to SWO for RMBHM in order to evaluate the distribution of water demands and supplies at a finer spatial scale, including distribution of water through the branched conveyance network within

each *service area*. This output file provides additional information for evaluating surface-water distribution and does not affect the calculations performed by SWO.

***Changes to SWO Diversion Order Calculation***:
The version of SWO used by RMBHM includes one change to the calculations performed by SWO compared to those described by Reclamation (2015). This change only applies to the proportionate reduction of *service area* diversion orders under over-allocated conditions—i.e., in cases where the reservoir release required to meet diversion orders exceeds the maximum possible release of project water for the current time step. As described in Reclamation (2015), in cases where the maximum project release is less than the demand-driven project release—i.e., in cases where the user-specified allocation procedure for the given *project* results in over-allocated conditions—all surface-water diversion orders served by the reservoir are reduced proportionately. This calculation was modified for RMBHM to reduce only the diversion orders for EBID and EPCWID, without reducing the delivery order for Mexico. This change was made to ensure that Mexico receives its full entitlement each year under the Convention of 1906.

# Appendix D. Consultation and Coordination Correspondence

# United States Department of the Interior

BUREAU OF RECLAMATION
Upper Colorado Region
Albuquerque Area Office
555 Broadway NE, Suite 100
Albuquerque, NM 87102-2352


IN REPLY REFER TO:

SEP 16 2013

ALB-150
ENV-6.00

Interested Parties (See Enclosed List)

Subject: Invitation to Participate as a Cooperating Agency for an Environmental Impact Statement on Certain Actions within the Rio Grande Project

Dear Ladies and Gentlemen:

The Bureau of Reclamation is preparing an environmental impact statement (EIS), pursuant to the National Environmental Policy Act (NEPA), to analyze the environmental effects of continued implementation of the Rio Grande Project Operating Agreement (OA) over its entire remaining term, through 2050. In addition, this EIS will evaluate the environmental effects of renewing San Juan Chama Project storage contracts under authority of the Act of December 29, 1981, 97, 95 Stat. 1717 in Elephant Butte Reservoir.

Reclamation is responsible for coordinating the preparation of the EIS, for the administrative tasks associated with the NEPA process, and for making the final decisions, according to our authorities. The Council on Environmental Quality NEPA Implementing Regulations (40 CFR 1500-1508) call for lead agencies to reduce paperwork and delay; and eliminate duplication with state and local procedures by inviting participation of cooperating agencies to prepare an EIS. Cooperating agencies assume certain responsibilities, which may include participating in the scoping process, developing applicable information, supporting environmental analyses, and assisting the lead agency with preparation of the EIS on those topics that pertain to the cooperating agency's jurisdiction by law or special expertise.

We invite you to participate in preparing this EIS as a cooperating agency because we believe your agency or organization may have jurisdiction by law or special expertise, with respect to this actions and/or issues to be considered in this EIS. Please provide a written response by October 4, 2013, to indicate your interest in becoming a cooperating agency. In your response, please specify a point of contact. Should you request to participate as a cooperating agency, we will provide a Memorandum of Understanding (MOU) template. The MOU, which is executed through signature by Reclamation and the cooperating agency, defines the roles, responsibilities, points of contact, and other requirements and agreements, for both Reclamation and the cooperating agency.

If you have any questions about the project; or for additional information, please contact Ms. Rhea Graham at 505-462-3560 or at rgraham@usbr.gov. Thank you for your interest and consideration.

Sincerely,

Mike A. Hamman
Area Manager

Enclosure

Mr. James Salopek, President
Elephant Butte Irrigation District
530 South Melendres Street
Las Cruces, NM 88005

Mr. Johnny Stubbs, President
El Paso County Water Control,
and Improvement District No. 1
P.O. Box 749
Clint, TX 79836-0749

Mr. Daniel Chavez, General Manager
Hudspeth County Conservation and Reclamation,
District No. 1
P.O. Box 125
Ft. Hancock, Texas 79839

Mr. Mark Sanchez, Executive Director
Albuquerque Bernalillo County Water,
Utility Authority
P.O. Box 568
Albuquerque, NM 87103-0568

Mr. Rick Carpenter
Water Resources and Conservation Manager
City of Santa Fe
Sangre de Cristo Water Division
PO Box 909
Santa Fe, NM 87504-0909

Mr. Pat Gordon, Commissioner
Texas Rio Grande Compact Commission
401 East Franklin Avenue, Suite 560
El Paso, TX 79901-1212

Mr. Scott Verhines, State Engineer
New Mexico Compact Commissioner
New Mexico Office of the State Engineer
PO Box 25102
Santa Fe, NM 87504-5102

Mr. Dick Wolfe, State Engineer
Colorado Compact Commissioner
Colorado Division of Water Resources
1313 Sherman St., Suite 821
Denver, CO 80203

Mr. Gilbert Anaya
Supervisory Environmental Engineer
International Boundary & Water Commission
United States Section
Environmental Management Division
4171 North Mesa, Suite C-100
El Paso, TX 79902-1441

Dr. Jeff Pappas
State Historic Preservation Officer and Director
New Mexico Historic Preservation Division
Department of Cultural Affairs
Bataan Memorial Building
407 Galisteo Street, Suite 236
Santa Fe, NM 87501

Dr. Mark Wolfe
State Historic Preservation Officer
Texas Historical Commission
P.O. Box 12276
Austin, TX 78711-2276

Dr. Benjamin Tuggle
Regional Director
Southwest Regional Office
U.S. Fish & Wildlife Service
P.O. Box 1306
Albuquerque, NM 87103-1306

education activities, scientific research projects, boundary marking, and enforcement of existing regulations. There would be no manipulation of the marsh other than emergency, safety-related, or limited improvements or maintenance actions. The destabilized marsh would continue to erode at an accelerated rate.

Alternative B: Hydrologic Restoration and Minimal Wetland Restoration—Under alternative B, the focus is on the most essential actions to reestablish hydrologic conditions that shield the marsh from erosive currents and protect the Hog Island Gut channel and channel wall. A breakwater structure would be constructed on the south end of the marsh, in alignment with the northernmost extent of the historic promontory, and wetlands would be restored to strategic areas where the water is less than 4 feet deep. This alternative also includes fill of some deep channel areas near the breakwater. The final element of this alternative is the reestablishment of hydrologic connections to the inland side of the Haul Road to restore bottomland swamp forest areas that were cut off when the Haul Road was constructed. Approximately 30 acres west of the Haul Road could be influenced by tidal flows as a result. These actions would not necessarily happen in any particular order, and may be dictated by available funds. However, it is assumed that the breakwater would be constructed first. This alternative would create approximately 70 acres of various new wetland habitats and allow the continued natural accretion of soils and establishment of wetlands given the new hydrologic conditions.

Alternative C: Hydrologic Restoration and Fullest Possible Extent of Wetland Restoration (NPS Preferred Alternative)—Under alternative C, the marsh would be restored in a phased approach up to the historic boundary of the marsh and other adjacent areas within NPS jurisdictional boundaries. Phased restoration would continue until a sustainable marsh is achieved and the overall goals of the project are met. The historic boundaries lie between the historic promontory and Dyke Island, the triangular island off the end of the Haul Road. The outer edges of the containment cell structures would be placed at the park boundary in the river.

The initial phase of this alternative would first establish a breakwater structure at the southern alignment of the historic promontory to provide immediate protection to Dyke Marsh from erosion. After the breakwater is established, the deep channel areas north of the historic promontory would be filled within the NPS boundary, and the marsh would be restored to the 4-foot contour at strategic locations to further reduce the risk of erosion and storm surges and promote sedimentation within the existing marsh. Afterwards, two cells would be constructed along the northern edge of the breakwater, restoring the original extent of the promontory's land mass.

All subsequent phases would establish containment cells out no further than the historic marsh boundary. The location of these cells would be prioritized based on the most benefits the specific locations could provide to the existing marsh. The timing of these subsequent phases and the size and number of cells built during these phases would be dependent upon available funds and materials.

In addition to the construction of containment cells, tidal guts would be cut into the restored marsh area that would be similar to the historical flow channels of the original marsh.

This alternative, like Alternative B, would also introduce breaks in the Haul Road, returning tidal flows to approximately 30 acres west of the Haul Road, which would help to re-establish the historic swamp forest originally found on the site.

Additional wetland may be restored south of the new breakwater to fill out the southernmost historic extent of the marsh. This area would not be protected from storms, and would be one of the last features implemented. In addition, the marsh restoration would extend north of Dyke Island, and tidal guts would be created. This alternative contains an optional restoration cell in the area currently serving as a mooring area for the marina. Such an option would only be implemented should the marina concession no longer be economically viable for the current concessioner, and then only if no other concessioner expresses interest in taking over the business, which would eliminate the need for the mooring field. In total, under this alternative, approximately 245 acres of various wetland habitats could be created.

Dated: October 21, 2013.

**Stephen E. Whitesell,**

*Regional Director, National Park Service, National Capital Region.*

[FR Doc. 2014–00633 Filed 1–14–14; 8:45 am]

BILLING CODE 4310–DL–P

## DEPARTMENT OF THE INTERIOR

### Bureau of Reclamation

**[14XR0680A1, RX.00236101.0021000, RR04313000]**

### Notice of Intent To Prepare an Environmental Impact Statement and Announcement of Public Scoping Meetings for Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project, New Mexico and Texas

**AGENCY:** Bureau of Reclamation, Interior.

**ACTION:** Notice of intent.

**SUMMARY:** The Bureau of Reclamation is issuing this notice to advise the public that an environmental impact statement (EIS) will be prepared for the proposed continued implementation of the 2008 Operating Agreement over its entire remaining term (through 2050) for the Rio Grande Project in New Mexico and Texas. The Operating Agreement is a written detailed description of how Reclamation allocates, releases from storage, and delivers Rio Grande Project water to users within the Elephant Butte Irrigation District (EBID) in New Mexico, the El Paso County Water Improvement District No. 1 (EPCWID) in Texas, and to users covered by the 1906 international treaty with Mexico. In addition, this EIS proposes to evaluate the environmental effects of renewing San Juan Chama Project storage contracts under authority of the Act of December 29, 1981, Pub. L. 97–140, 95 Stat. 1717, providing for storage in Elephant Butte Reservoir.

**DATES:** Comments on the scope of the EIS must be received by February 14, 2014.

Three public scoping meetings will be held to solicit public input on the scope of the EIS, potential alternatives, and issues to be addressed in the EIS. See the **SUPPLEMENTARY INFORMATION** section for meeting dates.

**ADDRESSES:** Written comments regarding the scope and content of the EIS should be sent to Ms. Rhea Graham, Bureau of Reclamation, Albuquerque Area Office, 555 Broadway NE., Suite 100, Mail Stop ALB–103, Albuquerque, New Mexico 87102, or provided via email at *rgraham@usbr.gov.*

Those not desiring to submit comments or suggestions at this time, but who would like to receive a copy of the EIS, should contact Ms. Graham using the information cited above. See the **SUPPLEMENTARY INFORMATION** section for locations of public scoping meetings.

**FOR FURTHER INFORMATION CONTACT:** Ms. Rhea Graham, Bureau of Reclamation;

telephone 505–462–3560; email at *rgraham@usbr.gov.* Individuals who use a telecommunications device for the deaf may call the Federal Information Relay Service (FIRS) at 1–800–877–8339 to contact Ms. Graham during normal business hours. The FIRS is available 24 hours a day, 7 days a week, to leave a message or question with Ms. Graham. You will receive a reply during normal business hours.

**SUPPLEMENTARY INFORMATION:** Pursuant to the National Environmental Policy Act, Reclamation will serve as the lead federal agency for preparation of the EIS on the continued implementation of the Operating Agreement for the Rio Grande Project, New Mexico and Texas. The responsible official for this action is Reclamation's Upper Colorado Regional Director.

**Background**

The Rio Grande Project includes Elephant Butte and Caballo dams and reservoirs, a power generating plant, and five diversion dams (Percha, Leasburg, Mesilla, American, and International) located on the Rio Grande in New Mexico and Texas. The Rio Grande Project was authorized by Congress under the authority of the Reclamation Act of 1902 and the Rio Grande Project Act of February 25, 1905. The Rio Grande Project Operating Agreement was signed in 2008 to allocate Rio Grande Project water, which includes water stored in Elephant Butte and Caballo reservoirs and return flows to the Rio Grande between the EBID in the Rincon and Mesilla valleys of New Mexico and the EPCWID in the Mesilla and El Paso valleys of Texas and Mexico. The Rio Grande Project also provides water to Mexico under the 1906 international treaty. Rio Grande Project water is provided by Reclamation to irrigate a variety of crops and for municipal and industrial water uses.

**Purpose and Need for Action**

The purpose and need for action is to meet contractual obligations to EBID and EPCWID to implement a written set of criteria and procedures for allocating, delivering, and accounting for Rio Grande Project water to both districts consistent with their rights under applicable law each year in compliance with various court decrees, settlement agreements, and contracts. These include the 2008 Compromise and Settlement Agreement among Reclamation, EBID, and EPCWID, and contracts between the United States and the EBID and EPCWID. The purpose and need of an ancillary but potentially similar action is to implement the provisions of the Act of December 29, 1981, to allow the storage of San Juan-Chama project water acquired by contract with the Secretary of the Interior pursuant to Public Law 87–483 in Elephant Butte Reservoir.

**Proposed Action**

The proposed federal action is to continue to implement the 2008 Operating Agreement for the Rio Grande Project over the remaining term (through 2050), and a potentially similar action under 40 CFR 1508.25, to implement long-term contracts for storage of San Juan-Chama water in the Rio Grande Project.

**Scoping Process**

This notice initiates the scoping process which guides the development of the EIS. To ensure that the full range of issues related to this proposed action are addressed and all significant issues identified, comments and suggestions are invited from all interested parties. Comments or questions concerning this proposed action and the EIS should be directed to Reclamation using the contact information provided above. To be most effective, written comments should be received prior to the close of the comment period and should clearly articulate the commentor's concerns.

**Dates and Addresses of Public Scoping Meetings**

The scoping meeting dates and addresses are:

- Thursday, January 30, 2014, 3:00 p.m. to 5:00 p.m., Bureau of Reclamation, Albuquerque Area Office, 555 Broadway NE., Suite 100, Albuquerque, New Mexico 87102
- Friday, January 31, 2014, 6:00 p.m. to 8:00 p.m., Elephant Butte Irrigation District, 530 South Melendres Street, Las Cruces, New Mexico 88005
- Saturday, February 1, 2014, 9:00 a.m. to 11:00 a.m., Bureau of Reclamation, El Paso Field Division, 10737 Gateway West, Suite 350, El Paso, Texas 79935

**Special Assistance for Public Scoping Meetings**

If special assistance is required at the scoping meetings, please contact Ms. Graham at 505–462–3560 or email at *rgraham@usbr.gov.* Please notify Ms. Graham at least two weeks in advance of the meeting to enable Reclamation to secure the needed services. If a request cannot be honored, the requestor will be notified.

**Public Disclosure**

Before including your address, phone number, email address, or other personal identifying information in your comment, please be advised that your entire comment—including your personal identifying information—may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

Dated: November 5, 2013.

**Brent Rhees,**

*Deputy Regional Director—Upper Colorado Region, Bureau of Reclamation.*

[FR Doc. 2014–00476 Filed 1–14–14; 8:45 am]

BILLING CODE 4310–MN–P

## INTERNATIONAL TRADE COMMISSION

**[Investigation No. 337–TA–904]**

## Certain Acousto-Magnetic Electronic Article Surveillance Systems, Components Thereof, and Products Containing Same; Institution of Investigation Pursuant to 19 U.S.C. 1337

**AGENCY:** U.S. International Trade Commission.

**ACTION:** Notice.

**SUMMARY:** Notice is hereby given that a complaint was filed with the U.S. International Trade Commission on December 11, 2013, under section 337 of the Tariff Act of 1930, as amended, 19 U.S.C. 1337, on behalf of Tyco Fire & Security GmbH of Switzerland; Sensormatic Electronics, LLC of Boca Raton, Florida; and Tyco Integrated Security, LLC of Boca Raton, Florida. A letter supplementing the complaint was filed on December 23, 2013. The complaint alleges violations of section 337 based upon the importation into the United States, the sale for importation, and the sale within the United States after importation of certain acousto-magnetic electronic article surveillance systems, components thereof, and products containing same by reason of infringement of U.S. Patent No. 5,729,200 (''the '200 patent'') and U.S. Patent No. 6,181,245 (''the '245 patent''). The complaint further alleges that an industry in the United States exists as required by subsection (a)(2) of section 337.

The complainants request that the Commission institute an investigation and, after the investigation, issue a general exclusion order and cease and desist orders.

**ADDRESSES:** The complaint, except for any confidential information contained therein, is available for inspection

# United States Department of the Interior

BUREAU OF RECLAMATION
Upper Colorado Regional Office
125 South State Street, Room 6107
Salt Lake City, UT 84138-1102


IN REPLY REFER TO:
ALB-103
ENV-3.00

JUN 24 2014

Honorable Frederick Chino, Senior
Mescalero Apache Tribe of the
Mescalero Reservation
P.O. Box 227
Mescalero, NM 88340

Subject: Request for Consultation on Environmental Impact Statement (EIS), (Action by August 15, 2014)

Dear President Chino:

The purpose of this letter is to consult with the Mescalero Apache Tribe of the Mescalero Reservation during the preparation of the EIS for the proposed continued implementation of the 2008 Operating Agreement over its entire remaining term (through 2050) for the Rio Grande Project in New Mexico and Texas. The operating agreement is a written detailed description of how the Bureau of Reclamation allocates, releases from storage, and delivers Rio Grande Project water to users within the Elephant Butte Irrigation District (EBID) in New Mexico, the El Paso County Water Improvement District No. 1 (EPCWID) in Texas, and to users covered by the 1906 international treaty with Mexico. In addition, the EIS proposes to evaluate the environmental effects of renewing San Juan-Chama Project storage contracts under authority of the December 29, 1981, Act, Public Law 97-140, 95 Statute 1717, providing for storage in Elephant Butte Reservoir.

Reclamation's goal is to complete National Environmental Policy Act of 1969 (NEPA) compliance, in the form of a Record of Decision after completion of the EIS, no later than December 31, 2015, in order to annotate the results in the water operations manual for the Rio Grande Project before the start of the 2016 irrigation season. The enclosed Notice of Intent to prepare an EIS was issued on January 15, 2014, and scoping comments were received from two agencies. We are preparing a scoping report, and hope to award a contract for EIS preparation by October 1, 2014.

During the preparation of the Supplemental Environmental Assessment (SEA) covering the 2008 Operating Agreement from 2013-2015, the Mescalero Apache Tribe was the only tribe offering comments. The SEA is available at: http://www.usbr.gov/uc/albuq/envdocs/ea/riogrande/op-Proced/Supplemental/Final-SuppEA.pdf. As noted on page 76 of that document, "... in response to a Reclamation scoping letter, the Mescalero Apache Tribe had concerns with native plants

growing along the irrigation canals in the service areas of the EBID and EPCWID. The Mescalero Tribe collects plant material for cultural purposes."

The EIS will build on the SEA analyses and findings along with other appropriate analyses. Please advise if you prefer a consultation meeting with your Tribal Council, or at some other venue. We are contacting you in accordance with Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, for recommended options to facilitate further coordination. A reply by August 15, 2014, regarding your preference for consultation would be appreciated.

Please contact Ms. Rhea Graham, Special Project Officer at 505-462-3560, to request a consultation with either myself or Mr. Mike Hamman the Albuquerque Area Office Manager.

Sincerely,

Larry Walkoviak
Regional Director

Enclosure

VIA ELECTRONIC MAIL

cc: Rene Cochise, Superintendent
Mescalero Agency
P.O. Box 189
Mescalero, NM 88340
Rene.cochise@bia.gov

Mr. Mike Hamman, Area Manager
Albuquerque Area Office
Bureau of Reclamation
555 Broadway Avenue Northeast
Suite 100 (ALB-100)
Albuquerque, NM 87102
Mhamman@usbr.gov

# United States Department of the Interior

BUREAU OF RECLAMATION
Upper Colorado Regional Office
125 South State Street, Room 6107
Salt Lake City, UT 84138-1102


IN REPLY REFER TO:
ALB-103
ENV-3.00

JUN 24 2014

Honorable Frank Paiz
Ysleta Del Sur Pueblo
Tribal Council Office
P.O. Box 17579
El Paso, TX 79907

Subject: Request for Consultation on Environmental Impact Statement (EIS), (Action by August 15, 2014)

Dear Governor Paiz:

The purpose of this letter is to consult with the Ysleta Del Sur Pueblo during the preparation of the EIS for the proposed continued implementation of the 2008 Operating Agreement over its entire remaining term (through 2050) for the Rio Grande Project in New Mexico and Texas. The operating agreement is a written detailed description of how the Bureau of Reclamation allocates, releases from storage, and delivers Rio Grande Project water to users within the Elephant Butte Irrigation District in New Mexico, the El Paso County Water Improvement District No. 1 in Texas, and to users covered by the 1906 international treaty with Mexico. In addition, the EIS proposes to evaluate the environmental effects of renewing San Juan-Chama Project storage contracts under authority of the December 29, 1981, Act, Public Law 97-140, 95 Statute 1717, providing for storage in Elephant Butte Reservoir.

Reclamation's goal is to complete the National Environmental Policy Act of 1969 (NEPA) compliance, in the form of a Record of Decision on the NEPA review after completion of the EIS, no later than December 31, 2015, in order to annotate the results in the water operations manual for the Rio Grande Project before the start of the 2016 irrigation season. The enclosed Notice of Intent to prepare an EIS was issued on January 15, 2014, and scoping comments were received from two agencies. We are preparing a scoping report, and plan to award a contract for EIS preparation by October 2014.

During the preparation of the Supplemental Environmental Assessment (SEA) covering the 2008 Operating Agreement from 2013-2015, the Pueblo of Ysleta del Sur did not offer comments. The SEA is available at: http://www.usbr.gov/uc/albuq/envdocs/ea/riogrande/op-Proced/Supplemental/Final-SuppEA.pdf. The EIS, will build on the SEA analyses and findings along with other appropriate analyses. Please advise if you prefer a consultation meeting with your Tribal Council, or some other venue. We are contacting you in accordance with Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, for recommended

options to facilitate further coordination. A reply by August 15, 2014, regarding your preference for consultation would be appreciated.

Please contact Ms. Rhea Graham, Special Project Officer at 505-462-3560, to request a consultation with either myself or Mr. Mike Hamman the Albuquerque Area Office Manager.

Sincerely,

Larry Walkoviak
Regional Director

Enclosure

VIA ELECTRONIC MAIL

cc: Mr. John Antonio, Superintendent
Southern Pueblos Agency
1001 Indian School Road, Northwest
Albuquerque, NM 87104
John.antonio@bia.gov

Mr. Mike Hamman, Area Manager
Albuquerque Area Office
Bureau of Reclamation
555 Broadway Avenue, Northeast
Suite 100 (ALB-100)
Albuquerque, NM 87102
Mhamman@usbr.gov

Graham, Rhea <rgraham@usbr.gov>

# EIS on Operating Agreement for Rio Grande Project--Letter regarding consultation

1 message

**Graham, Rhea** <rgraham@usbr.gov> Wed, Oct 14, 2015 at 3:33 PM
To: sskin@mescaleroapachetribe.com

Sher,

Thank you for taking my call and for following up with President Danny Breuninger, Sr., regarding Reclamation's letter to the Mescalero Apache Tribe (attached). The Environmental Impact Statement (EIS) is for continuation of the Operating Agreement for the Rio Grande Project until 2050, and the Supplemental Environmental Assessment (sEA), available at: http://www.usbr.gov/uc/albuq/envdocs/ealriogrande/opProced/Supplemental/Final-SuppEA.pdf, was for continuation of the Operating Agreement for the Rio Grande Project from 2012-2015.

As noted on page 76 of that document, "... in response to a Reclamation scoping letter, the Mescalero Apache Tribe had concerns with native plants growing along the irrigation canals in the service areas of the EBID and EPCWID. The Mescalero Tribe collects plant material for cultural purposes." We intend to honor the Mescalero Apache Tribe's response to the sEA going forward in the EIS. Our report on public scoping for this EIS can be viewed at: http://www.usbr.gov/uc/albuq/rm/RGP/EIS/RGOA-EIS-ScopingSummary.pdf.

We are hoping to complete the Record of Decision before the start of the irrigation season, and anticipate publishing the Draft EIS in January 2016.

Thank you for your assistance.

Rhea

Rhea Graham, Special Project Officer

Bureau of Reclamation Albuquerque Area Office

555 Broadway N.E., Suite 100, Mail Stop ALB-103

Albuquerque, NM 87102

(505) 462-3560 (Office) (505) 221-0470 (Mobile) (505) 462-3793 (Fax)

http://www.usbr.gov/uc/albuq/rm/RGP/

**PresChinoEIS.pdf**
1638K

Graham, Rhea <rgraham@usbr.gov>

# EIS on Operating Agreement for Rio Grande Project--Letter regarding consultation

1 message

**Graham, Rhea** <rgraham@usbr.gov> Wed, Oct 14, 2015 at 3:43 PM
To: svillarreal@ydsp-nsn.gov

Samantha,

Thank you for taking my call and for following up with Governor Carlos Hisa regarding Reclamation's letter to the Pueblo of Ysleta del Sur (attached). The Environmental Impact Statement (EIS) is for continuation of the Operating Agreement for the Rio Grande Project until 2050, and the Supplemental Environmental Assessment (sEA), available at: http://www.usbr.gov/uc/albuq/envdocs/ealriogrande/opProced/Supplemental/Final-SuppEA.pdf, was for continuation of the Operating Agreement for the Rio Grande Project from 2013-2015.

During the preparation of the Supplemental Environmental Assessment (SEA) covering the 2008 Operating Agreement from 2013-2015, the Pueblo of Ysleta del Sur did not offer comments. Our report on public scoping for this EIS can be viewed at: http://www.usbr.gov/uc/albuq/rm/RGP/EIS/RGOA-EIS-ScopingSummary.pdf.

We are hoping to complete the Record of Decision before the start of the irrigation season, and anticipate publishing the Draft EIS in January 2016.

Thank you for your assistance.

Rhea

Rhea Graham, Special Project Officer

Bureau of Reclamation Albuquerque Area Office

555 Broadway N.E., Suite 100, Mail Stop ALB-103

Albuquerque, NM 87102

(505) 462-3560 (Office) (505) 221-0470 (Mobile) (505) 462-3793 (Fax)

http://www.usbr.gov/uc/albuq/rm/RGP/

**GovPaizEIS.pdf**
1597K

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United States Department of the Interior

**ORIGINAL**

BUREAU OF RECLAMATION
Upper Colorado Region
Albuquerque Area Office
555 Broadway NE, Suite 100
Albuquerque, NM 87102-2352

102529

IN REPLY REFER TO:

ALB-180
ENV-3.00

OCT 29 2015

RECEIVED
NOV 03 2015
HISTORIC PRESERVATION DIVISION

Jeff Pappas, PhD
Mr. Bob Estes
New Mexico State Historic Preservation Division
Department of Cultural Affairs
Bataan Memorial Building
407 Galisteo Street, Suite 236
Santa Fe, NM 87501

Subject: National Historic Preservation Act (NHPA) Section 106 Consultation for the Rio Grande Project Operating Agreement, Rio Grande Project, New Mexico (Action by 30 days of receipt of this letter)

Dear Dr. Pappas and Mr. Estes:

The Bureau of Reclamation initiated consultation with you in 2013 under Title 54 U.S.C. § 306108, commonly known as Section 106 of the NHPA and its implementing regulations found at 36 CFR Part 800, for the "Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project, New Mexico and Texas." The Operating Agreement (OA) is a written description of how Reclamation allocates, releases from storage, and delivers Rio Grande Project water to users within the Elephant Butte Irrigation District (EBID) in New Mexico, the El Paso County Water Improvement District No. 1 in Texas, and to users covered by the 1906 international treaty with Mexico.

2015 NOV 24 PM 12: 40
BUREAU OF RECLAMATION
ALB. AREA OFFICE
RECEIVED

In 2013 Reclamation had determined that the continued implementation of the OA was an undertaking as defined in 36 CFR § 800.16(y). OA's are the type of activity that have the potential to cause effects on historic properties under 36 CFR § 800.3(a). On October 13, 2013, Dr. Estes sent us a letter declining our invitation to become a cooperating agency, but indicating his availability for continued consultation on the undertaking.

Since then Reclamation determined that the area of potential effects of the undertaking equates with the facilities of the Rio Grande Project, as shown in Figure 1. These include the federal facilities of Elephant Butte Dam, Caballo Dam, and five diversion dams, Percha, Leasburg, Mesilla, American, and International, and the non-federal facilities of the associated irrigation systems. It is our opinion that application of the Criteria for Evaluation and Effect has the results shown in the following table.

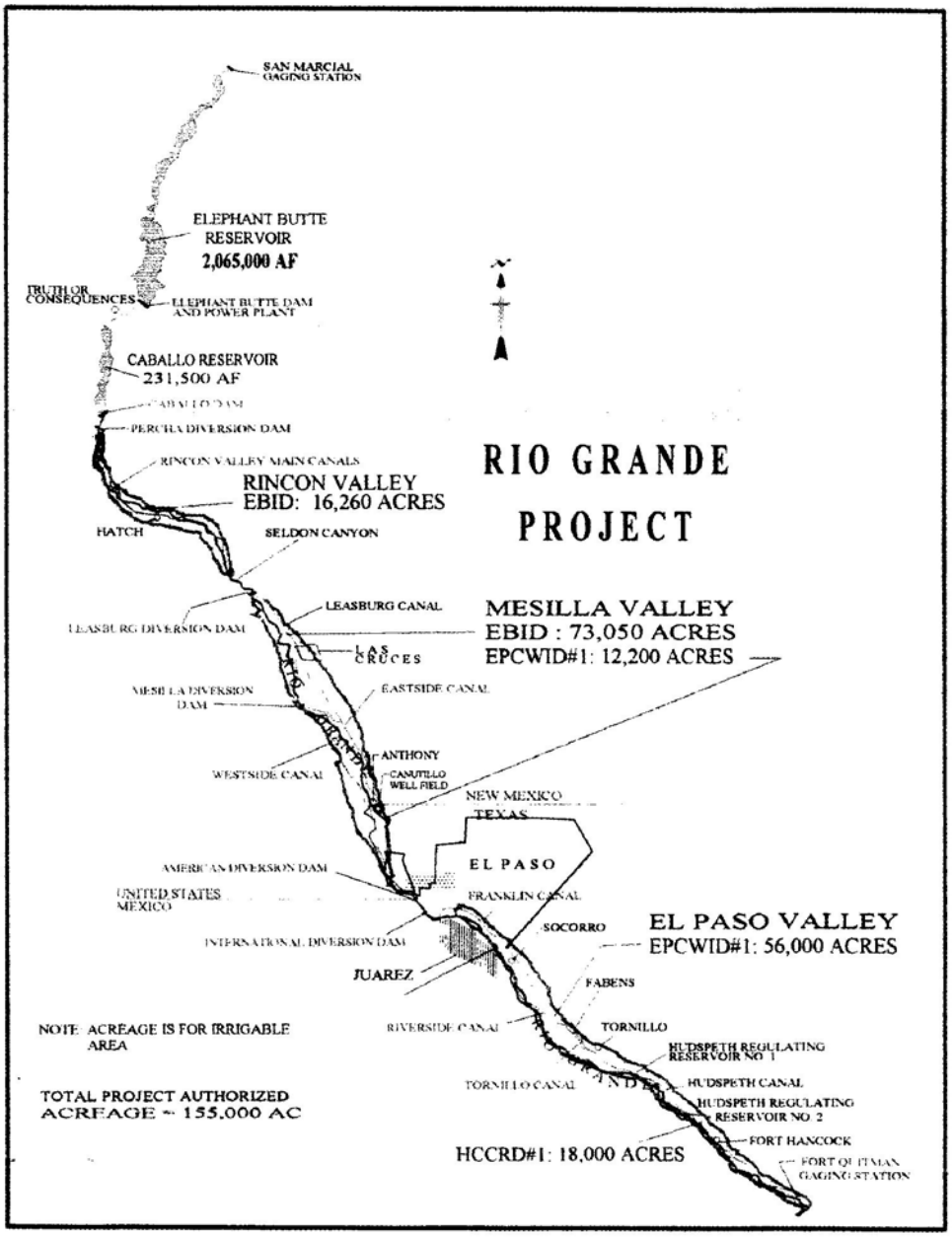


Figure 1: Map of the Rio Grande Project, showing all project facilities and area of potential effects.

| Site Designation | Eligible | Criteria | Effect |
|---|---|---|---|
| Elephant Butte Dam, Sierra County, NM (NR ID 79001556) | Listed | A | No Historic Properties Affected |
| Percha Diversion Dam, Sierra County, NM (NR ID 789001555) | Listed | A | No Historic Properties Affected |
| Franklin Canal, El Paso County, TX (NR ID 92000696) | Listed | A | No Historic Properties Affected |
| Elephant Butte Irrigation District (NR 96001616) | Eligible | A,C | No Historic Properties Affected |
| | | | |

Because the OA is merely a written algorithm regarding the process of accounting for storage and release of Rio Grande Project water, continuation of the agreement would not change the character or use of Rio Grande Project facilities. Reclamation has therefore concluded that a determination of "No Historic Properties Affected" pursuant to 36 CFR 800.4(d(1)) is appropriate for this undertaking.

We are submitting this finding to you. If we do not receive your response within 30 days of receipt of this letter, we shall assume your concurrence. As part of the National Environmental Policy Act review process, we have initiated consultation with two Native American Tribes to address our responsibilities at 36 CFR 800.2(c)(ii). We trust you will agree with this finding and seek your concurrence that the Section 106 consultation process has been successfully completed for the undertaking. If there are any questions, please contact Mr. Hector Garcia at 505-462-3550, or at hgarcia@usbr.gov.

Sincerely,

Jennifer Faler
Area Manager

Concur with recommendations as proposed.

Nov 20, 2015

for NM State Historic Preservation Officer

# United States Department of the Interior

BUREAU OF RECLAMATION
Upper Colorado Region
Albuquerque Area Office
555 Broadway NE, Suite 100
Albuquerque, NM 87102-2352

IN REPLY REFER TO:

AUG 20 2015

ALB-180
ENV 7.00

HAND DELIVERED

MEMORANDUM

To: U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office,
2105 Osuna NE, Albuquerque, NM 87113
Attention: Mr. Wally Murphy

From: Jennifer Faler
Area Manager

Subject: Biological Assessment (BA) for the Bureau of Reclamation's Proposed Continuation of the Rio Grande Project Operating Agreement (RGOA) and for the Storage of San Juan-Chama (SJ-C) Project Water in Elephant Butte Reservoir (EBR), Rio Grande Project (RGP)

The attached BA is submitted to the U.S. Fish and Wildlife Service (Service) to address the potential effects of Reclamation continuing to implement the RGOA and storing SJ-C water in EBR; on the Southwestern Willow Flycatcher (*Empidonax traillii extimus*; flycatcher), the Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*; cuckoo), the New Mexico meadow jumping mouse (*Zapus hudsonius luteus*; mouse), and the Rio Grande silvery minnow (*Hybognathus amarus*, minnow).

The RGOA is a written description of how Reclamation allocates RGP water to Elephant Butte Irrigation District (EBID), El Paso County Water Improvement District No.1 (EPCWID), and Mexico; consistent with applicable water rights, state and federal laws, and international treaties. The RGP and the RGOA have a long and litigious history, culminating in 2007 with Reclamation and the two districts agreeing on operating procedures. In 2008, Reclamation and the two districts signed an agreement through 2050, the RGOA, and developed a written Operations Manual, which is reviewed annually. The RGOA largely reflects historical operation of the RGP, with two key changes. First, the RGOA provides carryover accounting for any unused portion of the annual diversion allocations to EBID and EPCWID. Second, the RGOA adjusts the annual allocations by calculating the diversion ratio. The diversion ratio represents the amount of allocation used per unit release of project water from Caballo Dam.

In addition to evaluating the effects of the RGOA, this BA evaluates the effects of a Reclamation contract for storage of SJ-C water in EBR. Currently, only the Albuquerque-Bernalillo County Water Utility Authority (ABCWUA) has a contract for storage of a maximum of 50,000 acre feet per year of SJ-C water in EBR. In the future, other entities could enter into storage contracts, but the proposed action under consultation at this time is only for the ABCWUA long-term contract. Reclamation has limited discretion associated with normal EBR operations under the RGOA. Water stored in the RGP is the result of inflows dictated by Compact guidelines for New Mexico and Colorado. The needs of irrigators and irrigation delivery orders are non-discretionary and include treaty obligations to the Republic of Mexico. Irrigation release rates and times are determined by the two districts and Mexico, and are calculated to meet daily irrigation demands. Reclamation cannot restrict or increase releases to affect Article VII restrictions on upstream States. Reclamation's only discretionary actions associated with the RGOA are general operational guidelines and the two changes from historical operation mentioned above; the diversion ratio adjustments and the carry-over concept. Reclamation also has discretion over the storage of SJ-C water in EBR, and the timing of releases from EBR into Caballo Reservoir to maintain sufficient water in Caballo for irrigation demands.

Reclamation analyzed the RGOA from 2007 to 2012 with an Environmental Assessment (EA) and then from 2013 to 2015 with a Supplemental EA, both with an Endangered Species Act (ESA) determination of no effect. Throughout this period Reclamation was working on a model that could assess the RGOA for its duration through 2050 under an Environmental Impact Statement (EIS) process. Reclamation, in collaboration with the United States Geological Survey (USGS), developed the Rincon and Mesilla Basins Hydrological Model (based on the USGS's MODFLOW model) to project the effects of the RGOA and climate on water surface elevations in EBR.

Simulations were carried out using this model for three equally likely projections of future climate scenarios, including a drier scenario, a central tendency scenario, and a wetter scenario. Assuming these scenarios provide a reasonable representation of likely future climatic/hydrological conditions in the Rincon and Mesilla basins through 2050, the model results give an estimate of the expected frequency and duration of EBR at particular water surface elevations. From these elevations, we can extrapolate to effects on listed species. Reclamation's model at this time cannot separate the impacts of the RGOA, which has a much higher operational value during drought periods, from future climatic conditions. The model only projects what may happen through 2050 and is being updated in the next couple of years. For the flycatcher and cuckoo we have made a determination of "**may affect and likely to adverse affect**" the species and designated and proposed critical habitat. Since all impacts are based on a model that shows distinct EBR filling/emptying cycles, the analysis considers a range of impacts that could occur through 2050. However, the specific timing, duration, and magnitude of impacts is uncertain. Considering the current EBR water level and habitat elevation in EBR, the model under the three scenarios does not identify any adverse impacts to flycatchers and cuckoos for about 5-7 years. There is even a strong likelihood that the modeled cycles through 2050 would allow for vegetation to re-establish within EBR resulting in no net loss of habitat.

We request the Service issue a Biological Opinion (BO) that does not initially offer an incidental take statement (ITS), but that identifies a process to monitor and assess take over time. If the modeled cycles become reality, Reclamation proposes to assess potential impacts from a rising reservoir to flycatchers/cuckoos and their habitat prior to inundation, and would then seek an ITS from the Service. Reclamation would continue to monitor and assess during inundation, and specific reasonable prudent measures and terms and conditions would be identified after the reservoir recedes and the re-establishment of vegetation has been assessed.

In consideration of the information provided in the BA, our determination is that the proposed action would have **"no effect"** on the mouse or its critical habitat. For the minnow, a **"may affect, but not likely to adversely affect"** determination is warranted due to the ability of the minnow to move upstream, potentially into their critical habitat reach upstream of RM 62, whenever reservoir filling is of a sufficient magnitude and duration to produce such movement as modeled to occur after 2047.

We look forward to working cooperatively with your staff throughout this ESA consultation process to support the completion of a BO within the schedule for the associated EIS by spring 2016. Please direct any questions to Mr. Hector Garcia at 505-462-3550 or by email at hgarcia@usbr.gov.

Attachment

# United States Department of the Interior

BUREAU OF RECLAMATION
Upper Colorado Region
Albuquerque Area Office
555 Broadway NE, Suite 100
Albuquerque, NM 87102-2352

IN REPLY REFER TO:

NOV 18 2015

ALB-180
ENV 3.00

MEMORANDUM

To: U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office, 2105 Osuna NE, Albuquerque, NM 87113
Attention: Mr. Wally Murphy

From: Jennifer Faler

Subject: Action Area for the Biological Assessment (BA) for the Bureau of Reclamation's Proposed Continuation of the Rio Grande Project Operating Agreement (RGOA) and for the Storage of San Juan-Chama (SJ-C) Project Water in Elephant Butte Reservoir (EBR), Rio Grande Project (RGP)

Reclamation submitted the subject BA to the U.S. Fish and Wildlife Service (Service) on August 20, 2015. The RGOA Environmental Impact Statement (EIS) will address the potential effects of Reclamation's proposal to continue through 2050, to implement the RGOA and to store SJ-C water in EBR. After several meetings with the Service, Reclamation is defining the action area under the subject BA to only cover that area with potential effects to federally listed or proposed species, which is EBR from full pool to dead pool.

Under the National Environmental Policy Act process, the area of analysis for the RGOA EIS is relatively limited within the broader RGP geographic area and varies by resource and resource issues. The provisions of the RGOA and storage contract do not include construction of any new facilities, or other actions that are physically different or that exceed the bounds of historic operations of the RGP.

As discussed by our staff, Reclamation will continue to update both the hydrological and biological models as they pertain to the RGP, and specifically for EBR. When both models are updated and new data is available, we will coordinate with your office. The value of the biological model will be based on existing and/or updated data from the hydrological model, as it applies to the current modeled period of EBR rising between 2021 and 2026.

We look forward to continued cooperation with your staff throughout this EIS process. Please direct any questions to Mr. Hector Garcia at 505-462-3550 or by e-mail at hgarcia@usbr.gov.

# United States Department of the Interior

FISH AND WILDLIFE SERVICE

New Mexico Ecological Services Field Office
2105 Osuna Road NE
Albuquerque, New Mexico 87113
Telephone 505-346-2525 Fax 505-346-2542
www.fws.gov/southwest/es/newmexico/

December 3, 2015

Cons. #02ENNM00-2015-F-0734

Memorandum

To: Area Manager, Bureau of Reclamation, Albuquerque, New Mexico

From: David Campbell, Branch Chief, Large River Recovery and Restoration Programs, U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office, Albuquerque, New Mexico

Subject: Initiation of Formal Consultation in response to the Biological Assessment for the Bureau of Reclamation's Proposed Continuation of the Rio Grande Project Operating Agreement and for the Storage of San Juan-Chama Project Water in Elephant Butte Reservoir, Rio Grande Project

The U.S. Fish and Wildlife Service (Service) received the U.S. Bureau of Reclamation (Reclamation) Memorandum and Biological Assessment (BA) requesting the initiation of formal consultation on the Proposed Continuation of the Rio Grande Project Operating Agreement and for the Storage of San Juan-Chama Project Water in Elephant Butte Reservoir, Rio Grande Project (Lower Rio Grande Project) on August 21, 2015, held several meetings soon thereafter, and received a memorandum dated November 25, 2015. Correspondence since the submission of the BA has addressed the action area and biological models as requested by the Service. The information required of you to initiate consultation is now considered complete.

Section 7 allows the Service up to 90 calendar days to conclude formal consultation with your agency and an additional 45 calendar days to prepare our biological opinion. However, we understand your abbreviated timeline and will attempt to accommodate that schedule.

For further correspondence associated with the Lower Rio Grande Project, please reference consultation number 02ENNM00-2015-F-0734. Please contact Ms. Vicky Ryan, Fish and Wildlife Biologist, at 505-761-4738 with any questions.

# United States Department of the Interior

BUREAU OF RECLAMATION
Upper Colorado Region
Albuquerque Area Office
555 Broadway NE, Suite 100
Albuquerque, NM 87102-2352


IN REPLY REFER TO:
ALB-180
ENV-7.00

FEB 19 2016

VIA HAND-DELIVERY

MEMORANDUM

To: Field Supervisor, U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office, 2105 Osuna NE, Albuquerque, New Mexico 87113
Attn: Mr. Wally Murphy

From: Jennifer Faler
Area Manager

Subject: Biological Opinion on Effects of Actions Associated With the "Proposed Continuation of the Rio Grande Project Operating Agreement and Storage of San Juan-Chama Project Water in Elephant Butte Reservoir, New Mexico", Consultation #02ENNM00-2015-F-0734, Rio Grande Project

Thank you for providing the Bureau of Reclamation with the subject Biological and Conference Opinion (BO), dated January 21, 2015 (sic, 2016). This BO is part of an ongoing Environmental Impact Statement, which requires review by Area and Regional Office staff and management. Your BO stated that it would be considered final within a 30-day period ending on February 22, 2016. I recently informally communicated with you requesting an extension of time before finalizing the BO. Reclamation has several comments that need to be resolved before finalization of the BO. Through this memorandum Reclamation is formally requesting a 30-day extension through March 22, 2016. Reclamation will seek to set up meetings shortly to discuss our comments on the BO.

We look forward to continued cooperation with your staff throughout this process. If you have any questions, please contact Mr. Hector Garcia at 505-462-3550 or by e-mail at hgarcia@usbr.gov.

# Appendix E. Comments and Responses

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# Appendix E. Comments and Responses

## 1 Comment-Response Process

This appendix describes the public comment and response process to finalize the EIS (FEIS). Section 1.1 defines terms useful in understanding this document and changes made to the DEIS. Section 1.2 describes how the comments were acquired, categorized, addressed, and documented. Section 1.3 provides guidance on the use of this document. Section 2 presents summary comments and responses to comment categories raised by multiple commenters. Section 3 presents individual responses. Section 4 is the scanned and marked comment documents.

### 1.1 Definitions

Several terms are helpful in assisting commenters find their comments and understanding the responses.

***Comment***

A distinct statement or question about a particular topic, such as:

- Purpose and need for action
- Merits of alternatives
- Any aspect of potential environmental impacts arising from the alternatives
- Reclamation's use of facts, methods, or analyses in the EIS
- Reclamation's implementation of the NEPA process
- Matters outside the scope of the EIS

***Commenter or Public***

This term includes any and all potentially interested or affected parties, whether private citizens, state, local or tribal governments, environmental groups, water users or irrigation districts, civic and community organizations, businesses, etc.

***Comment category***

The resource topic or issue to which a comment is addressed. This may include the NEPA process including alternatives, the affected environment section of the EIS, or a specific resource category such as water quality.

***Comment document***

A written version of comments submitted by a commenter. This may be a letter, email, or transcript of oral comments at a public hearing. A comment document may contain any number of comments.

***Duplicate***

A comment or comment document that is the same in wording or so similar as to be virtually identical to another comment or comment document. Examples are a postcard emailed as part of an organized campaign to encourage people to comment on the DEIS or a petition through which more than one individual indicates agreement with the same comment.

***Substantive comment***

A comment relevant to the scope of the EIS, environmental analysis, or NEPA process that merits a response. Comments that offer support or opposition to an alternative are not substantive comments. Substantive comments are those that:

- Question, with reasonable basis, the accuracy of the information in the EIS;
- Question the adequacy of the environmental analysis;
- Present reasonable alternatives other than those in the EIS;
- Merit changes or revisions to the proposal.

***Summary comment, summary response***

A summary capturing the essence of similar comments on a given comment category and the summary response to those comments.

## 1.2 The Analytical Process

A notice of availability of the draft EIS (DEIS) was published in the *Federal Register* on March 18, 2016. Several comments were received requesting an extension of time to comment, so the total comment period was extended to June 8, 2016 to provide 83 days to comment on the DEIS.

During the comment period, two public hearings were held: one in Albuquerque, New Mexico, another in Las Cruces, New Mexico. Transcripts of these hearings are counted as two comment documents. In addition to the hearing transcripts, each comment document was scanned electronically and assigned a consecutive number beginning with 101. Twenty-four comment documents were received by the end of the comment period (June 8, 2016) containing 148 comments.

### 1.2.1 Responding to Comments

Each comment document was read by the interdisciplinary team to understand the overall intent and perspective of the commenter. Again, all forms of comment documents were included in this process, including emails, letters, transcripts from public meetings, records of phone calls, and attachments to comment documents. Within each comment document, all substantive comments were numbered and assigned a comment category.

In compliance with 40 CFR 1503.4, possible responses to substantive comments include:

- Modifying alternatives;
- Developing and evaluating new alternatives not previously given serious consideration in the EIS;
- Supplementing, improving, or modifying the analyses;
- Making factual corrections to the EIS;

- Explaining why the comment does not warrant further agency response or indicating those circumstances that trigger agency reappraisal or further response.

Reclamation received several comments asking for the data used as inputs and outputs to the hydrology and socioeconomic models. While these information requests were not substantive comments, these requests indicate a lack of clarity in describing the analytical processes, so Reclamation made a decision to revise the draft EIS and issue a final EIS, rather than merely issuing an errata sheet.

## 1.3 How to Use this Document and Find Your Comment

Table E-1 correlates names of commenters (individuals or organizations) with the assigned comment document number. Commenters should locate their comment document number in Table E-1 and then locate the scanned copy of their comment document in Section 4 to identify individual comments. Comment documents are arranged numerically based on date or receipt.

Within each comment document, comments are numbered consecutively. Individual responses are in Section 3. Where multiple comments were received on the same comment category, the reader may be referred to the summary comment and response section (Section 2). This helps create a more concise response section and helps guide the reader to the sections of the FEIS where the information may have changed based on responses to the comments. Summary comments and responses are presented in Section 2 alphabetically by topic.

Table E-1 Correlation of comment document number with commenters

| Comment Document Number | Date Received | Commenter | Affiliation |
|---|---|---|---|
| 101 | 3/30/2016 | Welsh, Heidi | Individual |
| 102 | 3/31/2016 | Dixon, Deborah K. | New Mexico Interstate Stream Commission |
| 103 | 4/5/2016 | Stein, Jay F. | Counsel for City of Las Cruces |
| 104 | 4/7/2016 | Bannerman, Kim | New Mexico Interstate Stream Commission |
| 105 | 4/13/2016 | Bannerman, Kim | New Mexico Interstate Stream Commission |
| 106 | 4/12/2016 | Bannerman, Kim | Williams & Associates, Court Reporting Service |
| 107 | 4/13/2016 | Bannerman, Kim | New Mexico Interstate Stream Commission |
| 108 | 4/18/2016 | Bannerman, Kim | New Mexico Interstate Stream Commission |
| 109 | 4/20/2016 | Bannerman, Kim | New Mexico Interstate Stream Commission |
| 110 | 5/4/2016 | Pelz, Jen | Wild Earth Guardians |
| 111 | 5/5/2016 | Pelz, Jen | Wild Earth Guardians |
| 112 | 5/5/2016 | Bannerman, Kim | New Mexico Interstate Stream Commission |
| 113 | 5/9/2016 | Houston, Robert | US Environmental Protection Agency |
| 114 | 5/11/2016 | Stein, Jay F. | Counsel for City of Las Cruces |
| 115 | 6/1/2016 | Speer Jr., James M. | Counsel for EPCWID |
| 116 | 6/3/2016 | Pelz, Jen | Wild Earth Guardians |

| | | | |
|---|---|---|---|
| 117 | 6/8/2016 | Bardwell, Beth | Audubon New Mexico |
| 118 | 6/8/2016 | Bixby, Kevin | Southwest Environmental Center |
| 119 | 6/8/2016 | Bardwell, Beth | Audubon New Mexico |
| 120 | 6/8/2016 | Wallace, Chad M. | Colorado Department of Law |
| 121 | 6/8/2016 | Dixon, Deborah K. | New Mexico Interstate Stream Commission |
| 122 | 6/8/2016 | Stein, Jay F. | Stein & Brockman; City of Las Cruces |
| 123 | 6/8/2016 | Pelz, Jen | Wild Earth Guardians |
| 124 | 6/9/2016 | Wunder, Matt | New Mexico Department of Game & Fish |

# 2 Summary Comments and Responses

As shown in Table E-1, Reclamation received 24 comment documents since the DEIS was published in May 2016. This section presents comment categories and responses where multiple comments were made about the same topic. The comment numbers are listed here and on the scanned copies of the comment documents (Section 4). For example, comment number 101.01 is the first comment within comment document 101. The organization is alphabetically by comment category in the FEIS.

### Category: Agriculture, Agriculture to Municipal and Industrial Conversions

Comment Numbers: 113.02, 113.03, 113.04, 122.03

**Summary comment:** The DEIS does not adequately address impacts to agriculture and the impact of population growth on water use and demand and plans of cities to convert agricultural water to M&I water.

**Response**: The discussion of cumulative impacts in Chapter 5 of the FEIS considers potential conversion of agricultural water to M&I water. Appendix C and Section 4.1 of the FEIS explain the modeling assumptions. Briefly, simulation and analysis of project operations was carried out to evaluate relative changes in the storage, release, and delivery of project water to diversion points for EBID, EPCWID, and Mexico from the five alternatives under future simulated climatic and hydrologic conditions within the project area. The modeling did not include projections of change in future M&I demand, use, or conversions. Rather, the modeling is sufficient for analysis of changes in project operations resulting from the five alternatives, without the confounding effects of changes in M&I demand. Specific consideration of potential effects of increased demand by municipalities or M&I uses are both highly uncertain and beyond the scope of this FEIS. The amount of water used for M&I deliveries would be the same as deliveries for irrigation based on the acreage converted.

Specific to the comments from the City of Las Cruces (Commenter 114), it should be noted that the diminishment of allocation to EBID as projected under the drier climate scenarios is a function of projected climate change, not the alternatives. Under wetter conditions, EBID and by extension, the City of Las Cruces' allocation would increase to more than what they have received historically. The City of Las Cruces' comment is more focused on the drought than the alternatives.

In response to these comments, Section 3.12, Socioeconomics has been updated to include more description of population growth and agricultural resources.

### Category: Allocation

Comment Numbers: 115.02, 120.05, 120.06, 120.17, 120.29, 121.14, 121.22
**Summary comment**: The DEIS does not adequately address historical allocations and divisions of water between the districts and the reason behind the OA.

**Response**: Many of the comments about allocation require individual responses (see Section 3.) The Summary response is that the OA was designed to correct issues that arose due to groundwater pumping in EBID and other changes in irrigation practices and cropping which altered the historical efficiencies of the project.

### Category: Alternatives

Comment Numbers: 118.01, 121.05, 123.01, 123.04, 124.01, 124.06
**Summary comment:** Commenters proposed several alternatives, including one that brought forward during scoping.

**Response:** Section 2.3, Alternatives Considered but Eliminated from Detailed Study, has been updated to include the additional alternatives and to clarify why the alternative submitted during scoping was not analyzed. Also, see individual responses in Section 3 below.

### Category: Alternatives, No Action Alternative

Comment Numbers 121.04, 122.01, 123.05, 123.06, 124.06
**Summary comment:** Commenters stated that the No Action Alternative was improperly construed and should be a return to pre-2008 procedures; i.e., Alternative 5 should be the No Action Alternative. They also commented that the No Action Alternative should not include a contract for storage of San Juan-Chama project water, which is Alternative 2.

**Response**: In the DEIS, the identification of the No Action Alternative as continuing with the existing elements of the OA and inclusion of the San Juan-Chama contract was based on the Council on Environmental Quality's (CEQ) "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations" (46 FR 18026, March 23, 1981, as amended). CEQ states there are two distinct interpretations of no action that an agency must consider, depending upon the nature of the proposal. The first situation is continuation of management plans or ongoing programs, the second involves Federal decisions on proposals for projects where the proposed activity would not take place. For the DEIS, the CEQ's first situation appeared to be the best fit for the proposed action. Here is the CEQ guidance:

> The first situation might involve an action such as updating a land management plan where ongoing programs initiated under existing legislation and regulations will continue, even as new plans are developed. In these cases, "no action" is "no change" from current management direction or level of management intensity. To construct an alternative that is based on no management would be a useless academic exercise. Therefore, the "no action" alternative may be thought of in terms of continuing with the present course of action until that action is changed. Consequently, projected impacts of alternative management schemes would be compared in the EIS to those impacts projected for the existing plan." [CEQ 1981:No. 3]

While the interdisciplinary team felt that the DEIS's Alternative 1 was appropriately identified based on CEQ's definition of no action as continuation of management plans or

programs, given the comments received on the DEIS about making Alternative 5 the No Action Alternative, the No Action Alternative was changed for the FEIS. Alternative 5 is now the No Action Alternative and changes were made consistently in the text.

### Category: Alternatives, Carryover Accounting

Comment Numbers: 120.26, 121.06, 121.07

**Summary comment:** The DEIS does not adequately address how carryover accounting would be calculated and the amount of carryover under the alternatives.

**Response:** Carryover water is calculated based on each district's unused allocation balance at the end of the primary irrigation season. The term "carryover" has been placed in the index so anyone wanting to check references will find them throughout the FEIS. The carryover provision was evaluated as implemented under the OA. Analysis of partial implementation or modification of the carryover procedure is beyond the scope of the FEIS.

### Category: Alternatives, Mimic Natural Hydrograph

Comment Numbers: 124.01, 124.06

**Summary comment:** The FEIS should analyze an alternative of storing and releasing project water to benefit wildlife and to mimic a natural hydrograph.

**Response**: Reclamation operates its projects based on the specific purposes authorized by Congress, or where there is a specific legal requirement (such as the ESA) that mandates a change in the actions of storage and release of water. For the RGP, the congressionally authorized purpose is irrigated agriculture. Reclamation lacks the authority to make a release specifically for wildlife, unless consultation with the Service requires such a release to avoid jeopardizing the continued existence of a listed species or adverse modification of critical habitat.

### Category: Alternatives, Mitigation Measures, see also Climate Change

Comment Numbers: 123.16, 124.03

**Summary comment:** The DEIS does not include mitigating measures for biological impacts. The commenters were concerned with the effect of climate change and the alternatives on vegetation and wildlife, and felt that a mitigating measure of revegetation by planting cottonwoods or willows on bare delta sediments should be included in the FEIS.

**Response:** The modelling results presented in Chapter 4 do not indicate there would be adverse effects to vegetation communities and wildlife requiring specific mitigating measures. However, through the ESA Section 7 consultation process, Reclamation committed to monitoring for any long-term effects to riparian habitat used by listed species. For any long-term adverse impacts during the predicted cycles through 2050, Reclamation will consider revegetation and the need for mitigating measures.

### Category: Alternatives, Operating Manual

Comment Numbers: 121.08, 121.28

**Summary comment:** The DEIS does not adequately address changes to the Operating Manual and future changes that could arise that would require additional review under NEPA.

**Response**: The Operating Manual may be changed in the future by mutual consent of Reclamation and the respective boards of EBID and EPCWID. The idea behind the manual is that there are uncertainties about the actual performance of the system, effects

of climate change, and other variables, and Reclamation and the districts may need to make adjustments over time. See “Environmental Commitments” in the Summary (page iv). Reclamation agrees that if changes would result in environmental effects not previously considered, then future NEPA, ESA and other environmental analyses would be conducted.

### Category: Climate Change

Comment Numbers: 121.36, 123.19, 123.20
**Summary comment**: The DEIS does not adequately address the impact of climate change on water resources and wildlife.

**Response**: Reclamation used the best available science of global climate change to produce climate projections under the alternatives (see Section 4.1). Climate projections inform or provide the detailed climate information that generated the wetter, central tendency, and drier climate scenarios that were used in the modelling. The method has been described by Reclamation in its *West-wide Climate Risk Assessments: Bias-Corrected and Spatially Downscaled Surface Water Projections*.

### Category: Compact, Rio Grande Compact

Comment Numbers: 120.01, 120.02, 120.09, 120.10, 120.11, 120.18, 120.19, 120.20, 120.21, 121.17, 120.20, 122.11
**Summary comment:** The DEIS does not adequately address the relationship between the alternatives and the Rio Grande Compact. Commenters were concerned with the calculation of Compact credits. These comments also relate to Geographic Scope, because some commenters felt that there would be upstream impacts related to Article VII storage. In general, commenters were concerned with how the alternatives might affect Compact compliance.

**Response:** Most of the comments about the Compact are out-of-scope for this analysis because the alternatives do not change or impact Compact storage or relinquishment. The Rio Grande Compact Commission administers the Compact waters to ensure equitable distribution, not Reclamation. That said, because the RGP reservoirs store Compact credit water, the total storage results in the FEIS include Compact water (see Section 4.2). The total amount of water in the reservoirs is important due to potential impacts on biological resources (see Sections 4.13 to 4.16); however, Appendix C provides data about just project storage without Compact water.

The reader should refer to Section 4.6, Releases and Table E-2, which provides the data to show whether Rio Grande Compact Article VII would be impacted. A comparison of the values by alternative and climate scenarios shows little difference among the alternatives. Examination of the 50th percentile values in Table E-2 shows that across the alternatives, from 446,457 acre-feet under Alternative 1 to 438,508 acre-feet under Alternative 5, there is little difference among alternatives. In conclusion, our finding from the Section 4.6 analysis and this table is that the alternatives have no effect on Article VII restrictions.

The Summary response is that because this table and Section 4.6 show that releases are basically the same under the alternatives and the amount of water in the reservoir in storage stays the same, therefore Article VII triggering is unchanged.

Table E-2 Mean annual releases (acre-feet), 2007-2050, non-exceedance probabilities by alternative and climate scenario

| Project Releases by Climate Scenario and Percentile | Alternative 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 20th Percentile | | | | | |
| drier | 227,069 | 227,069 | 226,371 | 196,788 | 212,314 |
| central | 269,698 | 269,698 | 213,951 | 255,625 | 225,364 |
| wetter | 342,287 | 342,287 | 331,409 | 334,435 | 338,992 |
| 50th Percentile | | | | | |
| drier | 446,457 | 446,457 | 431,656 | 450,085 | 438,508 |
| central | 655,444 | 655,444 | 712,025 | 643,252 | 692,498 |
| wetter | 670,995 | 670,995 | 700,846 | 649,809 | 683,352 |
| 80th Percentile | | | | | |
| drier | 738,645 | 738,645 | 742,302 | 738,404 | 742,399 |
| central | 739,822 | 739,822 | 743,789 | 467,846 | 745,815 |
| wetter | 746,250 | 746,250 | 749,017 | 771,660 | 750,587 |

### Category: Cumulative Actions, Cumulative Impacts, and Ongoing Litigation

Comment Numbers: 119.01, 120.03, 120.08, 120.13, 120.15, 122.05, 122.10, 123.18, 124.07, 124.08

**Summary comment:** The DEIS does not adequately describe cumulative actions that could result in cumulative impacts. Particular cumulative actions identified in the comments include: 1) water management initiatives and plans of cities, 2) USIBWC's actions, 3) upstream exchanges of San Juan-Chama water, and 4) litigation. Some felt that ongoing litigation was inadequately referenced in the DEIS, others felt litigation should be excluded because it could affect the litigation process.

**Response:** Each of the resource sections in the DEIS Chapter 4 had a cumulative impact section. For the FEIS, these sections were moved to a new Chapter 5 highlighting cumulative actions, in particular, reasonably foreseeable future actions that could lead to cumulative impacts. All the USIBWC actions referenced in the comments were added, and this was checked with USIBWC who is a cooperating agency. Plans of the City of Las Cruces and City of El Paso were also added when they were considered relevant to the action or geographic scope as a cumulative action. References to past litigation have been retained, but references to litigation that has not been concluded have been deleted because it is not reasonably foreseeable for NEPA purposes.

### Category: Evaporation

Comment Numbers: 121.07, 121.16

**Summary comment:** The DEIS does not adequately address evaporation losses in relation to carryover accounting and evaporative charges under the Compact. See also comments about the Compact.

**Response**: Compact credit water is treated as a fixed variable in the model and is not subject to the OA or alternatives modeled for the EIS. There is no specific amount identified as evaporative loss.

### Category: Geographic Scope, Northern Boundary

Comment Numbers: 121.09, 115.01, 121.15, 121.18, 123.09, 123.10, 123.11, 123.12, 123.13

**Summary comment**: The DEIS does not adequately define the upstream geographic scope of analysis. Some felt the FEIS should clarify that the study area/action area should begin at the inflow area to Elephant Butte Reservoir and not be extended upstream. Others felt the geographic scope should be extended upstream due to the environmental effects of both upstream exchanges of San Juan-Chama water and conveyance of San Juan-Chama water to Elephant Butte Reservoir. Commenters who felt the geographic scope should be extended upstream also referenced concerns with the Compact, Article VII.

**Response**: See the Rio Grande Compact section for explanation of Article VII storage. The FEIS clarifies that the geographic scope begins with Elephant Butte Reservoir and does not extend upstream because the analysis of effects of the alternatives is directed at the effects of water flowing into Elephant Butte Reservoir for storage, releases, and downstream effects—not upstream. The modelling approach used to evaluate the San Juan-Chama storage provides a reasonable analysis of environmental effects within the scope of this FEIS. Any environmental effects related to San Juan-Chama water flowing downstream or exchanges upstream are out-of-scope for this FEIS but will be analyzed when such actions are ripe for analysis. The alternatives have no effect on the utilization of San Juan-Chama water. The scope for the FEIS is defined as the Rio Grande Project—not the Middle Rio Grande or San Juan-Chama Project.

### Category: Geographic Scope, Southern Boundary

Comment Numbers: 120.27, 121.10, 121.11

**Summary comment**: The DEIS does not adequately define the downstream geographic scope of analysis. Some want to include HCCRD; others want the analysis to extend to Fort Quitman, as well as the City of El Paso, and the El Paso Valley.

**Response**: With respect to the downstream boundary for the EIS, the county line was selected because it marks the downstream end of RGP facilities. To clarify the reasoning, a detailed explanation regarding HCCRD is provided here. In 1924, HCCRD was organized to consolidate into one canal system several ditches that had been built in about 1915 and were diverting water from the Rio Grande at various points between the RGP boundary and Guayuco Arroyo. Under a Warren Act contract between HCCRD and the U.S., the district has been diverting drainage and wastewater from the RGP since 1925. Hudspeth County is included in the socioeconomic analysis, but no specific hydrological analysis was made of effects to HCCRD due to geographical location of their facilities and the nature of their contracts with the U.S. The U.S. and HCCRD have two contracts. The contract of 1924 allowed for water delivery to HCCRD from the terminus of the Tornillo Main Canal during the irrigation season. This water could not be made available from Elephant Butte Reservoir storage. The contract of 1951 provided the U.S. would deliver to HCCRD water available from the Tornillo Canal, the Fabens Waste Channel, and the outlet of the Tornillo Drain without the use of project storage.

With respect to expanding the analysis to include the City of El Paso or the El Paso Valley, the M&I water is part of the irrigation delivery to EPCWID that is analyzed in the FEIS.

### Category: Groundwater

Comment Numbers; 120.04, 120.14, 120.16, 120.24, 120.31, 121.12, 121.21, 121.23, 121.24, 121.25

**Summary Comment:** The DEIS does not adequately describe impacts of the alternatives on groundwater.

**Response**: Many of the comments were technical and merit individual responses. In general, the modelling results suggest that the magnitude and duration of groundwater declines are primarily driven by climate and hydrologic variability (e.g. variations in inflows to Elephant Butte Reservoir and crop irrigation requirements) as opposed to differences among the alternatives. This is clarified in Chapter 4, Section 4.9.

### Category: Groundwater Quality

Comment Numbers: 122.09, 123.17

**Summary comment:** The DEIS does not adequately analyze impacts of the alternatives on groundwater quality.

**Response**: Specific data or models are not available to quantitatively measure whether any of the alternatives affect groundwater quality. Moreover, project operations are not based on groundwater quality, so modeling of groundwater quality was not considered necessary. Note that pumping costs are included in the EIS.

### Category: Hydrology Model

Comment Numbers: 101.01, 102.03, 104.03, 105.03, 107.01, 108.02, 112.01, 113.05, 113.06, 114.01, 120.07, 130.12, 120.22, 120.28, 120.30, 121.19, 122.02, 122.06, 122.07, 122.08

**Summary comment**: The DEIS does not adequately describe the hydrologic model analysis methods or results.

**Response**: The description of model was edited to be clearer in Section 4.1. In Chapter 4, resources or resource topics were reformatted for ease of comparison of effects of the alternatives.

### Category: NEPA Process, Public Involvement

Comment Numbers: 102.05, 103.01, 108.01, 109.01, 110.01, 116.01, 117.01, 121.01

**Summary comment**: Commenters requested more time to review the DEIS or the Service's Biological Opinion. One commenter asked for a supplemental EIS.

**Response:** The time extension was granted: a total of 83 days were provided for public comment on the DEIS and Reclamation's biological assessment. Reclamation will incorporate environmental commitments from the Service's opinion into the FEIS and Record of Decision.

One commenter asked for the opportunity to comment on a supplemental EIS. Given that no new information has been provided to finalize the EIS, but only clarification and reformatting of tables and text, it is not necessary to issue a supplement.

### Category: Purpose and Need

Comment Numbers: 121.03, 123.03
**Summary comment:** Purpose and need is too narrow.

**Response**: The underlying problem to which the agency is responding with action is correct as stated. No change made.

### Category: Socioeconomics, Socioeconomic Model

Comment Numbers: 102.02, 104.02, 105.02, 121.39, 121.41, 122.04, 121.40
**Summary comment:** The DEIS does not adequately describe the economic model analysis methods or results.

**Response:** Section 4.19 was edited to clarify the effects of the alternatives.

### Category: Vegetation Communities and Wetlands

Comment Numbers: 124.02, 112.01
**Summary comment:** The DEIS is not adequate in describing impacts to wetlands and taking actions to promote and maintain riparian vegetation.

**Response:** Section 4.13 on vegetation was expanded to include wetlands per this comment. The vegetation section shows that cycles of rising and falling surface water in Elephant Butte Reservoir should allow natural regeneration to occur.

### Category: Wildlife and Special Status Species

Comment Numbers: 102.01, 104.01, 111.01
**Summary comment:** Several requests were made for the Service's biological opinion. Requests were made for more updated information about wildlife, including the minnow, flycatcher and tamarisk leaf beetles.

**Response:** On May 25, 2016, the Service's Biological opinion was issued on line at: https://www.fws.gov/southwest/es/newmexico/documents/BO/2015-0734_BOR_EBR_BO_Final_05252016_Signed.pdf. Reclamation will be making environmental commitments in the Record of Decision related to the Service's opinion.

# 3 Individual Responses

In this section, each comment number and category is provided, along with the response.

101.01 Hydrology model. See Summary Comment, but response is that the Chapters 3-4 narratives regarding the hydrological model were edited for clarity and tables were provided to clarify differences among alternatives.

102.01 Special Status Species. Reclamation provided the biological assessment for public review along with the draft EIS. The Service released the biological opinion to the public when they issued their final biological opinion.

102.02 Socioeconomics. See summary comment, but the response is the Chapter 4 Socioeconomics section was edited for clarity.

102.03 Hydrology model. See summary comment, but response is that the Chapters 3-4 narratives regarding the hydrological model were edited for clarity and tables were provided to clarify differences among alternatives.

102.04 References. Copies of the references cited were provided or URLs were provided. References cited section checked to ensure citations were provided.

102.05 NEPA process. Time extension was provided to 6/8/2016.

103.01 NEPA process. Time extension was provided to 6/8/2016.

104 Duplicate of 102.01 to 102.03

105 Duplicate of 102.01 to 102.03

106 Public hearing transcript.

107 Duplicate of 102.01 to 102.03

108 Duplicate of 102.01 to 102.03

109 Duplicate of 102.01 to 102.03

110.01 NEPA process. Time extension was provided to 6/8/2016.

111 Duplicate of 110.01

112 Duplicate of 102.01 to 102.03

113.01 Vegetation, wetlands. New sections on wetlands were added to Chapters 3 – 5.

113.02 Agriculture, Agriculture to M&I conversions. See Summary Comment section for response.

113.03 Agriculture, Agriculture to M&I conversions. See Summary Comment section for response.

113.04 Agriculture, Agriculture to M&I conversions. See Summary Comment section for response.

113.05 Groundwater, surface water connectivity. Comment noted. DEIS presented results showing that groundwater pumping for supplemental irrigation in the Rincon and Mesilla basins is likely to increase under alternatives where RGP allocations to EBID decrease. No change was made for the FEIS because the assumption is that there would be 100% substitution (i.e., if surface water delivery drops by 1 acre-foot, groundwater delivery goes up by 1 acre-foot. In addition, the model assumes that there is no limit on water delivery to irrigated lands--irrigators will use surface water, then groundwater, without limit until crop irrigation requirements are met.

113.06 Hydrology model (evaporation). See Summary Comment section for response.

**1**14 Duplicate of 102.03.

115.01 Geographic scope: northern border. See Summary Comment section for response.

115.02 Allocation. Added a definition under the Allocation section in Chapter 4 clarifying that the term in the EIS references how reclamation proposes to handle accounting for project water in the reservoirs, as well as releases and distribution to the districts and Mexico. The terms allocate and allocation in the EIS is consistent with the Compromise and Settlement Agreement among the U.S., EBID, and EPCWID. See also, summary comment section for response.

116.01 NEPA process. Time extension was provided to 6/8/2016.

117.01 NEPA process. Time extension was provided to 6/8/2016.

118.01 Alternatives. Comment added to Alternatives Considered but Rejected section of FEIS, but this request is out-of-scope for the action analyzed here.

119.01 Cumulative actions, cumulative impacts and litigation. See Summary Comment section for response.

119.02 References. Copies of the references cited were provided or URLs were provided. References cited section checked to ensure citations were provided.

120.01 Compact. See Summary Comment section for response.

120.02 Compact. See Summary Comment section for response.

120.03 Cumulative actions, cumulative impacts and litigation. See Summary Comment section for response.

120.04 Groundwater. Supplemental water would be needed by crops that need a higher amount of water, e.g. pecans versus cotton. Individual irrigations in both New Mexico and use groundwater for irrigation when Project deliveries are insufficient to meet crop irrigation requirements. Groundwater use for supplemental irrigation is widespread during periods of low Project supply, particularly in the Rincon and Mesilla valley portions of the Project. In addition, groundwater use for supplemental irrigation also occurs during periods of full Project supply due to changes in cropping patterns within the Project, including increased acreage of crops with high irrigation requirement (e.g., pecans) and decreased acreage of crops with lower irrigation requirement that were historically grown within the Project (e.g., cotton). Demand for supplemental irrigation varies among individual irrigators throughout the Project based on on-farm cropping and irrigation practices, including soil preparation such as leveling and tilling; irrigation methods such as furrow, spray, or drip; and crop selection.

120.05 Allocation. See Summary Comment section for response. See also response to comment number 120.06.

120.06 Allocation. Allocation has changed over time. This was explained in the Background sections of the DEIS, but the explanation is as follows. Up until 1951, Reclamation delivered an equal amount of water per acre to the farmers, as ordered. With the drought of the 1950s, Reclamation analyzed data from 1946 to 1950 and determined a full allocation meant 3.0412 acre-feet per acre. From 1951-1979, water was allocated equally to each acre of project land, resulting in proportionate distribution of Project

deliveries to land. After the 1979-1980 transfer of O&M responsibilities to the districts, Reclamation "allocated" water using the linear regression curves for the historic delivery (D1) and historic diversions (D2) based on deliveries from 1951-1978. From 1980-2007, water was allocated proportionately to district headings, resulting in a proportionate distribution of project diversions (at headings). Under the OA, the diversion ratio adjustment eliminates the strict allocation by proportion by adjusting EBID's annual allocation to account for changes in project performance relative to the period 1951-1978 as represented by the D-1 and D-2 curves.

120.07 Hydrology model. See summary comment, but response is that the Chapters 3-4 narratives regarding the hydrological model were edited for clarity and tables were provided to clarify differences among alternatives.

120.08 Cumulative actions, cumulative impacts and litigation. See Summary Comment section for response.

120.09 Compact. Edit done.

120.10 Compact. See Summary Comment section for response.

120.11 Compact. See Summary Comment section for response.

120.12 Hydrology model. Project water includes all inflows to the Rio Grande below Caballo Dam, including water bypassed to the Rio Grande from Project conveyance facilities (e.g., waste, operational spills) and return flows from Project drainage facilities, as well as storm runoff and groundwater discharge reaching the Rio Grande. All water diverted from the Rio Grande by EBID, EPCWID, and Mexico is thus included in Project accounting--including calculation of allocation charges, allocation credits, and the diversion ratio--regardless of how that water reached the river channel, with the exception of flood flows designated by Reclamation per Section 3.4 of the Operations Manual.

120.13 Cumulative actions, cumulative impacts and litigation. Groundwater assumptions only reach to the level that have been historically available to the Project as return flow from drains and river bank storage; however, the language was edited for clarity.

120.14 Groundwater. We are not sure why the statement creates confusion, but attempted to edit the text for clarity.

120.15 Cumulative actions, cumulative impacts and litigation. See Summary Comment section for response.

120.16 Groundwater. Reference deleted.

120.17 Allocation. Neither the Rio Grande Compact nor the OA impose an explicit limit on the amount of Project Water that may be released in a given year. Analysis carried out during the early 1950s, based on actual irrigation deliveries to Project lands during the period 1946-1950, determined that a delivery of 36.29 inches (3.024 acre-feet per acre) constituted a "normal delivery to the project lands". The D-1 Curve was later used to estimate the release from Project storage that would provide for delivery of 3.024 acre-feet per acre (assuming 155,000 irrigated acres within the Project). The resulting release of 763,842 acre-feet considered "full supply" for allocation purposes prior to the OA. A release of 790,000 acre-feet is considered "full supply" for allocation purposes under the OA. The use of 790,000 acre-feet to denote "full supply" for allocation purposes is consistent with the Rio Grande Compact, which refers to 790,000 acre-feet as a "normal release" from Project storage for any given year. Nevertheless, it should be noted that the values of 763,842 and 790,000 are used for allocation purposes only.

120.18 Compact. See Summary Comment section for response.

120.19 Compact. See Summary Comment section for response.

120.20 Compact. References to Compact edited per this comment.

120.21 Compact. See Summary Comment section for response.

120.22 Hydrology model. See response to 120.04.

120.23 Hydrology model. See response to 120.04.

120.24 Groundwater. Prior to 1980, Reclamation allocated, released, and delivered water to individual irrigators throughout EBID and EPCWID. By contrast, since 1980, Reclamation has allocated, released, and delivered Project Water to each district's authorized points of diversion. The diversion ratio provision of the OA was developed to ensure that annual allocations and deliveries to EPCWID's diversion points are consistent with historical Project delivery performance and are not impacted by depletion of stream flows and drainage return flows upstream of EPCWID's diversion points. Under current Project operations, EPCWID's final diversion point is American Diversion Dam, located at the southern end of the Mesilla Valley. Because EPCWID's final diversion occurs in the Mesilla Valley, and because water is conveyed to accounting points in El Paso Valley via concrete-lined canals, depletions occurring downstream of American Diversion Dam do not affect Project allocations and deliveries to EPCWID. Depletions occurring downstream of American Diversion Dam are therefore not considered in this EIS. For the EIS, we are only looking at the pumping in the Rincon and Mesilla Valleys because that is what affects project efficiency. Pumping in the El Paso Valley does not have the same impacts and is subsequent to the diversion of the Project water supply to EPCWID.

120.25 Edit. Done.

120.26 Alternatives, carryover. There are many reasons why a district may have unused allocation even if demands from the district's users are not fully met. For example, district allocations are not finalized until the end of the irrigation season. Monsoon inflows may reach the reservoir late in the season, too late to be put to beneficial use but early enough to increase allocations. In other cases, some users within the district may use their full water allotment from the district and still not meet their demand, whereas others with lower demand may not need their full allotment, resulting in carryover for the district.

120.27 Geographic scope, southern border. See Summary Comment section for response.

120.28 Hydrology model. Prior to 1951, Reclamation did not formally allocate water to Project lands or to EBID, EPCWID, and Mexico. Water was released to meet the delivery obligation to Mexico under the 1906 Convention, and to meet the irrigation demands of demands of irrigators throughout the Project as communicated through water orders. During the drought of the 1950s (approximately 1950-1957), Project supply was not sufficient to meet irrigation demands throughout the project. In order to deliver water on an equal basis throughout the Project, and to determine the United States' obligation to Mexico under the 1906 convention during periods of "extraordinary drought", Reclamation developed a procedure for allocating water to lands within the Project. The procedure determined the amount of water available to each acre of Project land, and the corresponding delivery obligation to Mexico based on the percent allocation to Project lands relative to a "normal delivery" of 3.024 acre-feet. The D-1 and D-2 Curves are based on the period 1951-1978 because this period is representative of historical Project allocation and operating procedures under Reclamation, prior to the transfer of operation

and maintenance responsibilities for conveyance and drainage facilities to EBID and EPCWID.

120.29 Allocation. See Summary Comment section for response.

120.30 Hydrology model. See Summary Comment section for response.

120.31 Groundwater. Groundwater pumping for supplemental irrigation historically occurred primarily from the shallow alluvial zones of the Palomas and Mesilla Basin aquifers. Similar to previous models of the Rincon and Mesilla valleys, RMBHM assumes that all groundwater pumping for supplemental irrigation occurs from the uppermost layer of the model, which generally coincides with the shallow alluvium. In response to the current drought, some irrigation wells have been drilled deeper. RMBHM maintains the assumption of previous modeling efforts that all irrigation well pumping occurs from the shallow alluvium.

121.01 NEPA process. See Summary Comment section. CEQ regulations at 1502.9 state that any agency shall prepare supplements if it makes substantial changes in the proposed action that are elevation to environmental concerns, or there are significant new circumstances or information relevant to environmental concerns, or to further purposes of the act. The team does not find these circumstances are met for this EIS.

121.02 NEPA process, irreversible and irretrievable commitments. Comment noted and see Section 1.5. With the 2007 EA, Reclamation found no significant impacts affecting the human environment; however, it committed Reclamation to gather data over the first five years of implementation to evaluate effects on the environment. In 2013, Reclamation supplemented the 2007 EA. This SEA was initially intended to analyze the potential impacts of implementing the OA through 2050. However, given the uncertainties of persisting drought and the need to improve the analytical tools, Reclamation determined that analysis of a longer period would have been of limited use (Reclamation 2013a, 2013b). In 2013, Reclamation began the development and refinement of modeling tools to thoroughly analyze the effects of implementing the OA through 2050 and to document the information in this FEIS. The Responsible Official has not determined which alternative--which elements of project accounting and delivery calculations--will be selected, but the FEIS identifies Alternative 1 as the preferred alternative.

121.03 Purpose and Need. Comment noted but do not agree it is too narrow.

121.04 Alternatives, No Action. See Summary Comment section for response.

121.05 Alternatives. A new alternative based on charges and credits would be based on data after the transfer of O&M to the districts. There is, in fact, a difference between "gross diversions" used to derive the D-2 Curve and "charged diversions" used to calculate the diversion ratio. EBID and EPCWID both understand and accept this difference as one of many negotiated aspects of the OA. Perhaps more importantly, there was no accounting for charges and credits during the D-2 period (1951-1978) as Reclamation delivered water directly to irrigators during this period.

121.06 Alternatives, carryover. . See Summary Comment section for response.

121.07 Evaporation. See Summary Comment section for response.

121.08 Alternatives, operating manual. See Summary Comment section for response.

121.09 Geographic scope, northern border. See Summary Comment section for response.

121.10 Geographic scope, southern border. See Summary Comment section for response.

121.11 Geographic scope, southern border. See Summary Comment section for response.

121.12 Groundwater. This statement regarding impacts of pumping downstream of diversion points applies to current operations, where the final delivery point to the districts is above American Dam. Neither the EIS nor the Tech Memo (Appendix C) states that "effects of pumping did not occur downstream of RGP diversion points during the historical period which forms the basis of the 2008 Operating Agreement (1951-1978)," as stated by this comment. We have not yet evaluated the extent to which changes in the El Paso Valley impact project performance relative to the D1/D2 period (e.g., how pumping in EP Valley during this period impacted seepage losses below American Dam).

121.13 Surface water, deliveries. The factors that affect the diversion ratio are predominately in the Rincon and Mesilla Valleys, and are therefore these areas are the focus of the FEIS discussion. There is an emphasis in the FEIS on those areas where the diversion ratio adjustment is determined.

121.14 Allocation.

121.15 Geographic scope, northern border. See Summary Comment section for response.

121.16 Evaporation. See Summary Comment section for response.

121.17 Compact. Comment noted, they are the same and no change was made. Also, see response to 120.21.

121.18 Geographic scope, northern border. See Summary Comment section for response.

121.19 Hydrology model. This comment is correct, there was an error in the allocation code of the RMBHM and the output described in the DEIS that affected Alternatives 1and 2. The error was fixed in the FEIS and Appendix C. The corrected results show a decrease in the impact of Alternatives 1 and 2 on allocations and deliveries to EBID and groundwater elevations in Rincon and Mesilla Valleys. Regarding model verification, the model was verified relative to historical conditions (comparison of observed vs. simulated storage, releases, diversions for the period 1960-2004). Verification of simulations used in the FEIS was based on detailed review of model code and results to ensure that the model correctly implemented each alternative and that the model results reflected the modelers' understanding of operations under each alternative. The commenter identified an error that was not identified in the DEIS model results. See also response to comment 122.06.

121.20 Compact. Assumption inherited from URGSim model used for URGIA, not an explicit assumption of the MODFLOW model used in the FEIS.

121.21 Groundwater. Groundwater pumping by the City of El Paso from the Canutillo Well Field, located in the southern Mesilla Valley, is specified in the model input file TXCN.EIS.wel. The input file specifies a pumping volume 16,394.4 acre-feet during the primary irrigation season (March-October) and 7,164.5 acre-feet during the non-irrigation season (November-February) for a total of 23,559 acre-feet per year. Pumping volumes are applied at a constant rate over the primary irrigation season and non-irrigation season, respectively, over the duration of the simulation period. The same pumping rate is used in all simulations evaluated in this FEIS. The assumptions and model results are reasonable for FEIS purposes of comparing alternatives, but are not designed to forecast future pumping.

121.22 Allocation. Comment noted. The analysis did not emphasize one water user over another; both are described in tables and text.

121.23 Groundwater. According to the graphs provided (page 25 of comment letter), significant groundwater declines occurred from 2003-2005, prior to the OA and prior to the current drought as defined in the figure. This suggests that recent groundwater declines are independent of the OA and/or that the current drought began in 2003, as opposed to 2008, as indicated in the figure, and the drought is still ongoing. These points suggest that groundwater declines since 2003 are consistent with declines during previous drought periods, and that the duration and magnitude of declines result from prolonged drought conditions rather than from the OA.

121.24 Groundwater. While some alternatives result in larger declines than others do, the overall magnitude and trends in groundwater declines are generally similar across all alternatives. Results suggest that the magnitude and duration of groundwater declines are primarily driven by climate and hydrologic variability (e.g., variations in inflows to Elephant Butte Reservoir and crop irrigation requirement) as opposed to differences between alternatives.

121.25 Groundwater. Assumption is also consistent with NMOSE's report titled "Water Use by Categories 2010". Quoting from the report: "Table 3.3 summarizes the percentage of surface water shortages, by river basin, for 2010." The table lists the percent surface water shortage in the Rio Grande Basin, Dona Ana County, as "0, offset by supplemental well pumping." NMOSE thus uses the same assumption as used in the hydrologic modeling for the FEIS.

121.26 Groundwater quality. See Summary Comment section for response.

121.27 Releases. Release data checked and clarified in FEIS.

121.28 Alternatives, Operating Manual. See Summary Comment section for response.

121.29 Geographic scope, northern border. See Summary Comment section for response.

121.30 Wildlife, Special Status Species. The mouse was considered throughout the action area, but based on field observations and its habitat requirements; it is not present nor likely to become present in the action area.

121.31 Wildlife, Special Status Species. Comment noted. Reclamation used the best available science from monitoring data to assess effects on the minnow.

121.32 Wildlife, Special Status Species. References added as appropriate.

121.33 Wildlife, Special Status Species. Agree, comment noted.

121.34 Wildlife, Special Status Species. Comment noted. Elephant Butte Reservoir and the RGP are in the baseline and the appropriate comparison is effects of the action (Alternative 1) against the baseline. While Elephant Butte Reservoir and the RGP existence is a factor in the endangered status of the minnow, the effects of the alternatives do not change its status. The finding is correct.

121.35 Wildlife, Special Status Species. Agree, added to text.

121.36 Climate change. See Summary Comment section for response.

121.37 References. Comment noted. No change made to biological assessment because consultation has been completed.

121.38 Reservoir elevations. Comment noted. Biological assessment analysis was based on use of time series analysis of fluctuations.

121.39 Socioeconomics. Socioeconomic sections updated in Chapter 4 to be clearer.

121.40 Socioeconomics. M&I water is valued more highly than agricultural water.

121.41 Socioeconomics. Socioeconomic sections updated in Chapter 4 to be clearer.

122.1 Alternatives. No Action. See Summary Comment section for response.

122.02 Hydrology model. Assumptions and model results clarified in text.

122.03 Agriculture, Agriculture to M&I conversions. See Summary Comment section for response.

122.04 Socioeconomics, M&I water. Presently the Las Cruces water supply is not dependent on the RGP water supply and RGP OA. In the event that Las Cruces should obtain access to Project water through contracts with EBID and Reclamation, Las Cruces surface water supply deliveries would be subject to the same allocation constrains as other EBID farmers.

122.05 Cumulative actions, cumulative impacts, and litigation. See Summary Comment section for response.

122.06 Hydrology model. The RMBHM model, as stated in Section 4.1 and presented in Appendix C, meets the Information Quality Guidelines pursuant to section 515 of the Treasury and General Government Appropriations Act and subsequent guidelines of the Department of the Interior and Reclamation. The model is based on two previous hydrologic models of the Rincon and Mesilla Basins: one developed by the NMOSE and others as documented by SSPA (2007); and the other developed by the USGS and documented in Hanson et al. (2013). Both of these models underwent extensive review. The RMBHM uses the One-Water Hydrologic Flow Model (MF-OWHM; Hanson et al. 2013), an integrated hydrologic modeling software based on the USGS Modular Groundwater Model, MODFLOW. MODFLOW is considered an international standard for simulating and predicting groundwater conditions and groundwater/surface-water interactions, according to the USGS (see http://water.usgs.gov/ogw/modflow/). The new code features that were added for use in the FEIS simulations underwent extensive peer input (review by other Reclamation hydrologists and by technical specialists in USGS who were not involved in developing these features). Based on Comment 121.19, an error was found in the data presented in the DEIS and the data were corrected for the FEIS with results provided in tables and narrative in Chapter 4 and in Appendix C.

122.07 Hydrology model. The OA was designed to operate under the full range of climatic and hydraulic scenarios experienced since 1951. See section on model sensitivity and validity.

122.08 Hydrology model. Water budgets for any desired area may be calculated from the model results provided in the Technical Memo, but were not placed in the body of the FEIS. In addition, the error noted above resulted in over-allocation to EPCWID under Alternatives 1 and 2, but this was corrected in the FEIS. Otherwise, the model reflects the allocation and accounting procedures defined in the OA and Operations Manual.

122.09 Groundwater quality. See Summary Comment section for response.

122.10 Cumulative actions, cumulative impacts, and litigation. See Summary Comment section for response.

122.11 Compact. See Summary Comment section for response. The alternatives do not affect Compact storage or relinquishment.

123.01 Alternatives. Comment noted. This comment is out-of-scope for this action. See Summary Comment section under northern boundary.

123.02 Alternatives. Comment noted. This comment is out-of-scope for this action. See Summary Comment section under northern boundary.

123.03 Purpose and Need. See Summary Comment section for response.

123.04 Alternatives. Comment noted. The negotiations of the OA were for an equitable distribution of the RGP water resources, consistent with historical distributes. Moreover, by identifying alternatives that vary the key elements of project accounting, Reclamation has considered a reasonable range of alternatives. The key stakeholders, EBID and EPCWID, agree that a reasonable range of alternatives was analyzed.

123.05 Alternatives; No Action. See Summary Comment section for response.

123.06 Alternatives; No Action. See Summary Comment section for response.

123.07 NEPA process, duration of action. See Section 1.5 on prior NEPA analyses. The SEA was initially intended to analyze the potential impacts of implementing the OA through 2050. However, given the uncertainties of persisting drought and the need to improve the analytical tools, Reclamation determined that analysis of a longer period would have been of limited use (Reclamation 2013a, 2013b). In 2013, Reclamation began the development and refinement of modeling tools to thoroughly analyze the effects of implementing the OA through 2050 and to document the information in this FEIS. This FEIS has been prepared to project effects of the alternatives through 2050.

123.08 Wildlife, Special Status Species. The baseline, snapshot in time, was based on data from 2014, 2015, and Reclamation consulted on the worst case for the listed species and their habitat. For the birds, the worst case would be due to the wetter climate scenario and continued implementation of the OA and continued execution of a contract for storage of San Juan-Chama Project water in Elephant Butte; i.e., those conditions that result in a higher reservoir elevation for a prolonged duration.

123.09 Geographic scope, northern border. See Summary Comment section for response.

123.10 Geographic scope, northern border. See Summary Comment section for response.

123.11 Geographic scope, northern border. See Summary Comment section for response.

123.12 Geographic scope, northern border. See Summary Comment section for response.

123.13 Geographic scope, northern border. See Summary Comment section for response.

123.14 Surface water. Text edited regarding low flow conveyance channel.

123.15 Wildlife, special status species. Comment noted. The biological assessment and Service’s biological opinion (Appendix F) were prepared in consideration of recovery of the species and the recovery plan. One of Reclamation's commitments will be a Southwest willow flycatcher and cuckoo management plan. No change to text.

123.16 Alternatives, mitigation measures. See Summary Comment section for response.

123.17 Groundwater, vegetation, wildlife, aquatic resources. Groundwater levels covered in Chapter 4 based on two representative wells. Other resources had qualitative assessments based on the outputs of the hydrology model.

123.18 Cumulative actions, cumulative impacts, and litigation See Summary Comment section for response. Specific to this comment, the OA does not affect upstream river management. Elephant Butte storage would only impact upstream river management during flood routing and flood control operations.

123.19 Climate change. See Summary Comment section for response.

123.20 Climate change. References reviewed and added as appropriate. Also see Summary Comment section for response.

123.21 Wildlife, special status species. Comment noted. The correct analysis is a comparison of the effect of the proposed action against the baseline--the snapshot of the species when the consultation occurred; i.e., 2015. Given that this is a projection into the future, and that projection indicates there will be cycles of wetting and drying, the effects to primary constituent elements of the birds' habitat should be beneficial due to vegetation rejuvenation. The effects of the preferred alternative, when compared to the baseline, does not meet the jeopardy standard. However, Reclamation acknowledges that the status of the listed species is endangered and threatened.

124.01 Alternatives. Reclamation operates its projects based on congressionally authorized purposes, in this case, irrigated agriculture in the U.S. and Mexico. Reclamation is mandated to make releases to benefit irrigated agriculture; it cannot adopt a more natural flow regime absent a change in Congressional authorization.

124.02 Vegetation. Fluctuations in Elephant Butte Reservoir surface elevations may help maintain diverse and dynamic riparian vegetation.

124.03 Alternatives; mitigation measures. See Summary Comment section for response.

124.04 Wildlife, special status species. Commitments to manage noxious weeds incorporated in vegetation section.

124.05 Wildlife, special status species. Comment noted. The biological assessment and biological opinion of the Service were prepared in consideration of recovery of the species and the recovery plan. One of Reclamation's commitments will be a Southwest willow flycatcher and cuckoo management plan. No change to text.

124.06 Alternatives. Comment noted. Reclamation operates its projects based on congressionally authorized purposes, in this case, irrigated agriculture. Reclamation is required by law to make releases to benefit irrigated agriculture; it cannot adopt a more natural flow regime absent a change in Congressional authorization.

124.07 Cumulative actions, cumulative impacts, litigation. See Summary Comment section for response.

124.08 Cumulative actions, cumulative impacts, litigation. See Summary Comment section for response.

# 4 Scanned Comment Documents

Graham, Rhea <rgraham@usbr.gov>

# Draft EIS - Rio Grande Project - Request for Digital Appendices

**Graham, Rhea** <rgraham@usbr.gov> Wed, Mar 30, 2016 at 10:36 AM
To: Heidi Welsh <heidi431@aol.com>
Cc: ADMIN RECORD <RGOA_EIS@empsi.net>

Heidi,
Thank you for your request. I can mail DVDs for the Appendix A & B files...we do not have access to file sharing sites with persons outside of the Federal government. Please send me your mailing address, and your affiliation, if any.
Thank you,
Rhea

Rhea Graham, Special Project Officer

Bureau of Reclamation Albuquerque Area Office

555 Broadway N.E., Suite 100, Mail Stop ALB-103

Albuquerque, NM 87102

(505) 462-3560 (Office) (505) 221-0470 (Mobile) (505) 462-3793 (Fax)

http://www.usbr.gov/uc/albuq/rm/RGP/

On Wed, Mar 30, 2016 at 10:03 AM, Heidi Welsh <heidi431@aol.com> wrote:

Good Morning, Rhea –

I am reviewing the 2016 Draft EIS for the Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project. I noticed there are references to the following digital appendices which contain model data and model files.

1

- Digital appendix files listed in Appendix A (pp. 53 of memo, PDF pp. 369): Formatted Model Results for Selected Operational and Hydrologic Parameters ("ALLOCATION.xlsx", etc.)
- Digital appendix files listed in Appendix B (pp. 54 of memo, PDF pp. 370): Model Files and Unformatted Model Output ("EIS.Alt1.ScenarioP25.zip", etc.)

I have also attached the appendices to this email.

I would like to review these data and model files. Can you upload them to an ftp or dropbox or mail them on a DVD? Due to the relatively short time period to review this information, your prompt response would be greatly appreciated.

Thanks in advance for your help.

Best Regards,
Heidi

# NEW MEXICO INTERSTATE STREAM COMMISSION

102

**COMMISSION MEMBERS**

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whoops

**VIA EMAIL: rgraham@usbr.gov and First Class Mail**

March 31, 2016

Ms. Rhea Graham
Bureau of Reclamation, Albuquerque Area Office
555 Broadway Boulevard NE., Suite 100
ALB-103
Albuquerque, NM 87102

Dear Ms. Graham:

The New Mexico Interstate Stream Commission (NMISC) is undertaking review of the Draft Environmental Impact Statement for Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project (Draft EIS), released March 18, 2016. We understand that the deadline for comment is May 9, 2016. In preparing to comment, we respectfully request the following.

First, there is a large amount of supporting data and information referenced in the Draft EIS but not included in the document nor available on the Bureau of Reclamation (Reclamation) website. Without this information the NMISC is unable to conduct a meaningful review of the Draft EIS. Accordingly, the NMISC requests the following supporting information:

1
- The Biological Opinion issued by the U.S. Fish and Wildlife Service and supporting data from which the analysis in the Biological Opinion was developed. (The Notice of Availability published March 18, 2016 states that the Biological Opinion is available at http://www.fws.gov/southwest/es/NewMexico/ES_bio_op.cfm, however, the document was not located on the link.)

2
- The IMPLAN model utilized to analyze the socioeconomic environmental consequences of the five alternatives, including all input and output files.

3
- All digital appendix files listed in Appendix A of the Hydrology Technical Memo, which is attached to the Draft EIS as Appendix C: Formatted Model Results for Selected Operational and Hydrologic Parameters (ALLOCATION.xlsx, etc.).
- All digital appendix files listed in Appendix B of the Hydrology Technical Memo, which is attached to the Draft EIS as Appendix C: Model Files and Unformatted Model Output (EIS.Alt1.ScenarioP25.zip, etc.).

- Several references that do not include web addresses and ISC is unable to locate, including:

4

  - Hanson, R. T., S. E. Boyce, W. Schmid, J. Knight, and T. Maddock, III. 2013. Integrated Hydrologic Modeling of a Transboundary Aquifer System – Lower Rio Grande. MODFLOW and More 2013: Integrated Hydrologic Modeling, Golden, Colorado, June 5-8, 2011.
  - IBWC (U.S. International Boundary and Water Commission). 2014a. Flood Control Improvements to the Rio Grande Canalization Project in Vado, New Mexico, United States Section, International Boundary and Water Commission, El Paso, Texas.
  - Reclamation (U.S. Department of the Interior, Bureau of Reclamation). 2002. Elephant Butte and Caballo Reservoirs Resource Management Plan and Final Environmental Impact Statement. U.S. Department of the Interior, Bureau of Reclamation, Albuquerque Area Office, Albuquerque, New Mexico.
  - Reclamation (U.S. Department of the Interior, Bureau of Reclamation). 2003a. Browsing Analysis of Riparian Vegetation: Elephant Butte Project Lands. U.S. Department of the Interior, Bureau of Reclamation, Denver Technical Service Center, Denver, Colorado.
  - Reclamation (U.S. Department of the Interior, Bureau of Reclamation). 2003b. Elephant Butte and Caballo Reservoirs Resource Management Plan. U.S. Department of the Interior, Bureau of Reclamation, Albuquerque Area Office, Albuquerque, New Mexico.
  - Congressional Research Service, 2015. U. S. – Mexico Water Sharing: Background and Recent Developments, Congressional Research Service document 7-5700, January 23, 2015.

Please provide all the requested information in electronic format, if available, to Kim Bannerman at kim.bannerman@state.nm.us. If you do not have the information electronically, please send a hard copy to her at the address listed above.

5 Second, the NMISC requests a ninety (90) day extension of time for submitting comments, from May 9, 2016 to August 7, 2016. Reclamation has provided a very limited amount of time to comment on the Draft EIS, especially in light of the large amount of supporting material not made available in conjunction with the Draft EIS. As you are aware, the Draft EIS is a nearly 400 page document, not including all the various model files and references that need review, as well as the U.S. Fish and Wildlife Service Biological Opinion drafted in consultation with Reclamation under Section 7 of the Endangered Species Act. To provide the public meaningful opportunity to participate in the Draft EIS process, we believe this extension is warranted.

The NMISC would appreciate Reclamation make a determination on this extension request well in advance of the current May 9, 2016 comment deadline to allow us and other stakeholders the opportunity to adequately prepare comments for Reclamation.

Thank you for the opportunity to comment on this Draft EIS and for your careful consideration of this request.

Sincerely,

Deborah K. Dixon

Deborah K. Dixon, P.E.
Director
New Mexico Interstate Stream Commission

DKD/kmb

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2016 APR 11 10: 20

# STEIN & BROCKMANN, P.A.
## ATTORNEYS AT LAW


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JAMES C BROCKMANN*
SETH R. FULLERTON*

*Of Counsel*
KATHERINE W HALL

* New Mexico Board Certified Specialists in Water Law

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Santa Fe, New Mexico 87504-2067
Telephone: 505-983-3880
Telecopier: 505-986-1028


April 5, 2016

Ms. Rhea Graham
Bureau of Reclamation,
Albuquerque Area Office
555 Broadway Blvd. NE., Ste 100
Albuquerque, NM 87102

RE: Las Cruces' Comments to draft EIS for Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project

Dear Ms. Graham:

The City of Las Cruces will be submitting comments on the draft EIS for Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project. The issues in the draft EIS are critical to Las Cruces as it relies for its water supply on groundwater from the Lower Rio Grande Underground Water Basin and needs to determine the effects of the Operating Agreement, and the increased depletions from the aquifer that result from it, on the City's water supply. To thoroughly analyze these issues, additional time will be required beyond the deadline for comments of May 9, 2016. Accordingly, the City joins with the New Mexico Interstate Stream Commission in its request of March 31, 2016, to extend the time for submitting comments from May 9, 2016, to August 7, 2016.

1

Thank you for your attention to this matter.

Sincerely,

Jay F. Stein

Jay F. Stein

CC: Jorge Garcia, Marcia Driggers, Deborah, K. Dixon, Kim Bannermann, Lee Wilson

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New Mexico Interstate Stream Commission

TRANSCRIPT OF PROCEEDINGS

April 7, 2016
4:00 p.m.
555 Broadway, Northwest
Albuquerque, New Mexico 87102

Reported by: Robin A. Brazil, RPR, CCR #154
Williams & Associates, LLC
1608 Fifth Street, Northwest
Albuquerque, New Mexico 87102

1 MR. RICH: Good evening. My name is
2 Chris Rich. We are here to take comments on the Draft
3 Environmental Impact Statement on continued
4 implementation of the 2008 operating agreement for the
5 Rio Grande Project Draft -- well, I already said that.
6 New Mexico and Texas.
7 I'm the hearing officer. We are here to
8 receive comments on the Draft EIS. Because this is for
9 comments on the Draft EIS, it helps if you've read it if
10 you're actually going to comment on it, because
11 otherwise it's not a comment.
12 We will also accept written comments at this
13 hearing.
14 This public hearing is taking place in the Rio
15 Grande Conference Room of the Albuquerque area Office of
16 the Bureau of Reclamation, located at 555 Broadway
17 Boulevard, Northeast, in Albuquerque, New Mexico.
18 The US Environmental Protection Agency has
19 given the EIS Number 20160063 to this Draft EIS.
20 Comments are due on May 9th, 2016, to Rhea Graham of the
21 Bureau of Reclamation. Her email is rgraham@usb.gov
22 should you wish to provide additional comments.
23 I will take comments in the order that you
24 signed in, and I think we'll put like a 20-minute max on
25 comments. That sounds reasonable under the

1 circumstances.
2 Please speak clearly. We have a court
3 reporter.
4 The -- the purpose of this meeting is to allow
5 the public to come and give oral comments as well as
6 providing written comments, but in order for the agency
7 to be able to consider these comments, we have to have
8 them written down for us, thus the court reporter, so
9 please speak clearly and distinctly.
10 And remember, we are taking comments. This is
11 not a question and answer. There will not be any
12 exchanges. It's just give -- present your comments, and
13 then we'll move on to the next person.
14 So, Kim, I think we'll start with you.
15 MS. BANNERMAN: Thank you. Do I --
16 MR. RICH: Yes. Oh, we have to be formal
17 here.
18 MS. BANNERMAN: Thank you all. My name's
19 Kim Bannerman. I'm an attorney with the New Mexico
20 Interstate Stream Commission. Thank you for this
21 opportunity to provide comments on the Draft
22 Environmental Impact Statement.
23 I just want to state first that although I
24 have read the document, we're not commenting in depth at
25 this point. We haven't had time to digest everything

1 that is in the document, but we did have a couple of
2 comments that we wanted to make today, and I also have
3 them written, so I'll submit them in writing as well.
4 And a lot of this is a continuation of our
5 March 31st, 2016, information request that we made in
6 writing to Ms. Graham.
7 She responded on April 4th, I believe, but we
8 had a couple more concerns about that information
9 request and some additional requests.
10 First of all, in the March 31st letter, w
11 requested the biological opinion issued by the US Fish
12 and Wildlife Service and supporting data from which the
13 analysis in that BO was developed.
14 We noted in our letter that the notice of
15 availability published on March 18th stated that the BO
16 is available and gave a URL website at that time;
17 however, the document is not located at that website.
18 In its response, Ms. Graham noted that the URL
19 link was included in the availability merely to share
20 where the document would be posted. We've checked every
21 day. The document is still not posted to that site.
22 We've also asked directly the Fish and
23 Wildlife Service for the document and been denied access
24 from Fish and Wildlife Service as well.
25 The document is an integral part of this

1 Environmental Impact Statement, and to provide the
2 public a meaningful opportunity to review and comment on
3 the EIS, we need that document, and we think it should
4 be made public immediately and that we should be given
5 access to the document immediately.
2 6 Second, in our March 31st letter we also
7 requested the IMPLAN model utilized to analyze the
8 socioeconomic and consequences of the five alternatives
9 listed in the Draft EIS.
10 In response, again, Ms. Graham noted that the
11 IMPLAN model and data are proprietary and that the
12 output and input were adequately described in the Draft
13 EIS.
14 We don't argue that the IMPLAN software is
15 proprietary as listed on IMPLAN's website, and we may
16 need to purchase software to access the model. We're
17 fine doing so. That's not the issue here. The issue is
18 there are assumptions made in that model that cannot be
19 reviewed in a meaningful manner without access to the
20 model utilized in the Draft EIS.
21 Merely listing the outputs and inputs put into
22 the model doesn't provide adequate analysis capability
23 of the various assumptions that go into any sort of
24 economic model like IMPLAN.
25 Again, the model's integral to any meaningful

1 review of the Draft EIS and should be utilized by the
2 public immediately.
3 And finally I'll just include -- I won't go
4 into these in depth -- based on our initial review of
3
5 the hydrologic model, we have five more additional
6 information requests that weren't included in the Draft
7 EIS or the documents we've seen following.
8 So again, thank you for allowing me to make
9 these comments on behalf of the Interstate Stream
10 Commission, and we look forward to your response to this
11 and any ongoing response to our March 31st letter as
12 well. Thank you.
13 THE COURT: Thank you for your comments,
14 and we appreciate that they're written as well.
15 MS. BANNERMAN: Okay. Who do I --
16 THE COURT: To the reporter. Any other
17 comments? Well, this is going to be a barn burner.
18 Well, we'll just wait and see who shows up next. Who's
19 feeling --
20 Nobil, do you have anything?
21 MR. SHAFIKE: No, everything is included
22 in the letter.
23 MS. GRAHAM: You put yes, so --
24 MR. RICH: He was just being agreeable.
25 MS. BANNERMAN: He wasn't sure if I was

1 going to cover everything he wanted.
2 (Recess was held from 4:28 to 6:53.)
3 MR. RICH: We're back on the record for
4 the public hearing on the continued implementation of
5 the 2008 operating agreement with the Rio Grande Project
6 Draft Environmental Impact Statement, New Mexico and
7 Texas.
8 We are at the end of our time, having received
9 comments from all those who came to provide comments,
10 and we're closing at seven o'clock.
11 (Hearing concluded at 7:00 p.m.)
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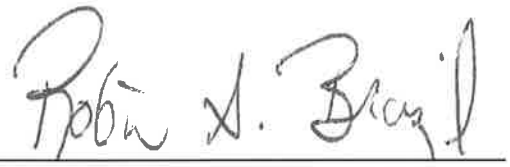
STATE OF NEW MEXICO )

)

COUNTY OF BERNALILLO)

I, ROBIN A. BRAZIL, Certified Court Reporter for the State of New Mexico, hereby certify that I reported, to the best of my ability, the foregoing proceedings; that the foregoing is a true and correct transcript of my stenographic notes, which were reduced to typewritten transcript through Computer-Aided Transcription; that on the date I reported these proceedings, I was a New Mexico Certified Court Reporter.

Dated at Albuquerque, New Mexico, this 14th day of April, 2016.



ROBIN A. BRAZIL
New Mexico CCR No. 154
WILLIAMS & ASSOCIATES, LLC
1608 Fifth Street, Northwest
Albuquerque, New Mexico 87102

# NEW MEXICO INTERSTATE STREAM COMMISSION

105

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BATAAN MEMORIAL BUILDING, ROOM 101
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(505) 827-6160
FAX: (505) 827-6188

To: Bureau of Reclamation Staff
From: New Mexico Interstate Stream Commission
Date: April 7, 2016
Re: Information Request - Draft EIS for 2008 Operating Agreement

Biological Opinion

1 In its March 31, 2016 letter the New Mexico Interstate Stream Commission (NMISC) requested the Biological Opinion (BO) issued by the U.S. Fish and Wildlife Service and supporting data from which the analysis in the Biological Opinion was developed. The NMISC noted that the Notice of Availability published March 18, 2016 stated that the BO is available at http://www.fws.gov/southwest/es/NewMexico/ES_bio_op.cfm, however, the document was not located on the link.

In its response to the March 31, 2016 letter, Bureau of Reclamation (Reclamation) staff again failed to include the BO. The response stated that the URL link was included in the Notice of Availability merely to "share where the document *would* be posted." The document is still not posted to the given link. Moreover, the NMISC requested the BO from the U.S. Fish & Wildlife Service and was again denied access. This document is an integral part of the Draft EIS and should be released to the public immediately.

IMPLAN Model

2 In its March 31, 2016 letter the NMISC also requested the IMPLAN model utilized to analyze the socioeconomic environmental consequences of the five alternatives, including all input and output files. Specifically the NMISC requests the model, all input and output data and files, and all post-processing files and analyses. In its response, BOR staff asserted that the IMPLAN model and data are proprietary and that the output and input were adequately described in the Draft EIS. The NMISC does not argue that the IMPLAN software is proprietary as described on their website and purchase of a software license may be necessary to run the model. That is not the issue.

The assumptions made in the model cannot be reviewed in a meaningful manner without access to the model utilized in the Draft EIS. Merely stating the outputs of the model does not allow analysis of the various assumptions that go into any economic model. Again, this model is an integral part of the Draft EIS and should be released to the public immediately.

Additional Hydrologic Model Information

3 The NMISC thanks BOR for release of the model files requested in the March 31, 2016 letter. Based on our initial review of the model the NMISC requests the following additional information related to the model:

1. Model Enhancements - All computer files, source code, and documentation for all "new features" and "enhancements" to the MODFLOW-OWHM Model that were made in developing the Rincon and Mesilla Basins Hydrologic Model ("RMBHM"), including those described in the Addendum section of Technical Memorandum No. 86-68210-2015-05, Simulation of Rio Grande Project Operations in the Rincon and Mesilla Basins: Summary of Model Configuration and Results ("RMBHM Technical Memo") (see pages 55-58).

2. Model Calibration - All model files, input and output files, PEST input and output files, post-processing spreadsheets, statistical analyses, and documentation related to parameterization, correlation, and calibration of the RMBHM, including all comparisons of historical data and simulated data at monthly, seasonal, annual, and other time intervals. This includes comparisons that were documented in the RMBHM Technical Memo and all other available comparisons. (see pages 18-21 of the RMBHM Technical Memo).

3. Model Sensitivity Analyses - All model files, input and output files, post-processing spreadsheets, statistical analyses, and documentation related to the sensitivity analysis that were conducted using the RMBHM. (see pages 19-20 of the RMBHM Technical Memo).

4. GIS Files - All GIS files related to or used in developing the RMBHM, and displaying spatial information and results from the model.

5. Hydrologic Inputs to Model – All computer files and analyses related to all hydrology and climate inputs to the RMBHM, including (a) historical data used in calibrating the model and (b) projected future data used in the MBHM simulation runs for the 5 alternatives described in 2016 Draft EIS. This includes all of the downscaled temperature and precipitation projections from global climate models, all hydrologic modeling to develop projects of future streamflow at selected locations within the Rio Grande Basin, including analyses performed with the Upper Rio Grande Simulation Model (URGSiM) (see pages 22 – 28 of the RMBHM Technical Memo)

Again the NMISC asks you please provide all the requested information in electronic format, if available, to Kim Bannerman at kim.bannerman@state.nm.us. If you do not have the information electronically, please send a hard copy to her at the address listed above.

Thank you for your time and attention.

106

# CONTINUED IMPLEMENTATION OF THE 2008 OPERATING AGREEMENT FOR THE RIO GRANDE PROJECT, DRAFT ENVIRONMENTAL IMPACT STATEMENT, NEW MEXICO and TEXAS

TRANSCRIPT OF PROCEEDINGS

Public Hearing to Receive

Oral, Written Comments

April 12, 2016
6:00 p.m.
Elephant Butte Irrigation District Board Room
530 South Melendres Street
Las Cruces, New Mexico 88005

REPORTED BY: HEATHER PITVOREC, RMR
NM CCR 506, TX CSR 9030
WILLIAMS & ASSOCIATES, LLC
1608 Fifth Street NW
Albuquerque, NM 87102

1 A P P E A R A N C E S

2

3 Hearing Officer: JOSHUA MANN

4

5 Attendee for U.S. Department of the Interior, Bureau of Reclamation:

6

7 RHEA LYDIA GRAHAM
555 Broadway Boulevard NE
Suite 100 (ALB-103)
8 Albuquerque, New Mexico 87102
rgraham@usbr.gov

9

10 Attendee for Environmental Management and Planning Solutions, Inc.

11

12 KEVIN T. DOYLE
54 1/2 Lincoln Street
13 Santa Fe, New Mexico 87501
kevin.doyle@empsi.com

14

15 Attendees for Public Hearing:

16 Phil King
Zack Libbin
17 Erek H. Fuchs
Jennifer Faler
18 Michelle Estrada Lopez
Dale Doremus
19 Pamela Homer
Marcy Driggers
20 Blane Sanchez
Nathalie Jacque
21 Dave Henney
Gill Sorg

22

23

24

25

1 P R O C E E D I N G S

2

3 HEARING OFFICER: Okay. I guess we can
4 get started. It's past 6:00, and Rhea informs me
5 that there is nobody coming in. I think we're it
6 for now, anyways.
7 Good evening and welcome to the Public
8 Hearing on the Continued Implementation of the 2008
9 Operating Agreement for the Rio Grande Project,
10 Draft EIS, New Mexico and Texas.
11 My name is Josh Mann. I'm the hearing
12 examiner. I'm with the Solicitor's Office in
13 Albuquerque. I'm here to receive your comments,
14 which will be recorded by our court recorder.
15 The hearing is not for answering questions
16 or holding dialogue with staff. The purpose of the
17 hearing is to receive and record your comments on
18 the subject matter of the draft EIS or -- yeah,
19 Draft Environmental Impact Statement or EIS.
20 We also accept written comments at this
21 hearing. The purpose of today's public hearing is
22 to take your comments regarding the Draft EIS. This
23 public hearing is in the Board Room at Elephant
24 Butte Irrigation District located at 530 South
25 Melendres Street in Las Cruces, New Mexico.

1 The U.S. Environmental Protection Agency
2 has given EIS No. 20160063 to this draft EIS.
3 Comments are due by May 9th, 2016, to Rhea Graham of
4 the Bureau of Reclamation. Her E-mail address is
5 Rgraham@USBR.gov, that's R-G-R-A-H-A-M at U-S-B-R
6 dot gov should you wish to provide additional
7 written comments after today's hearing.
8 I will take your comments in the order
9 that you signed in. However, nobody at this point
10 has stated that they want to make any comments.
11 So you'll notice that the document has
12 line numbers. Referring to the page number and line
13 numbers will be helpful when you're responding to
14 comments.
15 And so, because we don't have anybody that
16 has said they want to make comments, I suggest that
17 we go off the record until somebody comes in who
18 does want to provide comments.
19 That way, you don't have to record all of
20 our chatter, and we can talk.
21 So we'll go off the record now.
22 (A discussion was held off the record.)
23 HEARING OFFICER: So we're back on the
24 record. It is 9:00, and we're here for a public
25 hearing on the Continued Implementation of the 2008

1 Operating Agreement for the Rio Grande Project,
2 Draft Environmental Impact Statement, New Mexico and
3 Texas.
4 We did not receive any comments today.
5 There were no commentators, no comment-ors rather,
6 and we have filled our obligation. We will now
7 conclude this hearing.
8 Off the record.
9
10 (The proceedings concluded at 9:00 PM.)
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1 CONTINUED IMPLEMENTATION OF THE 2008 OPERATING
2 AGREEMENT FOR THE RIO GRANDE PROJECT, DRAFT
3 ENVIRONMENTAL IMPACT STATEMENT, NEW MEXICO and TEXAS
4
5 REPORTER'S CERTIFICATE
6
7 I, HEATHER E. PITVOREC, New Mexico CCR
8 #506, DO HEREBY CERTIFY that on April 12, 2016,
9 proceedings in the above-captioned matter were taken
10 before me, that I did report in stenographic
11 shorthand the proceedings set forth herein, and the
12 foregoing pages are a true and correct transcription
13 to the best of my ability.
14 I FURTHER CERTIFY that I am neither
15 employed by nor related to nor contracted with
16 (unless excepted by the rules) any of the parties or
17 attorneys in this case, and that I have no interest
18 whatsoever in the final disposition of this case in
19 any court.
20
21 Heather E. Pitvorec
22 Heather E. Pitvorec, RPR, RMR,
Certified Court Reporter No. 506
License Expires: 12/31/2016
23
24
25

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Graham, Rhea <rgraham@usbr.gov>

# Draft EIS Information Request

**Bannerman, Kim, OSE** <Kim.Bannerman@state.nm.us> Wed, Apr 13, 2016 at 5:17 PM
To: "Graham, Rhea" <rgraham@usbr.gov>, ADMIN RECORD <RGOA_EIS@empsi.net>
Cc: "Doremus, Dale, OSE" <dale.doremus@state.nm.us>, "Schmidt, Rolf I., OSE" <rolf.schmidt@state.nm.us>

Rhea,

1

I just finished speaking with Dale Doremus who I understand you spoke with last night at the public hearing. It sounds like you have not adequately reviewed the information request we made last week.

My statements last week at the public hearing, as well as the written comments I submitted, are abundantly clear that we need more information than what you have already provided us. My comments specifically stated that we were thankful for what you had already provided, but we need additional information in order to do an adequate review.

The comments are attached. Please provide the additional information we have requested in a timely fashion.

Please also notify me of the date the Biological Opinion will be available on the website you listed in the Notice of Availability.

Best,

Kim Bannerman

Attorney

New Mexico Interstate Stream Commission

PO Box 25102

Santa Fe, NM 87504-5102

Phone: (505) 827-4004

Fax No. (505) 476-0399

Email: kim.bannerman@state.nm.us

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**Comments Submitted at Public Hearing 040716.doc**
56K

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Graham, Rhea <rgraham@usbr.gov>

# Rio Grande DEIS Extension Request

**Bannerman, Kim, OSE** <Kim.Bannerman@state.nm.us> Mon, Apr 18, 2016 at 12:06 PM
To: "Graham, Rhea" <rgraham@usbr.gov>, ADMIN RECORD <RGOA_EIS@empsi.net>
Cc: "Dixon, Deborah, OSE" <Deborah.Dixon@state.nm.us>, "Haas, Amy, OSE" <amy.haas@state.nm.us>, "Jay F. Stein" <jfstein@newmexicowaterlaw.com>, "Doremus, Dale, OSE" <dale.doremus@state.nm.us>, Jennifer Faler <jfaler@usbr.gov>, "Schmidt, Rolf I., OSE" <rolf.schmidt@state.nm.us>

Ms. Graham,

1 Will you please update us on the status of our request for an extension of the May 9th deadline for comments. As you will recall, we asked for a 90 day extension to August 7th.

2 Also, at the April 7th public hearing the NMISC requested additional information, both in writing and through oral comments. I followed up on that request with an email to you on Wednesday, April 13th. To date we have not received any of the additional items requested. As I have already made clear, the NMISC cannot conduct a meaningful review of the Draft EIS without this information. The fact the comment deadline is so soon and Reclamation has not provided us with the information necessary to review the document is further support for granting the comment extension.

Please update me as soon as possible on these items.

Kim Bannerman

Attorney

New Mexico Interstate Stream Commission

PO Box 25102

Santa Fe, NM 87504-5102

Phone: (505) 827-4004

Fax No. (505) 476-0399

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Graham, Rhea <rgraham@usbr.gov>

# Extension Request Follow Up

**Bannerman, Kim, OSE** <Kim.Bannerman@state.nm.us> Wed, Apr 20, 2016 at 11:45 AM
To: "Graham, Rhea" <rgraham@usbr.gov>, ADMIN RECORD <RGOA_EIS@empsi.net>
Cc: "Jay F. Stein" <jfstein@newmexicowaterlaw.com>, "Dixon, Deborah, OSE" <Deborah.Dixon@state.nm.us>, "Doremus, Dale, OSE" <dale.doremus@state.nm.us>, "Haas, Amy, OSE" <amy.haas@state.nm.us>, Jennifer Faler <jfaler@usbr.gov>, "Schmidt, Rolf I., OSE" <rolf.schmidt@state.nm.us>

Ms. Graham,

I am again following up on the ISC's request for an extension to the May 9th deadline for comments on the Rio Grande Operating Agreement Draft EIS. We submitted our request for an extension nearly three weeks ago.

1

Please get back to me on the status of our request.

Kim Bannerman

Attorney

New Mexico Interstate Stream Commission

PO Box 25102

Santa Fe, NM 87504-5102

Phone: (505) 827-4004

Fax No. (505) 476-0399

Email: kim.bannerman@state.nm.us

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**From:** Bannerman, Kim, OSE
**Sent:** Monday, April 18, 2016 12:06 PM
**To:** 'Graham, Rhea'; ADMIN RECORD
**Cc:** Dixon, Deborah, OSE; Haas, Amy, OSE; 'Jay F. Stein'; Doremus, Dale, OSE; Jennifer Faler; Schmidt, Rolf I., OSE
**Subject:** Rio Grande DEIS Extension Request

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**Graham, Rhea <rgraham@usbr.gov>**

# Re: Rio Grande Project DEIS Comment Deadline

**Jen Pelz** <jpelz@wildearthguardians.org> Wed, May 4, 2016 at 12:14 PM
To: "Graham, Rhea" <rgraham@usbr.gov>
Cc: Jennifer Faler <jfaler@usbr.gov>

Hi Rhea,

1 I am writing to request that Reclamation extend the comment deadline for the March 2016 DEIS regarding continued implementation of the 2008 OA for the RG Project and San Juan-Chama storage in Elephant Butte.

The basis for the request is that the January 21, 2016 Biological Opinion of the Service for the Project although completed has not been released to the public (at least according to our conversation earlier this week and the USFWS website containing all the recently issued Biological Opinions in New Mexico). The DEIS at page 5-4 references the forthcoming Biological Opinion, but says "[i]n a memorandum dated February 19, 2016, Reclamation requested an extension until March 22, 2016, to review the Biological Opinion prepared by the Service." Clearly, this deadline for review of and release of the Biological Opinion has come and gone.

After reviewing the DEIS and the correspondence included in Appendix D, it is clear that Reclamation believes that the Project "may affect and likely to adversely effect" the Southwestern willow flycatcher and "may affect, but not likely to adversely affect" the Rio Grande silvery minnow. The Biological Opinion of the Service will help inform Guardians' comments (as well as others).

We ask that you extend the comment deadline on the DEIS for an additional 45 days from when the BO is released to the public. We believe that the folks commenting on the DEIS (including Guardians) should all have an opportunity–the same opportunity the Service provided to Reclamation–to review the Biological Opinion prior to providing our comments on the DEIS.

Thank you for your consideration,
Jen

–

WildEarth Guardians
A Force for Nature

Jen Pelz
Wild Rivers Program Director

jpelz@wildearthguardians.org
303-884-2702
Follow @jen_pelz

WildEarth Guardians | 516 Alto Street | Santa Fe, NM 87501
www.wildearthguardians.org

*"To be whole. To be complete. Wildness reminds us what it means to be human, what we are connected to rather than what we are separate from."*
– Terry Tempest Williams

111

Coulam, Nancy <ncoulam@usbr.gov>

# Re: Rio Grande Project DEIS Comment Deadline

2 messages

**Jen Pelz** <jpelz@wildearthguardians.org> Thu, May 5, 2016 at 9:18 AM
To: "Graham, Rhea" <rgraham@usbr.gov>
Cc: Nancy Coulam <ncoulam@usbr.gov>, Jennifer Faler <jfaler@usbr.gov>, Ken Rice <krice@usbr.gov>, Mary Carlson <mcarlson@usbr.gov>

Rhea,

Thank you so much for the notice. We also really appreciate the comment deadline extension.

1 Nancy--Do you know when the Biological Opinion will be released to the public?

Thanks,
Jen

On Thu, May 5, 2016 at 9:09 AM, Graham, Rhea <rgraham@usbr.gov> wrote:

Jen,
See attached press release and Federal Register notice regarding extension of comment period and change of contact person for the Draft EIS.
Rhea & Nancy

Rhea Graham, Special Project Officer

Bureau of Reclamation Albuquerque Area Office

555 Broadway N.E., Suite 100, Mail Stop ALB-103

Albuquerque, NM 87102

(505) 462-3560 (Office) (505) 221-0470 (Mobile) (505) 462-3793 (Fax)

http://www.usbr.gov/uc/albuq/rm/RGP/

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Thank you for your consideration,
Jen

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Jen Pelz
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Graham, Rhea <rgraham@usbr.gov>

# Extension Request Follow Up

**Bannerman, Kim, OSE** <Kim.Bannerman@state.nm.us> Thu, May 5, 2016 at 9:33 AM
To: Nancy Coulam <ncoulam@usbr.gov>
Cc: ADMIN RECORD <RGOA_EIS@empsi.net>, "Jay F. Stein" <jfstein@newmexicowaterlaw.com>, "Dixon, Deborah, OSE" <Deborah.Dixon@state.nm.us>, "Doremus, Dale, OSE" <dale.doremus@state.nm.us>, "Haas, Amy, OSE" <amy.haas@state.nm.us>, Jennifer Faler <jfaler@usbr.gov>, "Schmidt, Rolf I., OSE" <rolf.schmidt@state.nm.us>, "Graham, Rhea" <rgraham@usbr.gov>

Nancy,

Thank you for the email. I saw this in the Federal Register this morning.

We have still not received any response to our request for additional information made nearly a month ago, on April 7th. I followed up on that request April 13th and again on April 18th. Without this requested information we cannot conduct a meaningful review of the Draft EIS. I've attached our request again here.

1

With only a 30 day extension it is imperative that we receive this information within the next week to allow us time to review.

Kim Bannerman

Attorney

New Mexico Interstate Stream Commission

PO Box 25102

Santa Fe, NM 87504-5102

Phone: (505) 827-4004

Fax No. (505) 476-0399

Email: kim.bannerman@state.nm.us

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**From:** Graham, Rhea [mailto:rgraham@usbr.gov]
**Sent:** Thursday, May 05, 2016 9:18 AM
**To:** Bannerman, Kim, OSE; Nancy Coulam
**Cc:** ADMIN RECORD; Jay F. Stein; Dixon, Deborah, OSE; Doremus, Dale, OSE; Haas, Amy, OSE; Jennifer Faler; Schmidt, Rolf I., OSE
**Subject:** Re: Extension Request Follow Up

Kim,

In response to your request(s), attached are the press release and Federal Register notice regarding extension of the comment period and change of contact person.

Rhea & Nancy

Rhea Graham, Special Project Officer

Bureau of Reclamation Albuquerque Area Office

555 Broadway N.E., Suite 100, Mail Stop ALB-103

Albuquerque, NM 87102

(505) 462-3560 (Office) (505) 221-0470 (Mobile) (505) 462-3793 (Fax)

http://www.usbr.gov/uc/albuq/rm/RGP/

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Kim Bannerman

Attorney

New Mexico Interstate Stream Commission

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Santa Fe, NM 87504-5102

Phone: (505) 827-4004

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Email: kim.bannerman@state.nm.us

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**Sent:** Monday, April 18, 2016 12:06 PM
**To:** 'Graham, Rhea'; ADMIN RECORD
**Cc:** Dixon, Deborah, OSE; Haas, Amy, OSE; 'Jay F. Stein'; Doremus, Dale, OSE; Jennifer Faler; Schmidt, Rolf I., OSE
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Please update me as soon as possible on these items.

Kim Bannerman

Attorney

New Mexico Interstate Stream Commission

PO Box 25102

Santa Fe, NM 87504-5102

Phone: (505) 827-4004

Fax No. (505) 476-0399

Email: kim.bannerman@state.nm.us

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---

**Comments Submitted at Public Hearing 040716.doc**
56K

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
**Region 6**
**1445 Ross Avenue, Suite 1200**
**Dallas, TX 75202-2733**

May 9, 2016

Rhea Graham
Bureau of Reclamation, Albuquerque Area Office
555 Broadway NE, Suite 100, Mail Stop ALB-103
Albuquerque, NM 87102

Re: **Comment Letter for the Draft Environmental Impact Statement for the Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project, along the Rio Grande River in New Mexico, Texas, and Mexico.**

In accordance with our responsibilities under Section 309 of the Clean Air Act (CAA), the National Environmental Policy Act (NEPA), and the Council on Environmental Quality (CEQ) regulations for implementing NEPA, the U.S. Environmental Protection Agency (EPA) Region 6 office in Dallas, Texas, has completed its review of the Bureau of Reclamation Draft Environmental Impact Statement (Draft EIS) for the Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project. The purpose of the project is to meet contractual obligations while complying with applicable law concerning water allocation, delivery, and accounting. A Federal decision is needed to decide whether to continue operations of the Rio Grande Project through 2050, and whether to allow the storage of San Juan-Chama Project Water in Elephant Butte Reservoir.

EPA's review identified some potential adverse impacts to agricultural resources. For these reasons we have rated the Draft EIS as "Environmental Concerns – Adequate" (EC-1). The EPA's Rating System Criteria can be found at http:/www.epa.gov/compliance/nepa/comments/ratings.html. EPA recommends that the issues be addressed in the Final EIS. We have enclosed detailed comments which clarify our concerns.

EPA appreciates the opportunity to review the Draft EIS. Please send our office one copy of the Final EIS when it is electronically filed with the Office of Federal Activities. If you have any questions or concerns, please contact Magda Dallemagne of my staff at (214) 665-7396 or by e-mail at dallemagne.magdeleine@epa.gov.

Sincerely,

Robert Houston
Chief, Special Projects Section

Enclosures

**DETAILED COMMENTS ON THE**
**U.S. DEPARTMENT OF THE INTERIOR**
**BUREAU OF RECLAMATION**
**DRAFT ENVIRONMENTAL IMPACT STATEMENT**
**FOR THE CONTINUED IMPLEMENTATION OF THE 2008 OPERATING AGREEMENT FOR THE RIO GRANDE PROJECT**

**BACKGROUND:** The Continued Operations of the Rio Grande Project consists of altering the operational methods, water movement, and general annual allocation of the Rio Grande Project waters through New Mexico, Texas, and finally through Mexico. No construction is involved in any of the alternatives

## WETLANDS

The Draft EIS provides impact summaries of all alternatives, including the no action alternative, in which anticipated effects are discussed. These summaries expect some net loss of riparian vegetation at Elephant Butte Reservoir, indicate negligible impacts on river discharges from reservoirs in the non-irrigation season, and anticipate none to minor negative impacts on aquatic resources.

1 All alternatives, including the no action alternative, mentioned in the Draft EIS have minor impacts to the aquatic ecosystems, and appear to be within the range on normal annual fluctuations based on climate and rainfall variations. Potential impacts to wetlands are not specifically discussed. Since they are most likely to coincide with the riparian zone, which is discussed, it is likely that any wetlands impacts would fall within the category of minor impacts and be within the range of normal annual fluctuation. Occasionally there are springs or other small local wetland areas outside the riparian corridor that might be affected by alterations to riverine hydrology. It is not known if this type of local wetland was searched for during the review process, the concept was not addressed.

Overall, we do not expect that the proposed action would significantly change the current status of the aquatic resource. These impacts to will depend on river flows and reservoir levels. The changes to these levels resulting from the selected alternative, or any of the evaluated alternatives, are expected to be negligible and within the normal annual fluctuations based on climate and annual rainfall variations.

*Recommendations:*

- Investigate whether or not springs and other small local wetlands are located within the range of normal annual fluctuation. Include any impacts associated with the proposed alternatives, including the no action alternative, in the Final EIS.

## AGRICULTURE

2 The model descriptions and impact summaries found in the Draft EIS do not provide adequate information and detail in regards to the agricultural impact of the project. The impact of population growth on water use versus the impact of reduction in agriculture water consumption on crops and cropping areas is not adequately discussed. Whether urban or agricultural use will 3 have priority is uncertain, and the environmental impact of the priority is not discussed. The environmental impact as a result of the effect of surface water reduction on ground water consumption is not explained adequately. The model also fails to address water loss adequately, from natural flow to evaporation, and the impacts therein. In short, the Draft EIS fails to 4 adequately address agricultural issues and impact associated with this project.

*Recommendations:*

5
- Include a more in-depth discussion of the agricultural impacts associated with the proposed alternatives, including the no action alternative, in the Final EIS.
- If necessary, conduct a more intensive investigation into the aforementioned issues to provide information for a larger discussion on this topic.

## ENVIRONMENTAL JUSTICE

The Draft EIS demonstrates adequate and appropriate process for Tribal and Environmental Justice Analysis. As there were no Indian Trust Assets identified relative to any of the project alternatives, the implementation of any of the proposed alternatives, including the no action alternative, would have no impact on Indian Trust Assets. The Bureau of Reclamation determined that there would be no adverse impact on the use of native plants for traditional tribal practices by Native Americans, even though the Federal actions could result in disturbance to these native plants along area canals.

No construction is authorized under any alternatives, including the no action alternative; therefore, no direct impacts, such as from dust, noise, or disturbance, would occur on identified minority or low-income population. Based on the Bureau of Reclamation analysis, no disproportionate adverse impacts would occur on minority or low-income populations relative to this project.

*Recommendations:*

- Make a concise summary of indirect, direct, and cumulative impacts, including "may affect and is likely to adversely affect" of the preferred alternative or alternative of choice 6 would have on the respective minority population accessible to the public.

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Coulam, Nancy <ncoulam@usbr.gov>

# RE: Las Cruces Follow Up

1 message

**Jay F. Stein** <jfstein@newmexicowaterlaw.com> Wed, May 11, 2016 at 10:20 AM
To: Nancy Coulam <ncoulam@usbr.gov>, Jorge Garcia <JAG@las-cruces.org>, Marcy Driggers <marcyd@las-cruces.org>, "James C. Brockmann" <jcbrockmann@newmexicowaterlaw.com>, "lwa@lwasf.com" <lwa@lwasf.com>
Cc: ADMIN RECORD <RGOA_EIS@empsi.net>, "Dixon, Deborah, OSE" <Deborah.Dixon@state.nm.us>, "Doremus, Dale, OSE" <dale.doremus@state.nm.us>, "Haas, Amy, OSE" <amy.haas@state.nm.us>, Jennifer Faler <jfaler@usbr.gov>, "Schmidt, Rolf I., OSE" <rolf.schmidt@state.nm.us>, "Graham, Rhea" <rgraham@usbr.gov>, "Bannerman, Kim, OSE" <Kim.Bannerman@state.nm.us>

Nancy -

Our firm represents the City of Las Cruces in preparing comments to the dEIS on the Operating Agreement for the Rio Grande Project.

We appreciate the extension of time to present comments, but are writing to join once again in the New Mexico Interstate Stream Commission's request for information of April 7th; renewed on April 13th, April 18th, and May 5th. We concur that without the requested information (resubmitted by Kim Bannerman on May 5th) , a comprehensive and complete review of the issues as secured to commenters by NEPA will not have been possible.

1 We request that the information requested by the ISC be provided without delay.

Thank you for your attention to this matter.

Jay F. Stein, Esq.

Stein & Brockmann, P.A.

P.O. Box 2067

Santa Fe, NM 87504-2067

505.983.3880

505.986.1028 (fax)

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6/1/2016

Record of Call

From: James M. Speer Jr., Counsel for EPCWID

To: Nancy Coulam

RE: Comments on Draft EIS and Biological Opinion for Rio Grande Project Operating Agreement

1 Mr. Speer called with two concerns: 1) the biological opinion issued by the U.S. Fish and Wildlife Service indicated the action area included the Middle Rio Grande Project Area when it should be restricted to the Rio Grande Project area. He stated that the draft EIS had text and figures that indicated the effects of the OA extended upstream—north of Elephant Butte.

I indicated that the Service's concern was due to the broader management unit for the Southwest willow flycatcher, but that Reclamation's action area was restricted to just the RGP. I would check the text and figures and see if corrections are needed.

2 2) The term allocation throughout the draft EIS is not correct. The two districts agreed to divide the project water, first in 1938 and then in more recent years. He does not agree that Reclamation is "allocating" although a function of the OA is to divide the waters between the districts.

I said I would have Bert Cortez and others check this language in the EIS and see if it should be revised.

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Coulam, Nancy <ncoulam@usbr.gov>

# Re: Biological Opinion Received--Extension of Comment Deadline 45 days

1 message

**Jen Pelz** <jpelz@wildearthguardians.org> Fri, Jun 3, 2016 at 12:36 PM
To: "Coulam, Nancy" <ncoulam@usbr.gov>
Cc: Kevin Doyle <kevin.doyle@empsi.com>, Hector Garcia <hgarcia@usbr.gov>, Jennifer Faler <jfaler@usbr.gov>

Nancy,

Thank you for sending me the final biological opinion for the RG Project Operating Agreement and San Juan-Chama Storage Project.

I am writing to request that Reclamation extend the comment deadline for the RG Project DEIS to 45 days from when the Biological Opinion was released to the public to July 15, 2016. As you know, the Biological Opinion for the project was finalized and dated May 25, 2016. I received a copy via email on May 31, 2016.

1

This document contains critical information about the impacts of the project on the Southwestern willow flycatcher and yellow-billed cuckoo. I believe that it is unfair to ask the public to review this document and provide comments to Reclamation in 8 days (6 of which are business days), when it took Reclamation four months to review and comment on a prior draft of the opinion of the Service dated January 21, 2016.

I originally made this request on May 4, when it became apparent that the Biological Opinion would not be released before the original comment deadline expired and suggested 45 days from the date of release of the Biological Opinion. I have included my prior email for your reference. While we appreciate the initial extension until June 8, we believe the public deserves, just like the agency, to have all of the relevant materials and adequate time to evaluate a project of this scope.

I appreciate you considering my proposal, please let me know if you have any questions. I can be reached at 303-884-2702.

Thank you,

Jen Pelz
Wild Rivers Program Director
WildEarth Guardians
jpelz@wildearthguardians.org
303-884-2702

——— Forwarded message ———
From: **Jen Pelz** <jpelz@wildearthguardians.org>
Date: Wed, May 4, 2016 at 12:14 PM
Subject: Re: Rio Grande Project DEIS Comment Deadline
To: "Graham, Rhea" <rgraham@usbr.gov>
Cc: Jennifer Faler <jfaler@usbr.gov>

Hi Rhea,

I am writing to request that Reclamation extend the comment deadline for the March 2016 DEIS regarding continued implementation of the 2008 OA for the RG Project and San Juan-Chama storage in Elephant Butte.

The basis for the request is that the January 21, 2016 Biological Opinion of the Service for the Project although completed has not been released to the public (at least according to our conversation earlier this week and the USFWS website containing all the recently issued Biological Opinions in New Mexico). The DEIS at page 5-4

references the forthcoming Biological Opinion, but says "[i]n a memorandum dated February 19, 2016, Reclamation requested an extension until March 22, 2016, to review the Biological Opinion prepared by the Service." Clearly, this deadline for review of and release of the Biological Opinion has come and gone.

After reviewing the DEIS and the correspondence included in Appendix D, it is clear that Reclamation believes that the Project "may affect and likely to adversely effect" the Southwestern willow flycatcher and "may affect, but not likely to adversely affect" the Rio Grande silvery minnow. The Biological Opinion of the Service will help inform Guardians' comments (as well as others).

We ask that you extend the comment deadline on the DEIS for an additional 45 days from when the BO is released to the public. We believe that the folks commenting on the DEIS (including Guardians) should all have an opportunity–the same opportunity the Service provided to Reclamation–to review the Biological Opinion prior to providing our comments on the DEIS.

Thank you for your consideration,
Jen

On Tue, May 31, 2016 at 10:31 AM, Coulam, Nancy <ncoulam@usbr.gov> wrote:

Dear Ms. Pelz,

I am attaching the biological opinion of the Service for the continued operation of the Rio Grande Project operating agreement, per your request.

Nancy Coulam
environmental compliance officer
801-524-3684

--

Jen Pelz
Wild Rivers Program Director

jpelz@wildearthguardians.org
303-884-2702
Follow @jen_pelz

WildEarth Guardians
A FORCE FOR NATURE

WildEarth Guardians | 516 Alto Street | Santa Fe, NM 87501
www.wildearthguardians.org

*"To be whole. To be complete. Wildness reminds us what it means to be human, what we are connected to rather than what we are separate from."*
– Terry Tempest Williams

116

Coulam, Nancy <ncoulam@usbr.gov>

# Re: Biological Opinion Received--Extension of Comment Deadline 45 days

1 message

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Cc: Kevin Doyle <kevin.doyle@empsi.com>, Hector Garcia <hgarcia@usbr.gov>, Jennifer Faler <jfaler@usbr.gov>

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I appreciate you considering my proposal, please let me know if you have any questions. I can be reached at 303-884-2702.

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Jen Pelz
Wild Rivers Program Director
WildEarth Guardians
jpelz@wildearthguardians.org
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Date: Wed, May 4, 2016 at 12:14 PM
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To: "Graham, Rhea" <rgraham@usbr.gov>
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We ask that you extend the comment deadline on the DEIS for an additional 45 days from when the BO is released to the public. We believe that the folks commenting on the DEIS (including Guardians) should all have an opportunity--the same opportunity the Service provided to Reclamation--to review the Biological Opinion prior to providing our comments on the DEIS.

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Dear Ms. Pelz,

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Nancy Coulam
environmental compliance officer
801-524-3684

--

JEN PELZ
WILD RIVERS PROGRAM DIRECTOR

jpelz@wildearthguardians.org
303-884-2702
Follow @jen_pelz

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*"To be whole. To be complete. Wildness reminds us what it means to be human, what we are connected to rather than what we are separate from."*
– Terry Tempest Williams

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Coulam, Nancy <ncoulam@usbr.gov>

# Request for Extension to submit comments to

1 message

**Bardwell, Beth** <bbardwell@audubon.org> Wed, Jun 8, 2016 at 10:59 AM
To: "ncoulam@usbr.gov" <ncoulam@usbr.gov>
Cc: "Jennifer Faler (jfaler@usbr.gov)" <jfaler@usbr.gov>

Dear Ms. Coulam:

1 I am writing to request and extension to submit comments to the Rio Grande Project Draft EIS. The Biological Opinion on the Rio Grande Operating Agreement contains critical information about Southwestern Willow Flycatchers and Yellow-billed Cuckoo, two species that are a focus of my organization and has only been available since May 31st or roughly one week. We would appreciate an extension to allow us sufficient time to review the relevant documents and share our comments with the Bureau on this important federal water project and the associated riparian and aquatic habitat that it impacts.

Thank you so much for your consideration of this request.

Yours, Beth

Beth Bardwell

Director of Conservation

Audubon New Mexico

575-418-0288 (cell)

4850 Tobosa Rd.

Las Cruces, NM 88011

nm.audubon.org

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THE SOUTHWEST ENVIRONMENTAL CENTER

BY EMAIL TO NCOULAM@USBR.GOV

June 8, 2016

Nancy Coulam
Bureau of Reclamation

Dear Ms. Coulam:

Please accept these comments from the Southwest Environmental Center on the *Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project Draft Environmental Impact Statement.*

The Southwest Environmental Center is a nonprofit organization dedicated to restoring wildlife and habitats in the Southwest. We have been actively engaged in habitat restoration efforts along the Rio Grande in southern New Mexico for two decades. Our current La Mancha Wetland project is intended to restore riparian and aquatic habitats that have largely been eliminated due to many decades of operation of both the Rio Grande Project (RGP) and Rio Grande Canalization Project.

1 For all the alternatives, we are asking BOR to authorize new points of diversions for small quantities of RGP water (say, less than 20 acre-feet annually at each diversion) for habitat restoration projects. We understand that BOR does not want to consider alternatives in this EIS that include changes to existing RGP diversion points because they are not part of the Operating Agreement (OA). (DEIS-p. 2-5) However, we are requesting that additional small diversions be authorized as part of this EIS since we do not know when there will be another opportunity to make such a request. We did not have an opportunity, nor cause, to make such a request when the OA was approved in 2008. We are not aware that BOR undertakes NEPA analysis of RGP operations at other times.

We make this request for the following reasons:

- Creating a network of small (less than five acres each) refugial, off-channel aquatic habitats where fish and other aquatic organisms can survive when flows in the river are low or nonexistent during the nonirrigation season is a viable approach to reestablishing and sustaining native fish populations. This approach does not rely on year-round flows in the river to sustain fish populations, and as such, would not constitute a major disruption of RGP operations.

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1 cont.

- It is also an approach to avoiding listing of aquatic species under the federal Endangered Species Act, which would be hugely disruptive to current RGP operations. After 20 years experience with habitat restoration within the RGP, our organization is convinced that there are currently a number of potential candidates for listing within the RGP.
- However, this approach to aquatic species conservation is unlikely to work using only the existing RGP diversion points (Percha, Leasburg, etc.). The spacing and location of these diversions would require that fish travel long distances through the irrigation system to reach these refugial habitats, and vice versa to return to the river to comingle with other populations. This is unlikely to happen. Many fish would end up flopping in pecan orchards and chile fields. Additional points of diversion will need to be established to convey RGP water (and fish) short distances between the river and refugial habitats.
- This is not an academic request. We have previously informed BOR, EBID, USIBWC and OSE of the need to seek a new point of diversion of RGP water to serve our La Mancha Wetland Project (under development).
- We understand the need to account for water diverted from these new points of diversion to comply with the OA, and fully support whatever measures are needed to achieve a level of accountability that is acceptable to BOR, USIBWC and the districts.
- However, the amount of water that would be diverted at these new points of diversions is infinitessimally small compared to overall deliveries within the RGP. Accounting for them should be quite manageable. We are aware that a number of farmers within EBID are "river pumpers" who divert RGP water directly from the river and are required to account for those diversions.
- We understand that using RGP water to support these habitat projects may require contracts negotiated under the Miscellaneous Purposes Act of 1920. However, that should not be a reason prima facie to reject new points of diversion to support these projects.

Thank you for the opportunity to comment.

Yours,

Kevin Bixby

Kevin Bixby
Executive Director

# La Mancha Wetland Project

Map prepared by E.J. Simpson
at the Spatial Applications Research Center
New Mexico State University

Las Cruces, NM

**Data Sources**
Dona Ana Roads: Dona Ana County 2008 Data
Interstates: ESRI Base Data 9.3
Imagry: Dona Ana County 2007 Aerials
Rio Grande: Spatial Applications Research Center

**Coordinate System and Projection**
Projection: Transverse Mercator
GCS North American 1983
Datum: D North American 1983

THE SOUTHWEST ENVIRONMENTAL CENTER

Coulam, Nancy <ncoulam@usbr.gov>

# Re: RGP operating agreement DEIS

1 message

**Kevin Bixby** <kevin@wildmesquite.org> Wed, Jun 8, 2016 at 2:37 PM
Reply-To: kevin@wildmesquite.org
To: "Coulam, Nancy" <ncoulam@usbr.gov>

Nancy,

Please see our attached comments and acknowledge receipt.

Thanks,

Kevin

On 5/25/2016 8:29 AM, Coulam, Nancy wrote:

> Hello Mr. Bixby, The comment period was extended to June 8th, which is a Wednesday. So you have until then. If there is any way you could get your comments in before then, that would be great as I am working on comment-responses now. However, if you need til the 8th, that is fine.
>
> Nancy Coulam
>
> On Tue, May 24, 2016 at 11:25 AM, Kevin Bixby <kevin@wildmesquite.org> wrote:
> Are comments on the Rio Grande Project Operating Agreement DEIS now due Wednesday, June 8, or Monday, June 6? The press release says " on or before Monday, June 8, 2016" but June 8 is not a Monday.
>
> Thanks,
>
> --
> Kevin Bixby, Executive Director
> Southwest Environmental Center
> 275 North Main Street
> Las Cruces, NM 88001
> (575) 522-5552 (575) 526-7733 fax
> www.wildmesquite.org
>
> If we destroy Creation, Creation will destroy us. --Pope Francis

--
Kevin Bixby, Executive Director
Southwest Environmental Center
275 North Main Street
Las Cruces, NM 88001
(575) 522-5552 (575) 526-7733 fax
www.wildmesquite.org

If we destroy Creation, Creation will destroy us. --Pope Francis

**BOR OA comments.docx**
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**ORIGINAL**

THE SOUTHWEST ENVIRONMENTAL CENTER 1992 2012

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VIA ELECTRONIC AND REGULAR MAIL

May 26, 2016

Jennifer Faler, Area Manager
Albuquerque Area Office
U.S. Bureau of Reclamation
555 Broadway NE, Suite 100
Albuquerque, NM 87102-2352

Dear Ms. Faler:

Thank you for your letter of April 26, 2016, responding to our letter dated September 10, 2015, in which you communicated your concerns about our La Mancha Wetland restoration project.

You stated that the use of our Rio Grande Project (Project) surface water for La Mancha would require us to enter into a contract with Elephant Butte Irrigation District (EBID) and Reclamation for a change of use of our existing Project water use rights under the provisions of the 1920 Miscellaneous Purposes Act. You further stated that you consulted with EBID about using our Project surface water for La Mancha, and that EBID informed you that La Mancha "would not meet the requirements for irrigation for native vegetation since it will be used for fish habitat" since EBID policy states that "No aquaculture or exposed ground water habitat is authorized."

It is our view that La Mancha, when completed as designed, will use a combination of groundwater and surface water. Groundwater is being used to supply an existing pond on SWEC's private land. The pond supports fish and other aquatic creatures. Currently, there is no surface water connection to the river. The size of the pond expands and contracts according to groundwater levels, which are affected by flows of surface water in the river and pumping by our neighbors.

We will seek a permit to divert surface water onto the site. Surface water will be conveyed via an earthen channel that will be excavated across the USIBWC floodway, into a gated concrete culvert already installed under the flood control levee, and discharged onto our private property. This surface water will be used to irrigate areas adjacent to the pond to support native trees, shrubs, hydrophytes and grasses. The addition of surface water may cause a temporary increase in the size of the pond, but only until it has a chance to sink into the ground. In effect, the pond

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itself is part of the conveyance system by which we intend to deliver Project water from the river to irrigate native plants surrounding the pond.

We understand the Rio Grande Project was authorized for irrigation. Does Reclamation share EBID's view that use of our surface water for La Mancha is not an authorized use of Project water? If so, could you please explain why not? As stated, we intend to use our surface water to irrigate native plants, including some that are riparian and wetland species that may occasionally be inundated for brief periods of time.

Does Reclamation share EBID's view that the use of surface water to irrigate native vegetation is an authorized use of Project water, per EBID's Policy 2013-ENG14? If so, could you explain to us how using Project water for one type of ecological restoration project is an authorized use of Project water, but using it for another type of ecological restoration project is not? It would seem that all such projects would meet the definition of irrigation, or neither would.

Also, since your letter refers to EBID's Policy 2013-ENG14, is it your view that this policy is intended to cover all types of ecological restoration projects, or only those specifically intended to reestablish native vegetation on USIBWC property? The latter would seem to be the case, as USIBWC restoration projects are referenced in the policy as background. Furthermore, Section 1.vi. of the policy requires that projects that might attract a listed or candidate species under the Endangered Species Act must be covered by an incidental take statement that is contained within a biological opinion, conference opinion or similar document issued by the U.S. Fish and Wildlife Service, requirements that would seem to apply only to federal agencies, not private landowners.

If Reclamation believes that we must enter into a third party contract under the Miscellaneous Purposes Act, we have some questions about how that might work. For example, we already have Project water rights for the land on which La Mancha is located. Will we be required to forfeit some or all of our current Project water rights that are appurtenant to our private property? If only a portion, how much, and how will that be determined? In addition, will we be assessed additional fees by Reclamation and EBID for surface water used for La Mancha? Will we be required to pay for administrative costs associated with the contract? As a small nonprofit, any additional fees would impose a significant financial burden on us, increasing the costs of our habitat restoration projects.

In your letter, you mentioned that Reclamation and EBID have concerns about flood control issues by "having a pipe through the levee specifically designed to flow during periods of high flow in the Rio Grande Channel." As you are probably aware, this pipe was installed by USIBWC, which has flood control responsibilities for the Rio Grande Project. The pipe includes a gate to control flows through it. We fully intend to apply for a permit from USIBWC before putting this pipe into operation for La Mancha. We are certain any USIBWC-issued permit will include conditions to address flood control concerns.

Finally, you stated that the 2008 Operating Agreement requires that all deliveries of Project water will be measured and properly accounted. We have had numerous discussions with EBID

about this issue and we are fully committed to utilizing whatever methods of measuring diversions are required by EBID. When we apply to the New Mexico Office of State Engineer for a permit to change the point of diversion for our Project water, we will include language in the application stating that commitment.

We understand that our La Mancha Project is unprecedented and raises issues that have not been dealt with before, which is why we have worked diligently with Reclamation, EBID and other stakeholders over the past 10 years to make sure that we understand everyone's concerns and address them to the best of our ability. It is our hope that others will help us work through these concerns so that together we can continue to restore important ecological habitats within the Rio Grande Project.

Sincerely,

Kevin Bixby
Executive Director

Cc: Bert Cortez, USBR

6/8/2016

RECORD OF CALL AND FOLLOW UP EMAIL

From: Beth Bardwell, Director of Conservation, Audubon New Mexico

To: Nancy Coulam

RE: Comments on Draft EIS and Biological Opinion for Rio Grande Project Operating Agreement

1 Ms. Bardwell called to say that the draft EIS did not include sufficient consideration of the ongoing effects of the Rio Grande Project and the IBWC's Rio Grande Canalization Program on birds and riparian habitat. In particular, references were missing that indicated Reclamation had considered effects on birds and habitat based on information in the following documents:

2

1) the IBWC's Land Management Plan associated with the IBWC's Rio Grande Canalization Project, and Environmental Water Transactions Program,
2) the letter dated November 9, 2011 from Reclamation to the Audubon Society regarding the conversion of Rio Grande Project irrigation water to miscellaneous purposes, including protection and conservation of birds and their habitat
3) the policy of EBID and IBWC to classify native vegetation riparian habitat as water-righted acres within EBID boundaries
4) the IBWC's River Management Plan of Nov. 2014.
5) the Service's biological opinion (consultation No. 02ENNM00-2012-F-0016) regarding the IBWC's Integrated Land Management Alternative for Long-term Management of the Rio Grande Canalization Project, dated 2012.

These need to be included in the FEIS and Reclamation should ask IBWC (Liz VVerdecchia) for a copy of the Rio Grande Canalization Environmental Water Transaction Program Final Framework and program Report, dated 2015.

Coulam, Nancy <ncoulam@usbr.gov>

# USIBWC Environmental Water Transactions Program

1 message

**Bardwell, Beth** <bbardwell@audubon.org> Wed, Jun 8, 2016 at 11:46 AM
To: "ncoulam@usbr.gov" <ncoulam@usbr.gov>

Hi Nancy:

Here is a lot of background on IBWC Rio Grande Canalization program including Biological Opinion and EBID Restoration Policy and Bureau of Reclamation letter authorizing water transfers to restoration sites in Rio Grande Canalization Program.

I think you would be well served to ask Liz Verdecchia for a copy of the Rio Grande Canalization Environmental Water Transactions Program Final Framework and Program Report (March 2015).

Thank you. Beth

Beth Bardwell

Director of Conservation

Audubon New Mexico

575-418-0288 (cell)

4850 Tobosa Rd.

Las Cruces, NM 88011

nm.audubon.org

**From:** Bardwell, Beth
**Sent:** Wednesday, June 08, 2016 11:00 AM
**To:** 'ncoulam@usbr.gov' <ncoulam@usbr.gov>
**Cc:** Jennifer Faler (jfaler@usbr.gov) <jfaler@usbr.gov>
**Subject:** Request for Extension to submit comments to

Dear Ms. Coulam:

I am writing to request and extension to submit comments to the Rio Grande Project Draft EIS. The Biological Opinion on the Rio Grande Operating Agreement contains critical information about Southwestern Willow

Flycatchers and Yellow-billed Cuckoo, two species that are a focus of my organization and has only been available since May 31st or roughly one week. We would appreciate an extension to allow us sufficient time to review the relevant documents and share our comments with the Bureau on this important federal water project and the associated riparian and aquatic habitat that it impacts.

Thank you so much for your consideration of this request.

Yours, Beth

Beth Bardwell

Director of Conservation

Audubon New Mexico

575-418-0288 (cell)

4850 Tobosa Rd.

Las Cruces, NM 88011

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**7 attachments**

**2012-0016_USIBWC_Land_Management_Alternative_Rio_Grande_Canalization_Project_August_2012.pdf**
1348K

**Canalization_Restoration_OverviewMap_OnePagewithrestorationsites.pdf**
593K

**CanalizationRestoration FACTSHEET_JUNE2014.pdf**
477K

**EWTP FACTSHEET_JUNE2014.pdf**
422K

**USIBWC Canalization River Management Plan - FINAL NOVEMBER 2014 (3).pdf**
2876K

**BureauLtr_110911.pdf**
847K

**Policy_2013_ENG14.pdf**
154K

United States Department of the Interior

BUREAU OF RECLAMATION
Upper Colorado Region
Albuquerque Area Office
555 Broadway NE, Suite 100
Albuquerque, NM 87102-2352

IN REPLY REFER TO:

EP-100
ENV-7.00

NOV 09 2011

Ms. Beth Bardwell
Director of Freshwater Conservation
Audubon New Mexico
4850 Tobosa Rd.
Las Cruces, NM 88011

Subject: Water Transfers from Irrigated Agriculture to Habitat Restoration Sites Within the Rio Grande Project

Dear Ms. Bardwell:

The Bureau of Reclamation has determined that the following parameters will apply in any form of agreement which would facilitate the conversion of Rio Grande Project irrigation water to other miscellaneous uses. The conversion would be as authorized by the U. S. Congress, on February 25, 1920, for the sale of water of a Reclamation project for miscellaneous purposes other than irrigation. [41 Stat. 451] This act provided the Secretary of the Interior, through Reclamation law, the authority to enter into contracts to supply water from any Reclamation project irrigation system for other purposes than irrigation with the following provisions:

a). approval of such contract by the "water users association" shall be obtained first;
b). no contract shall be entered into except upon showing that there is no other practicable source of water supply for the purpose;
c). no water will be furnished under the contract if the delivery of such water shall be detrimental to the water service for such irrigation project; and
d). monies derived from contract(s) shall be placed into the Reclamation fund and be credited to the project from which such water is supplied.

When it is determined by Reclamation that there is not a conversion of water from irrigation to other miscellaneous purposes, the following will apply:

- Project water will be leased or acquired from willing water rights holders;
- Habitat restoration sites will be located within EBID or EP#1 irrigation district service boundaries;
- Irrigation district service boundaries may be expanded through an EBID and/or EP#1 board approved boundary realignment process to include habitat restoration sites and

comply with existing contracts which specify limits on total Project and district acreage;

- Project water will be leased or water rights permanently acquired and transferred through a EBID or EP#1 board approved leasing, voluntary suspension and transfer or reclassification process;
- Lands from which water has been transferred shall not be irrigated or otherwise use Rio Grande Project water when the entire surface water allotment is transferred.
- The use of Rio Grande project water for enhancement and establishment of riparian and wetland habitat will be considered an agricultural use provided the water righted acreage is subject to the same rights and obligations as other water righted acreage including a pro-rata diminishment of the allocation in water-short years.

If you have any questions, please do not hesitate to contact Mr. Filiberto Cortez at 915-534-6300.

Sincerely,

Mike Hamman
Area Manager

cc: Mr. Christopher Rich
US DOI Intermountain Region
Office of the Solicitor
125 South State Street, RM 6201
Salt Lake City, UT 84138

# POLICY 2013-ENG14

POLICY SUBJECT: Use of Project Water for Native Vegetation Habitat Restoration Sites in Elephant Butte Irrigation District.

DATE APPROVED: June 12, 2013

PURPOSE: To provide guidelines and criteria for classification of native vegetation riparian habitat as water righted acres within EBID's boundaries.

BACKGROUND: EBID and International Boundary and Water Commission entered into a Memorandum of Understanding to cooperatively exercise their governmental authority to promote a conservation program within the Rio Grande Canalization Project that results in restoration of native vegetation riparian habitat. Lands not previously eligible for water rights may now be reclassified as water righted lands for habitat restoration as defined here and subject to the terms of EBID Policy 2003-ENG12, as amended May 9, 2012.

Water Righted Lands for Habitat Restoration

1. Lands which are generally well suited for restoration of native vegetation riparian habitat shall be eligible for reclassification as EBID water-righted lands subject to the following provisions:
    i. Lands must be capable of or have a history of growing native trees, shrubs, hydrophytes, and grasses;
    ii. Lands may show evidence of salinization (alkalinity) provided they are generally well suited for successful cultivation of the native plants to be restored;
    iii. Lands may show evidence of a shallow water table provided they are generally well suited for successful cultivation of the native plants to be restored;
    iv. Lands may receive water from existing irrigation facilities or through alternative methods;
    v. Lands must be within EBID boundaries. The boundaries may be expanded by following the process set forth by statute; and,
    vi. Lands which may be utilized by a listed or candidate species under the Endangered Species Act must be covered at all times under an Incidental Take Statement issued by the U.S. Fish and Wildlife Service under the Endangered Species Act and contained within a Biological Opinion, Conference Opinion, or similar document issued by the Service.

2. Project water that is used to support native plant survival and growth on water-righted restoration sites shall be considered irrigation, the designated purpose of the Rio Grande Project and EBID.
3. All lands for which a restoration project increases net evapotranspiration over baseline conditions shall have EBID water rights. The baseline for calculating whether the restored plant community will increase net evapotranspiration is the pre-restoration project site condition or, if applicable, the March 2009 USIBWC Conceptual Restoration Plan, Rio Grande—Caballo Dam to American Dam, New Mexico and Texas. For sites where restoration activities increase net evapotranspiration, the entire site shall be water righted. No temporary water transfers out of these sites will be allowed but temporary water transfers in will be allowed.
4. Upon successfully satisfying land reclassification criteria, the reclassified land shall be subject to applicable fees and/or assessments on an equal basis with other EBID constituents.
5. Water-righted restoration sites will receive an equal allotment per acre with other EBID district water-righted lands, sharing pro rata in shortages as required by law. EBID water deliveries to water-righted restoration sites shall receive Project water during the same irrigation period as other EBID water righted lands as determined by the EBID Board of Directors.
6. No aquaculture or exposed groundwater habitat is authorized under this Policy.

# RESTORATION ACTIVITIES IN THE RIO GRANDE CANALIZATION PROJECT: PROJECT BRIEF JUNE 2009 – JUNE 2014

INTERNATIONAL BOUNDARY AND WATER COMMISSION, U.S. SECTION

## RESTORING THE RIO GRANDE

### The Record of Decision

In 1999, the International Boundary and Water Commission, U.S. Section (USIBWC) began a public scoping and consultation process to develop alternatives for an Environmental Impact Statement on river management of the Rio Grande Canalization Project (RGCP), the 105-mile project area from the Percha Dam near Arrey, NM downstream to the American Diversion Dam in El Paso, TX. In June 2009, after ten years of discussions with the public and stakeholders, the USIBWC signed the Record of Decision (ROD) on River Management Alternatives for the RGCP. The ROD committed the USIBWC to continuing the agency's mission of water delivery, flood control and maintaining flood capacity while changing management practices of the Rio Grande corridor. New management practices would now include implementation of a variety of environmental improvements through the year 2019, including: phasing out grazing leases, ceasing floodplain mowing on almost 2,000 acres to develop managed grasslands, updating the river management plan, evaluating alternative channel maintenance activities, resurveying river cross sections, implementing 30 habitat restoration sites which would restore about 550 acres of 12 habitat types, and developing an environmental water transactions program to acquire water rights.

*The 2009 Record of Decision committed the USIBWC to implementing about 550 acres of habitat restoration and 2,000 acres of managed grasslands along the Rio Grande in Lower New Mexico and West Texas.*

Broad Canyon Arroyo Restoration 2011-2014

*On Right: Broad Canyon Arroyo Restoration: From top: Dense saltcedar August 2011; Saltcedar excavation March 2012; Post saltcedar excavation March 2012; Prescribed burns of saltcedar debris piles January 2013; Planting along the river banks February 2013; and Growing willow trees May 2014.*

## Implementation: Last 5 Years

In the first 5 years of ROD Implementation, the USIBWC and its partners have completed the following:

### Restoration Work

- Completed base studies for implementation (such as restoration plans, cultural resources investigations, soils and groundwater data, and endangered species surveys)
- From 2011 to 2014, planted almost 5,000 trees and treated or excavated about 350 acres of saltcedar on the first 9 restoration sites. Work was done by the U.S. Fish and Wildlife Service (USFWS) through an Interagency Agreement.
- Installed 55 shallow groundwater monitoring wells at 21 sites.
- Began a restoration site monitoring program.

### Environmental Water Transaction Program

- Developed an Environmental Water Transaction Program (EWTP) through a Public-Private partnership with USFWS, National Fish and Wildlife Foundation, Audubon New Mexico, and the Elephant Butte Irrigation District (EBID). The EWTP established rules and procedures for the USIBWC to acquire water and water rights through voluntary transactions to sustain restoration sites.
- USIBWC intends to acquire water rights for about 475 acres of restored habitat through voluntary transactions with willing sellers.
- Signed a Memorandum of Understanding with EBID to work collaboratively on the EWTP.
- Secured passage of an EBID policy that authorizes use of EBID-administered water for native vegetation on restoration sites.
- Identified initial willing water rights sellers, purchased surface water rights associated with 4.0 acres of land and is in the process of acquiring more.
- Created an irrigation plan for the Leasburg Extension Lateral Wasteway #8 restoration site with plans to irrigate in June 2014.
- Leased water for a second irrigation of the Leasburg restoration site in July 2014.

**Leasburg Extension Lateral Wasteway #8 Restoration Work:** *From top: Tree planting February 2012; Blooming cottonwoods August 2012; Measuring groundwater levels July 2013; Blooming cottonwoods and willows May 2014.*

### Other Implementation Work

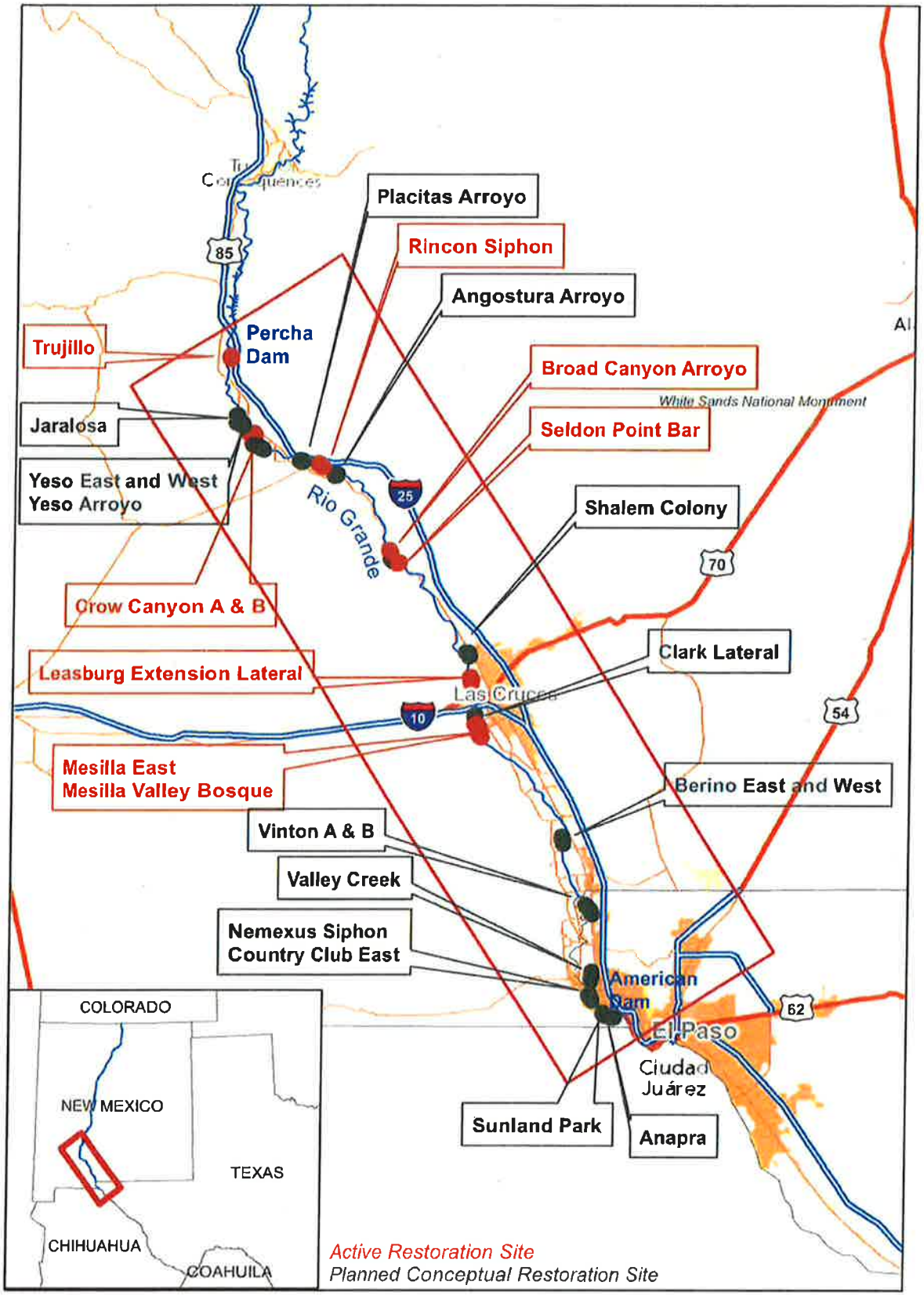
- Completed a draft River Management Plan and draft Channel Maintenance Plan in 2013 with ongoing stakeholder review.
- Consulted with the USFWS under the Endangered Species Act on possible impacts to federally endangered species, specifically the southwestern willow flycatcher. The USFWS issued a Biological and Conference Opinion in August 2012, requiring the USIBWC to maintain 53.5 acres of flycatcher habitat.
- Secured exclusion of the Lower Rio Grande from designation as critical habitat for the flycatcher because of USIBWC's commitment to a flycatcher management plan including agreements to develop a water transaction program and implementation of the overall restoration plan.
- Signed an Interagency Agreement with the U.S. Bureau of Reclamation to conduct flycatcher surveys.
- The USIBWC continues to coordinate with stakeholders (environmental groups, irrigation districts, and elected officials) through an Implementation Committee which meets about every other month.

## Implementation: The Next 5 Years

- In the next 5 years, the USIBWC anticipates restoring the remaining 21 restoration sites, purchasing water rights, continuing channel maintenance discussions and studies, and finalizing the River Management Plan. The USIBWC estimates the 10-year implementation of the ROD will cost $11.1 million. As of June 2014, $2.6 million has been obligated or spent, representing about 23% completion.

For more information, visit http://www.ibwc.gov/EMD/canalization_eis.html or call 915-832-4701

# USIBWC Rio Grande Canalization Project
# Habitat Restoration Sites




0 5 10 20 30 40 Miles

USIBWC, June 2014

# RIO GRANDE CANALIZATION PROJECT
# ENVIRONMENTAL WATER TRANSACTIONS PROGRAM
# PROJECT BRIEF JUNE 2009 – JUNE 2014

INTERNATIONAL BOUNDARY AND WATER COMMISSION, U.S. SECTION

## ACQUIRING WATER TO RESTORE THE RIO GRANDE

### Background

In June 2009, the International Boundary and Water Commission, U.S. Section (USIBWC), the federal agency charged with applying the boundary and water treaties between the United States and Mexico, signed the Record of Decision (ROD) on River Management Alternatives for the Rio Grande Canalization Project (RGCP). The RGCP extends from Percha Diversion Dam in Sierra County, New Mexico 105 river miles downstream to the American Diversion Dam, in El Paso County, Texas. The ROD committed the USIBWC to implement 30 habitat restoration sites as well as to develop an Environmental Water Transactions Program (EWTP) to acquire water rights for the restoration sites.

### The Environmental Water Transactions Program

The USIBWC developed the EWTP through a Public-Private partnership with the U.S. Fish and Wildlife Service, National Fish and Wildlife Foundation, Audubon New Mexico, and the Elephant Butte Irrigation District (EBID). The EWTP establishes rules and procedures for the USIBWC to acquire water and water rights through voluntary transactions to sustain restoration sites. USIBWC intends to acquire water rights for about 475 acres of restored habitat through voluntary transactions with willing sellers.

### Why do we need to restore native riparian habitat on the Rio Grande?

Before construction of the Canalization Project, the floodplain was a mosaic of riparian habitats including riparian forests, open woodlands, wet meadows, grasslands, and dense riparian shrub.

© Photo by Adriel Heisey

*Seldon Point Bar restoration site*

### What is a water transaction?

A water transaction is a voluntary agreement, in this case between a willing seller and the USIBWC, under which the seller agrees to sell (or lease) their EBID surface water right to USIBWC. Water transactions can be a sale, annual lease, multiple-year lease or donation.

### I would like to sell my water rights to support riparian restoration on the Rio Grande. Whom do I contact?

A water rights holder can contact Audubon New Mexico if they are interested in selling or leasing their water rights to the program. Audubon will process the offers and confirm the material facts of the water rights for sale and lease for consideration by USIBWC. Alternatively, a water rights holder can contact the USIBWC directly.

*Beth Bardwell*
*Director of Freshwater Conservation*
*Audubon New Mexico*
*4850 Tobosa Rd.*
*Las Cruces, NM 88011*
*575-522-5065 (office)*
*575-418-0288 (cell)*
*bbardwell@audubon.org*

*Elizabeth Verdecchia*
*Natural Resources Specialist*
Elizabeth.Verdecchia@ibwc.gov
*915-832-4701*

Our river valley was filled with large native trees including cottonwoods, Goodding willows, and native shrubs, which provided refuge from the summer heat for recreation and relaxation along the river. These native plants also provided food and cover to wildlife, songbirds, and pollinating bees and butterflies. Many of these native habitats were lost when the Canalization Project was constructed. The USIBWC has historically mowed much of the floodplain within the levees for flood control but in 2010 began setting aside additional areas which would not be mowed. The goal now is to restore a more natural environment on over 2,500 acres through a combination of practices including exotic vegetation removal, native vegetation plantings, restoration of natural river banks, supplemental irrigation, and cessation of mowing. Water is a key ingredient needed to achieve these enhanced habitat restoration goals.

## Why do we need to acquire water rights for restoration work?

Where restoration results in an increase in water depletion or irrigation is desired to sustain the new native vegetation, USIBWC will acquire water and/or water rights, at market value, from willing sellers and transfer them to the restoration sites. The EBID will treat USIBWC like any other irrigator, with USIBWC water-righted lands receiving an equal allotment per acre like other EBID district water-righted lands, and sharing pro rata in shortages during low water years. USIBWC and its cooperating entities have contracted with Audubon New Mexico to help develop and administer the environmental water transactions program.

## What Progress has been made so far?

- The USIBWC and EBID signed a Memorandum of Understanding to work collaboratively on the EWTP.
- The EBID Board recently approved a policy authorizing the use of Rio Grande Project surface water rights for native habitat restoration.
- The EWTP has identified initial willing water rights sellers, purchased surface water rights associated with 4.0 acres of land and is in the process of acquiring more.
- The USIBWC and its partners created an irrigation plan for the Leasburg Extension Lateral Wasteway #8 restoration site with plans to irrigate in June 2014.
- The EWTP has leased water for a second irrigation of the Leasburg restoration site in 2014.
- The USIBWC constructed 55 groundwater monitoring wells at 21 restoration sites to monitor water levels and impacts from drought. This data will be vital to determining what sites need supplemental water.

*Old growth cottonwoods at the Jaralosa Restoration Site, May 2014*

*USFWS plants native trees at the Leasburg restoration site, March 2014*

*USIBWC staff monitor groundwater levels at the Leasburg Extension Lateral WW#8 restoration site, May 2014*

With supplemental water, about 1,500 newly planted trees at the Leasburg restoration site, and about 3,500 trees planted at other restoration sites, can grow and provide habitat to wildlife and endangered species while enhancing the human experience and health of the river.

For more information, visit
http://www.ibwc.gov/EMD/canalization_eis.html or call 915-832-4701

# USIBWC Rio Grande Canalization Project

# River Management Plan

International Boundary and Water Commission, U.S. Section

*Last Updated November 12, 2014*

# United States Department of the Interior

FISH AND WILDLIFE SERVICE
New Mexico Ecological Services Field Office
2105 Osuna Road NE
Albuquerque, New Mexico 87113
Phone: (505) 346-2525 Fax: (505) 346-2542


August 30, 2012

Consultation No. 02ENNM00-2012-F-0016
Previous Consultation No. 2-22-00-I-025

Gilbert G. Anaya, Chief
Environmental Management Division (Bldg C, Suite 310)
International Boundary and Water Commission
4171 N. Mesa Street
El Paso, Texas 79902

Dear Mr. Anaya:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological and conference opinion (Opinion) on the effects of the United States Section of the International Boundary and Water Commission (IBWC) proposed action of an Integrated Land Management Alternative for Long-Term Management (Land Management Alternative) of the Rio Grande Canalization Project (RGCP) in Sierra County and Doña Ana County, New Mexico, and El Paso County, Texas. This Opinion concerns the effects of the proposed Land Management Alternative on the endangered southwestern willow flycatcher (*Empidonax traillii extimus*) (flycatcher) and on the flycatcher's proposed critical habitat. Your request for formal consultation, in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.), was received on November 2, 2011. No permit or license applicants (16 U.S.C. 1532 and 1536(3)) were identified by IBWC as part of this consultation.

This Opinion is based on information submitted in the November 2, 2011, Land Management Alternative Biological Assessment (BA; SWCA Environmental Consultants 2011), Record Of Decision (IBWC 2009), Conceptual Restoration Plan (U.S. Army Corps of Engineers (USACE) et al. 2009), conference calls or meetings between IBWC and the Service, supplemental information provided by e-mail, and other sources of information available to the Service. The administrative record for Consultation No. 02ENNM00-2012-F-0016 is on file at the Service's New Mexico Ecological Services Field Office in Albuquerque, New Mexico.

The Service concurs with IBWC's findings that the proposed action "may affect, but is not likely to adversely affect" Aplomado falcon (*Falco femoralis*) or least tern (*Sternula antillarum*). As documented in your BA, and with additional IBWC commitment to allow these species to leave on their own volition when encountered prior to or during project activities, the Service finds that the proposed action will have insignificant and discountable effects to least tern and Aplomado falcon. Those conservation measures identified by IBWC described in the Service's 2004 concurrence letter for the proposed action (USFWS 2004) that address livestock management, mowing practices, and soil erosion remain in effect. If monitoring or other information results in modification or the inability to complete all aspects of the proposed action, consultation should be reinitiated. Please contact the Service if: 1) future surveys detect listed, proposed, or candidate species in habitats where they have not been previously observed; 2) the proposed action changes or new information reveals effects of the proposed action to listed species that have not been considered in this analysis; or 3) a new species is listed or critical habitat designated that may be affected by the action. Consultation for individual projects or river management plans may also be necessary during project planning if circumstances are different from those described in the BA. The remainder of this Opinion addresses direct, indirect, and cumulative effects of the proposed action on the flycatcher and its proposed critical habitat.

No critical habitat is currently designated for the flycatcher within the action area; however, critical habitat has been proposed for designation and this Opinion assesses effects of the proposed action on proposed critical habitat. The Service does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statute and the August 6, 2004, Ninth Circuit Court of Appeals decision in Gifford Pinchot Task Force v. USDI Fish and Wildlife Service (CIV No. 03-35279) to complete the following analysis with respect to critical habitat. This consultation analyzes the effects of the action and its relationship to the function and conservation role of the physical and biological features of flycatcher critical habitat to determine whether the current proposed action destroys or adversely modifies flycatcher critical habitat.

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CYNTHIA H. COFFMAN
Attorney General

DAVID C. BLAKE
Chief Deputy Attorney General

MELANIE J. SNYDER
Chief of Staff

FREDERICK R. YARGER
Solicitor General

**STATE OF COLORADO**
**DEPARTMENT OF LAW**

RALPH L. CARR
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Denver, Colorado 80203
Phone (720) 508-6000

**Natural Resources and Environment Section**

June 8, 2016

Nancy Coulam, UC720
Bureau of Reclamation
125 State Street, Room 8100
Salt Lake City, Utah 84138-1147
e-mail: ncoulam@usbr.gov

RE: Rio Grande Project Operating Agreement DEIS

Dear: Ms. Coulam:

The Colorado Division of Water Resources ("DWR") thanks you for the opportunity to comment on the Draft Environmental Impact Statement for the Rio Grande Project Operating Agreement ("DEIS"). The Office of the Attorney General for the State of Colorado submits these comments on behalf of DWR.

As home to many water users on the Rio Grande and its tributaries, and as a signatory state to the Rio Grande Compact ("Compact"), Colorado has a strong interest in how the Bureau of Reclamation operates Elephant Butte Reservoir. The Compact contains provisions concerning Elephant Butte Reservoir that protect Colorado, and the operation of the Rio Grande Project implicates some of Colorado's rights and obligations under the Compact. As such, DWR appreciates the opportunity to provide comments as set forth below.

To assist the Bureau of Reclamation as it revises the DEIS, DWR has identified areas of broad concern.

1

Rio Grande Compact: The DEIS does not always accurately construe the Compact and its provisions. In particular, calculation of Compact Credits and available Project Supply in the DEIS should comport with the Compact. Although these calculations underlie analysis of all alternatives, it is not clear that the DEIS accurately captures the impacts of the alternatives under existing legal constraints. In several locations, the DEIS appears to rely on

2 Compact Credit calculations and delivery requirements that are inconsistent with the Compact. DWR recommends working with the Rio Grande Compact Commission to more accurately describe and operate under the terms of the Compact.

3 Texas v. New Mexico and Colorado, No. 141, Original: The litigation should not be a basis for evaluating any of the alternatives in this EIS at this time. The Compact does provide a legal framework under which the Project must operate, and is common to all alternatives. However, the outcome of disputed issues in litigation is not known at this time and it is beyond the scope of the EIS to try to define the positions of the parties. These descriptions may inadvertently impact the litigation process or may undermine the results of the EIS. It is especially important for the EIS to avoid comment on the litigation because the United States is a party.

4 Project Supply and Allocation: Analysis of all alternatives presumes supplemental ground water irrigation throughout the Project area. It appears that this may affect diversion ratio, carry over amounts, and annual demands. However, the DEIS does not explain why supplemental irrigation is needed or why there are differences in the need within the Project area.

5 Moreover, the analysis does not include the entire Project area. The DEIS further does not describe how historical allocation ratios are maintained

6 given unexplained variances in Project demand and supplemental irrigation.

Modeling: DWR has not had sufficient time to thoroughly examine the development and application of the model that underlies the analysis of the alternatives in the DEIS. DWR does have some concerns with the lack of

7 explanation in the DEIS for some of the assumptions used in developing the model. Moreover, because the model does not include inputs or project impacts throughout the Project area, the model may lack robustness in showing the impacts of or differences among the various alternatives.

In addition to these broad topical comments, DWR includes comments in tabular format along with this letter. These comments fall under, and are in addition to, the broad areas of concern described above. The comments are aimed at improving the DEIS, but may not include all concerns that DWR may have regarding statements made in the DEIS. As such, DWR's omission of any comment or correction of perceived misstatements does not constitute an admission or waiver with respect to any factual or legal issue in any current or future proceedings.

DWR appreciates the opportunity to review the DEIS and provide comments. Please feel free to contact me or Mike Sullivan, 303-866-3581 x8202, with any questions.

Sincerely,

FOR THE ATTORNEY GENERAL

CHAD M. WALLACE
Senior Assistant Attorney General
Natural Resources & Environment Section
Telephone: (720) 508-6281
Email: chad.wallace@coag.gov

cc: Mike Sullivan

State of Colorado Comments on the Rio Grande Project Operating Agreement DEIS

| Comment # | Page # | Line # | Commenting | Comment |
|---|---|---|---|---|
| Rio Grande Compact | | | Colorado Division of Water Resources | |
| 1 | ES4 | 88-90 | " 8 | This incorrectly construes the nature of the litigation in No. 141. The text is unnecessary as a basis for the EIS and should be removed. |
| 2 | ES5 | 137-138 | " 9 | Change "Rio Grande Project Compact" to "Rio Grande Compact." |
| 3 | 1-1 | 10 | " 10 | The EIS states that the alternatives are consistent with the Rio Grande Compact. However some aspects of the alternatives are being litigated regarding their alleged violation of the Rio Grande Compact. If the EIS must make a statement on this issue it should state that the Project will be operated consistent with the Rio Grande Compact. See also Comment 4. |
| 4 | 1-4 | 93-94 | " 11 | These items all reference subtracting non-Rio Grande Project storage, which includes Rio Grande Compact credits. However, it appears that the Compact credit adjustments only consider water physically in the reservoir at the time and calculates the credits on a monthly basis. Such a method may not accurately calculate available Project storage. Colorado accrues Rio Grande Compact credits in the amounts by which actual deliveries to the Lobatos gage in any calendar year exceed scheduled deliveries. Compact Arts. I and III. Colorado's deliveries neither need to be measured in Elephant Butte Reservoir nor estimated on a monthly basis. |
| 5 | 1-5 | 113-114 | " 12 | It is unclear what is meant by "other inflows to the Rio Grande" and who claims ownership to such water. Without further explanation, it cannot be determined how the alternatives allocate the inflow or how the inflow impacts the diversion ratio alternatives. |

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| 6 | 1-7 | 202-203 | " 13 | The basis for asserting the parties to the 2008 Operating Agreement have interests in surface and hydrologically connected ground water is unclear. Is Reclamation asserting an ownership interest in groundwater? Is groundwater viewed as Project water? Is groundwater allocated independently under the laws of New Mexico and Texas? Answering these questions may be necessary to assess the impacts from the various alternatives. However, these issues may also implicate positions asserted in the ongoing interstate litigation. |
| 7 | 1-8 | 262-264 | " 14 | The statement that "supplemental groundwater pumping is authorized and managed by the states, independently of the Federal Rio Grande Project" creates confusion regarding the interests stated in comment 6. |
| 8 | 1-10 | 335-346 | " 15 | Construing the New Mexico District Court and U.S. Supreme Court cases is unnecessary and should be deleted. |
| 9 | 1-12 | 434-437 | " 16 | Stated goals should not include conservation of hydrologically connected ground water in New Mexico and Texas. See comment 6. |
| 10 | 2-8 | 286-288 | " 17 | What is the basis for increasing the amount of full Project allocation from 763,842 acre feet per year to 790,000 acre feet? This adjustment does not appear to reflect actual and historical use patterns. |
| 11 | 2-10 | 359-364 | " 18 | Although Reclamation has asserted that how it calculates Rio Grande Compact credits is not a true alternative, but a modeling assumption, Colorado maintains that the basis for analysis of the alternatives incorrectly calculates Compact credits. This error affects how Reclamation determines available Project water. Colorado generates Rio Grande Compact credits in the amounts by which actual deliveries to the Lobatos gage in any calendar year exceed scheduled deliveries. Compact Arts. I and III. Colorado's deliveries neither need to be measured in |

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| | | | | Elephant Butte Reservoir nor estimated on a monthly basis. See Comment 4. |
| 12 | 3-5 | 60-62 | " 19 | An evaluation in this EIS of whether the OA is in compliance with the Rio Grande Compact is not conclusive and does not reflect agreement or consensus among the Compacting parties. See Comments 3 and 4. |
| 13 | 3-5 to 3-7 | 81-90 | " 20 | This section incorrectly summarizes the Rio Grande Compact. The Compact does not ensure an equitable apportionment of water, but makes allocations of water that have been deemed equitable by the compacting states. The Compact does not set delivery requirements to states, but sets two delivery points, one at the Lobatos gage and one at the San Marcial gage. The Compact does not provide for delivery of water to the Rio Grande Project, at Elephant Butte Reservoir or elsewhere. The Compact does not have obligations for Colorado and New Mexico to deliver water to downstream states, but sets two delivery points, one at Labatos gage and one at the San Marcial gage. |
| 14 | 4-6 | 231 | " 21 | It is unclear what is meant by "In addition, the storage and relinquishment of Rio Grande Compact credit water in EBR is represented as a time-varying input." See comment 4 regarding the calculation of Compact credit water. |
| 15 | 4-7 | 233-236 | " | See Comment 4. |
| 16 | 4-14 | 434-436 | " | See Comment 4. |
| 17 | 4-16 | 514-517 | " | See Comment 4. |
| 18 | 4-31 | 820-822 | " | See Comment 4. |
| 19 | 4-98 | 3017-3029 | " | See Comments 3 and 4. |
| Project Supply | | | | |
| 20 | ES4, 1-5, 1-8, 2-8, 4-13, 4-35, 4-36 | 112-116, 115-120, 262-264, 270-271, 267-270, 389-392, | 22 | Common to all alternatives, it is unclear why supplemental groundwater is required throughout the Project area when a full allocation is available. Has |

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| | | 897-899, 906-907, 921 | 23 | Reclamation increased the area served by the Project, the duty of water per acre, or expanded the scope of the Project? Is Reclamation allowing the Project to meet increased demands by also replacing impacts to Project deliveries caused by ground water pumping? |
| 21 | ES4, 1-5, 1-8, 3-11, 4-8, 4-35, | 112-116, 115-120, 270-271, 245-249, 309, 908, | " 24 | The basis for considering the impacts to irrigation efficiency from well pumping only within EBID is unclear. Related to comment 20, it appears that Reclamation has presumed an increase in the duty of water throughout the Project area, but only considered its effects in some areas. |
| 22 | 3-8 | 141 | " 25 | "maintaining irrigation demand" should be changed to "meeting irrigation demand" |
| 23 | 4-20, 4-35 | 597, 906-907 | " 26 | On what basis did Reclamation presume carryover for each district if it also presumed a need for supplemental ground water supply? Although it asserts ground water use is an individual user decision, analysis of the alternatives does not show how the amount of carry-over is derived, especially when all alternatives presume that the surface supply is inadequate to meet demands. |
| 24 | 1-5 | 144-146 | " 27 | On what basis does Reclamation assert that HCCRD only receives excess seepage and drainage water if it has not evaluated irrigation use throughout the Project area? An analysis of the interactions between irrigation demand, irrigation efficiency, and water supply is needed to evaluate the accuracy of this conclusion. |
| Project Allocations | | | | |
| 25 | 1-9 | 277 | " 28 | The DEIS states that the D1 and D2 curves represent conditions during 1951 to 1978 Project operations. However, there is no explanation of whether this time period is representative of either earlier or current conditions within the Project. |
| 26 | 1-9, 1-10, 2-8, | 305-314, 317-321, 267-270, | " 29 | The diversion ratio appears to only represent conditions within some of the Project area. It does not attempt to |

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| | | | | account for ground water impacts, irrigation efficiency, or duty of water per acre throughout the Project area. There is no explanation of how this spatial limitation maintains equality in allocation of acre feet per acre across the Project area. |
| Model | | | | |
| 27 | 4-5, 4-8, 4-14, 4-15, 4-35, 4-37, 4-39, 4-40, 4-42, | 159-170, 309, 448-449, 460-462, 908, 985, 1042, 1087, 1132, | " 30 | The limited model domain and assumptions used in both the model and for the Project area are not the most robust method of analysis of water responses throughout the Project. Colorado suggests expanding the model domain and conducting additional evaluation of the assumptions used in the model and for unmodeled areas. |
| 28 | 4-6 | 204 | " 31 | On what data is the presumption that all well pumping is from shallow alluvium based? |
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# NEW MEXICO INTERSTATE STREAM COMMISSION

**COMMISSION MEMBERS**

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June 8, 2016

U.S. Bureau of Reclamation
Attn: Nancy Coulam
125 South State Street, Room 8100
Salt Lake City, U.T. 84138-1147

**Submitted Via Email to: ncoulam@usbr.gov**

**RE: New Mexico Interstate Stream Commission's Comments on the Draft Environmental Impact Statement for the Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project, New Mexico and Texas**

Dear Ms. Coulam:

The New Mexico Interstate Stream Commission (the "Commission") submits the following comments on the draft environmental impact statement ("DEIS") for the continued implementation of the 2008 Operating Agreement for the Rio Grande Project, New Mexico and Texas (the "2008 Operating Agreement"). The notice of availability and announcement of public hearings was published in the Federal Register, 81 Fed. Reg. 14886 on March 18, 2016. The comment period was subsequently extended to June 8, 2016. 81 Fed. Reg. 27173 (May 5, 2016).

The 2008 Operating Agreement has had, and will continue to have, major effects on water users in New Mexico. The 2008 Operating Agreement also has implications for the Rio Grande Compact between Colorado, Texas and New Mexico. Therefore, the Commission has a vital interest in the DEIS for the 2008 Operating Agreement.

We hope the Commission's review of the document, and our comments contained herein, can aid the Bureau of Reclamation ("Reclamation") as it works to incorporate additional information in and corrections to the National Environmental Policy Act ("NEPA") documents for the 2008 Operating Agreement so they are completed in the spirit of full disclosure and support informed decision making. That said, for the reasons

1 stated below, the Commission has fundamental objections to the DEIS. Due to the DEIS's inadequate analysis, a supplemental draft environmental impact statement should be prepared for public review and comment. If Reclamation does not prepare a

1 cont. supplemental draft environmental impact statement, it should at least provide the information and analysis requested by the Commission in this document and reopen the comment period for a reasonable time thereafter to allow for true meaningful review of the DEIS.

## I. Reclamation has Predetermined the Outcome of its NEPA Analysis

"Compliance with NEPA does not . . . justify a predetermined action. The NEPA process is intended to identify and evaluate alternatives in an impartial manner." Reclamation NEPA Handbook (DOI 2012) § 2.3.2, at 2-3. "An agency shall commence preparation of an environmental impact statement as close as possible to the time the agency is developing or is presented with a proposal so that preparation can be completed in time for the final statement to be included in any recommendation or report on the proposal. The statement shall be prepared early enough so that it can serve practically as an important contribution to the decision making process and will not be used to rationalize or justify decisions already made." 40 C.F.R. § 1502.5 (Council on Environmental Quality [CEQ] NEPA Regulations).

Reclamation cannot actually commit to a decision prior to completing its NEPA analysis and then use that analysis to "justify a predetermined action." Reclamation NEPA Handbook § 2.3.2, at 2-3. Instead, it must "identify and evaluate alternatives in an impartial manner." *Id.* Reclamation has not identified and evaluated alternatives in an impartial manner in the DEIS, but instead uses the analysis therein to justify a decision it made long ago to adopt the 2008 Operating Agreement.

The language of the DEIS purports to suggest that Reclamation has not predetermined the outcome. For instance, despite the CEQ NEPA Regulations recommendation that the agency identify a preferred alternative in the draft, if one exists, 40 C.F.R. § 1502.14(e), Reclamation does not indicate a preferred alternative in the DEIS. In choosing to not include a preferred alternative, Reclamation attempts to indicate that it has not fully made up its mind. Reclamation also frames the decision analyzed as whether to continue the 2008 Operating Agreement, again suggesting that it is truly examining this question.

Despite this language, upon in-depth review of the DEIS it becomes clear that Reclamation is attempting to paint a false portrait of the analysis undertaken in the document. The DEIS itself acknowledges that the purpose and need for the action is "to meet contractual obligations to EBID [Elephant Butte Irrigation District] and EPCWID [El Paso County Water Improvement District No. 1]." DEIS at ES-5, 1-12. These contractual obligations are in the 2008 Compromise and Settlement Agreement ("2008 Settlement") and the 2008 Operating Agreement. DEIS at ES-5, 1-7, 1-12. The former agreement

binds the parties to the terms and conditions in the 2008 Operating Agreement, and the 2008 Operating Agreement itself was executed by the parties on March 10, 2008. DEIS, App. A. The DEIS does not hide this fact, stating that "implementation of the OA is the result of settlement of litigation between Reclamation and the districts." *Id.* at 1-9. Reclamation clearly committed to a predetermined outcome by executing the 2008 Settlement and then implementing the 2008 Operating Agreement prior to completing its NEPA analysis, and it cannot justify or remedy that fact in the Draft EIS. *See, e.g., Metcalf v. Daley*, 214 F.3d 1135, 1144-45 (9th Cir. 2000) (holding that the federal agency involved violated NEPA when it irreversibly and irretrievably committed resources by entering into a contract before considering that contract's environmental consequences); *see also* 40 CFR § 1506.1 (stating that until a record of decision is issued, no action on the proposal shall be taken that would have an adverse environmental effect or limit the choice of reasonable alternatives).

This is further reflected in the alternatives that Reclamation examines in the DEIS. Alternatives 1 and 2 simply continue the 2008 Operating Agreement in accordance with the current manual while Alternatives 3 and 4 simply remove one major new feature of the 2008 Operating Agreement each. With the exception of Alternative 5, all alternatives involve continued implementation of the 2008 Operating Agreement in some form. DEIS at ES-7. This is because the 2008 Settlement and 2008 Operating Agreement bind Reclamation to implementation of the carryover storage and diversion ratio provisions through 2050. DEIS, App. A § 1.8, at 2 (carryover storage); § 2.5, at 5 (diversion ratio). The DEIS acknowledges that implementing Alternative 5 "would . . . breach the settlement agreement among the U.S., EBID, and EPCWID." DEIS at 2-6.

2 In short, because Reclamation executed a binding contract requiring implementation of the 2008 Operating Agreement prior to conducting a NEPA analysis it irretrievably and irreversibly committed itself to that decision. Reclamation's own handbook specifically counsels against this type of action, stating, "NEPA also requires that environmental concerns and impacts be considered during *planning* and *decision making* so steps may be more easily taken to correct or mitigate the impacts of an action." Reclamation NEPA Handbook § 2.3.1, at 2-2 (emphasis added). This is true for water contract negotiations just as with any other Reclamation Project. "At the very beginning of the contracting process . . . Reclamation should engage the NEPA process and include the consideration of environmental factors into development of a B[asis] O[f] N[egotiation]." *Id.* at § 4.12.2, at 4-9. Reclamation failed in this task by rushing into the 2008 Settlement and 2008 Operating Agreement. Reclamation tries to remedy its lack of planning by now claiming in the DEIS that the "decision to be made" is "whether to continue to implement the OA through 2050," yet it is clear that decision has already been made. This is a fundamental flaw in the DEIS and in Reclamation's NEPA process.

## II. The DEIS Fails to Adequately Examine the Full Range of Alternatives

The alternatives analysis "is the heart of the environmental impact statement." 40 C.F.R. § 1502.14. An agency must select and discuss a range of alternatives that "fosters informed decision making and informed public participation." *California v. Block*, 690 F.2d 753, 767 (9th Cir. 1982). It is contrary to the purpose of NEPA to fail to examine a range of alternatives, focusing rather on extremes or "straw man" alternatives that lead to a pre-ordained selection. *See Natural Resources Defense Council, Inc. v. Evans*, 232 F.Supp.2d 1003, 1038-41 (N.D. Cal. 2002). For the reasons discussed below, Reclamation has not demonstrated that it has analyzed a full range of alternatives, thereby failing to allow for informed decision making and public participation in regard to the 2008 Operating Agreement. The Commission requests that the DEIS be revised to include detailed consideration of additional alternatives as Reclamation continues its analysis.

### A. The Purpose and Need Statement in the DEIS is defined so narrowly as to preclude the consideration of a reasonable range of alternatives.

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An environmental impact statement must contain a statement that specifies the underlying purpose and need to which the agency is responding. 40 C.F.R. § 1502.13; Reclamation NEPA Handbook § 8.5, at 8-5. The purpose and need statement "is a critical element that sets the overall direction of the process and serves as an important screening criterion for determining which alternatives are reasonable." Reclamation NEPA Handbook § 8.5, at 8-5. Courts have long recognized that an agency may not define the purpose of and need for an action in unreasonably narrow terms because that will unduly constrain the range of alternatives considered in an environmental impact statement. *See, e.g., Simmons v. U.S. Army Corps of Engineers*, 120 F.3d 664 (7th Cir. 1997) (stating that "[o]ne obvious way for an agency to slip past the strictures of NEPA is to contrive a purpose so slender as to define competing 'reasonable alternatives' out of consideration…."). "If a purpose and need statement appears to allow only one reasonable solution, the statement, as well as the reasons for rejecting other alternatives, should be re-examined and confirmed or revised, as appropriate." Reclamation NEPA Handbook § 8.5, at 8-6.

The purpose and need statement in the DEIS is "to meet contractual obligations to EBID and EPCWID and comply with applicable law governing water allocation, delivery, and accounting." DEIS at ES-5, 1-12. The contractual obligations are the 2008 Settlement and the 2008 Operating Agreement, as the DEIS acknowledges. DEIS at ES-5, 1-7, 1-12. The DEIS specifically states that "implementation of the OA is the result of settlement of litigation between Reclamation and the districts." DEIS at 1-9.

3 cont. Defining the purpose and need as meeting prior contractual obligations to EBID and EPCWID artificially and unreasonably constrains the analysis in the DEIS by constraining the options available for examination to those that allow for "continued implementation through 2050 of the operating procedures defined in the OA and RGP [Rio Grande Project] operations manual." DEIS at ES-7. And, the only alternatives that satisfy the purpose and need of "meet[ing] contractual obligations to EBID and EPCWID" are Alternatives 1 and 2. Both of these alternatives involve continued implementation of the 2008 Operating Agreement in accordance with its terms. DEIS at ES-7, 2-3. The only difference between them is that Alternative 2 does not involve the storage of San Juan-Chama Project water in Elephant Butte Reservoir. DEIS at ES-7, 2-3. This is not a meaningful difference and demonstrates that Reclamation, contrary to its own NEPA Handbook, has artificially constrained the purpose and need statement as to allow for "only one reasonable solution"— continued implementation of the 2008 Operating Agreement. Reclamation must revise the purpose and need statement in the DEIS to allow for analysis of a meaningful range of alternatives, such as those addressed below in Section II.C.

### B. Reclamation Improperly Defined the No-Action Alternative.

4 The CEQ's NEPA regulations require agencies to consider "the alternative of no action" in every environmental impact statement. 40 C.F.R. § 1502.14(d). When Reclamation is considering adopting a new contract, the no action alternative "represents conditions as they would be with no contract." Reclamation NEPA Handbook § 4.12.2, at 4-9. Only when Reclamation is considering renewing a contract should the no-action alternative mean "continuing the existing contract." *Id.* § 4.12.2, at 4-9. Reclamation's 2007 Environmental Assessment,[1] although it was prepared to analyze adhoc changes to Project operations rather than the 2008 Operating Agreement, properly stated that, under the no-action alternative, "the Rio Grande Project would continue to operate under Reclamation's previously imposed operation procedures as it has for more than 20 years." 2007 Environmental Assessment at 6. The 2013 Supplemental Environmental Assessment,[2] which did address the 2008 Operating Agreement, also properly stated the no-action alternative "would continue Project operations according to pre-OA conditions." Reclamation's analysis in 2013 examined pre-Operating Agreement ("pre-OA") conditions even though it was prepared five years after adoption of the 2008 Operating Agreement, because it was intended to analyze the environmental effects of

[1] In 2007 Reclamation issued an Environmental Assessment and Finding of No Significant Impact for a set of operating procedures that constituted a material departure from historic operations. Its focus was a five-year period, but the procedures were superseded by the 2008 Operating Agreement without additional NEPA review.

[2] In 2013 a Supplemental Environmental Assessment and Finding of No Significant Impact was issued for continued implementation of the 2008 Operating Agreement for the three-year period 2013-2015.

4 cont. a new contract—the 2008 Operating Agreement. 2013 Supplemental Environmental Assessment at 10.

However, in the DEIS Reclamation has dramatically shifted its position and improperly characterized its no-action alternative as "continued implementation through 2050 of the operating procedures defined in the OA and RGP Operations Manual." DEIS at ES-7. Because Reclamation is still analyzing the effects of entering into the 2008 Operating Agreement, not renewing it, it is improper and logically inconsistent for Reclamation to assume the existence of this very action as part of the no-action baseline. It is also misleading to the public regarding the nature of the proposed action and its environmental impacts. Reclamation should revise the DEIS to include operation of the Project according to pre-OA conditions as its no-action alternative so that it can properly compare the environmental impacts of the 2008 Operating Agreement to true baseline conditions.

### C. Reclamation Failed to Fully Consider Feasible Alternatives

Federal agencies must "[r]igorously explore and objectively evaluate all reasonable alternatives." 40 C.F.R. § 1502.14(a). While the range of alternatives must be reasonable and feasible, Reclamation should "include alternatives based upon input from other agencies, the public at large and local community interests. If one or more community alternative(s) exist, and it is feasible and practical, it should be included in the EIS." Reclamation NEPA Handbook § 8.6.2, at 8-9. When Reclamation limits the range of alternatives, "the criteria used to limit the alternatives should be explicitly defined by Reclamation and logically supported." *Id.*

Section 2.5 of the DEIS describes alternatives considered but eliminated from detailed study. Analysis of this Section indicates Reclamation's continued failure to comply with its own NEPA Handbook. Reclamation fails to examine several alternatives that are reasonable and feasible and were suggested by the Commission in the scoping 5 process.[3] Moreover, Reclamation eliminates several reasonable alternatives arbitrarily and without any suggested criteria for doing so. Reclamation should reconsider its decision to eliminate the following alternatives in a supplemental draft environmental impact statement. The Commission also suggests ways to expand on the alternatives analysis, including additional alternatives.

Prior to delving into the Commission's analysis of the DEIS alternatives, it is important to note that on April 7, 2016 the Commission requested additional information regarding the hydrologic modeling used in the DEIS analysis. See Attachment B, (April 7, 2015

[3] See Attachment A, (February 14, 2014 letter from the Commission to Reclamation).

letter from the Commission to Reclamation). The Commission asked for specific data files, source code, and documentation for Model Enhancements, Model Calibration, Model Sensitivity Analyses, GIS Files, and Hydrologic Inputs to the Model.[4] Reclamation performed hydrologic analysis of the Rincon and Mesilla basins using the United State Geologic Survey ("USGS") groundwater flow modeling software MODFLOW-OWHM (Hanson et al., 2014), with additional software features developed and implemented by Reclamation in collaboration with the USGS. This additional software is used to simulate the surface and ground water operations for the area of the Project analyzed by Reclamation for each of the DEIS alternatives. To fully analyze simulated Project operations, we must have access to the new software code, its documentation and full information on its linkage to MODFLOW-OWHM. Absent this information, the Commission is not able to fully evaluate whether proposed alternatives correctly simulate the full scale of the operations under the 2008 Operating Agreement, and operations prior to the Agreement. Accordingly, the Commission's analysis of the modeling scenarios is limited to the model outputs received from Reclamation.

1. *Removing Credits and Charges and Using Actual Deliveries of Water in Accounting*

The system of credits and charges is a significant aspect of the Project water accounting under the 2008 Operating Agreement, and is therefore explicitly within the scope of the DEIS analysis. However, the alternative described in the DEIS is poorly framed as an all or nothing proposition; Reclamation states that examining such credits and charges did not meet the purpose and need and is outside the scope. The Commission disagrees. The credits and charges could and should be evaluated for potential revision or refinement to the 2008 Operating Agreement, an easy alternative to examine in the DEIS. Moreover, adjustments to some of these credits and charges to reflect actual deliveries would make the accounting of Project water use by EBID and EPCWID more reasonable and more equitable under the 2008 Operating Agreement.

5 cont. To adequately address this alternative, the Commission recommends that the system of charges and credits in the 2008 Operating Agreement and the Rio Grande Project Operations Manual ("Operations Manual")[5] be evaluated by considering whether or not the associated operations are reflected in the data used to develop the D1 and D2

[4] The Commission has actually been requesting specific information on the modeling tools used to conduct the analysis in the DEIS since the scoping period, but Reclamation has continued to withhold this information. See Attachment A, at 3-4 (Commission's Comments on Scoping).

[5] The Operations Manual is a companion document that is intricately tied to the 2008 Operating Agreement. The Operations Manual is further discussed in Section IV.E., below.

5 cont.

curves.[6] For example, data behind the D2 regression analysis is not well documented, but appears to be based on annual total canal heading diversions from 1951 – 1978. This historical diversion data would not include the same credit and charge system that the Project employs today, and therefore there is a systematic difference between the "diversions" of the D2 data set and the "charged diversions" that calculate today's diversion ratio. The effects of this systematic difference should be evaluated, especially given the fact that the 2008 Operating Agreement charges EBID for all discrepancy from the D2 curve. By simply eliminating this proposed alternative from analysis in the DEIS, Reclamation is ignoring a reasonable adjustment to the 2008 Operating Agreement and failing to "[r]igorously explore and objectively evaluate all reasonable alternatives." 40 C.F.R. § 1502.14(a).

The inequitable effect of the current application of credits and charges under the 2008 Operating Agreement is easily demonstrable. The diversion data from which the D2 curve was derived include diversions made by EPCWID in winter months. Current accounting no longer includes off-season diversion, and the resulting discrepancy is charged to EBID. The D2 diversion data includes drain flows diverted into the EPCWID canal system. Such diversion of drain flows either no longer occurs or is no longer accounted for, and the resulting discrepancy is charged to EBID. Furthermore, the 2008 Operating Agreement awards EPCWID the American Canal Extension credit, which in theory accounts for delivery efficiency improvements in the El Paso Valley. It is unclear how this credit is applied, but as described in the 2008 Operating Agreement, this credit causes an equal reduction in EBID's allocation.

In general, credits tend to reduce charged diversion below actual diversions, and tend to reduce the diversion ratio. Under the 2008 Operating Agreement, reductions to the diversion ratio result in reductions to EBID's allocation. In addition, credits that EPCWID receives at the end of the year, or in excess of the district's needs, go directly into the EPCWID's carryover account. The carryover account, plus additional water designated to ensure delivery of the carryover water, is sequestered early in the following year's allocation process, leaving less water available for current year allocation, thus reducing EBID's potential allocation.

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[6] The D1 curve is a linear regression of annual Project release data and Project delivery data, using data on delivery to U.S. farms, and to Mexico at Acequia Madre, from 1951-1978.The purpose of the D1 curve was to estimate the delivery shortage based on the amount of Project water available for release from Caballo Dam, which was in turn used to determine the Mexican Allocation. The D2 curve is a linear regression of annual Project release data and total canal diversion data for the same period of time. The purpose of the D2 curve was to determine the amount of water to be allocated for diversion at canal headings in New Mexico, Texas and Mexico, based on the amount of Project water available for release from Caballo Dam. To the best of the Commission's knowledge, Reclamation has accepted the curves as definitive determinations of historical system performance, but the Commission is unaware of a detailed analysis supporting the determination.

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a. *Additional Alternative*

An important feature that should be simulated as part of an alternative is a modified allocation procedure that assigns deficits in Project performance equitably between EBID and EPCWID, instead of assigning them all to EBID as the current allocation procedure does. The Commission suggests the following alternative process be conducted in a supplemental draft environmental impact statement:

(1) Determination of the factors that cause discrepancy between current Project performance, as measured by the diversion ratio, and historic Project performance, as reflected by the D2 curve;

(2) Quantification of D2 discrepancy effects, i.e., the quantification of the effect of these factors on current Project performance relative to historical Project performance;

(3) Equitable assignment of these D2 discrepancy effects between EBID and EPCWID based on the causes of the factors; and

(4) Revision of the allocation procedure so that both EBID and EPCWID are allocated their D2 shares, reduced by the equitable assignment of D2 discrepancy effects.

Specific factors that need analysis under this proposed alternative include:

(1) Accounting Artifacts: factors present in current accounting have caused systematic differences between the net allocation charges currently used in determining Project performance and the diversions used to determine historical Project performance;

(2) Groundwater pumping and/or increased depletions: changes in groundwater pumping, depletion, and irrigation practices that have impacted all historical sources of Project Supply in the Rincon, Mesilla and Hueco basins; and

(3) Credits: Allocation or accounting terms which increase the total amount that one District can divert but may have negative impacts on the allocation of the other District (such negative impacts are most likely to impact EBID under the diversion ratio allocation).

2. *Change Carryover Accounting to Reflect Actual Conservation*

6 The Carryover Accounting provision of the 2008 Operating Agreement was not adequately analyzed in the DEIS, or Reclamation's earlier NEPA efforts, to determine its full impact on Project operations. As summarized in Section 4.4.7 of the DEIS, the

carryover provision of the 2008 Operating Agreement is projected to result in the following average annual impacts on EBID (P50 Scenario):

6 cont.

| EBID Supply | Alternative 3 (No Carryover Accounting) | Alternative 1 (2008 OA) | Impact of Carryover Accounting | % Impact of Carryover Accounting |
|---|---|---|---|---|
| Total Allocation | 264,752 | 213,053 | -51,699 | -19.5% |
| Net Diversions | 198,287 | 153,583 | -44,704 | -22.6% |
| Farm Deliveries | 94,477 | 72,841 | -21,636 | -22.5% |

The simulated impact of carryover accounting on the estimated Project water allocation, diversions, and deliveries to EBID shown in the above table is substantial. The Commission requests, as it did during the scoping process for the DEIS,[7] a full evaluation of the carryover accounting practices under the 2008 Operating Agreement. The DEIS only analyzed complete removal of the carryover provision. DEIS, Section 2.3, at 2-3. While changes in the Project authorization may be needed, adjusting the carryover accounting provisions in the 2008 Operating Agreement is a reasonable alternative that should have been considered in the DEIS to address the current inequities of the 2008 Operating Agreement for EBID and its farmers, as well as to provide EPCWID a savings account for use in very dry years. The following outlines the evaluation the Commission believes is warranted in a supplemental draft environmental impact statement.

Under the 2008 Operating Agreement, unused allocation is accounted for as carryover in Project storage whether or not this water is physically available in the Project reservoirs at the end of the year (i.e., "paper carryover"). In the following year, these paper carryover accounts are filled first with the available physical supply in the reservoir and inflow to the reservoir. To the extent that paper carryover needs to be filled with wet water during a calendar year, this reduces the annual allocation of Project water in the current year to both districts and to Mexico.

The adverse impacts of the carryover accounting on Project water allocations to Project supply are magnified by the diversion ratio adjustment portion of the 2008 Operating Agreement. The actual diversion ratio varies from year to year depending on hydrologic conditions, pumping, irrigation efficiencies, irrigation return flows, and other factors. The

[7] Attachment A, at 6.

magnified impact occurs when a district calls for delivery of water in a year with a lower diversion ratio than the year in which the water was saved. For example, if EPCWID calls for delivery of 100,000 acre-feet ("AF") of water in a year with a diversion ratio of 1.0, then 100,000 AF must be released from storage to make that delivery. If EPCWID instead carries that water over in storage because its demand was presumably fulfilled with less water in a "wet" year and calls for its delivery in a subsequent year under dry hydrologic conditions with a diversion ratio of 0.7, then 142,800 AF would have to be released in order to deliver 100,000 AF to EPCWID. This increased release would reduce the annual allocation to EBID in the current year and/or subsequent years and inappropriately shifts the equitable management of Project water during periods of dry or drought conditions, when the value of water for crop irrigation is acute.

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A related factor is the absence of any charge or reduction for evaporation on carryover allocations under the Operating Agreement. Because no evaporation is charged to the carryover, water that would otherwise be available for annual allocation to the Districts and Mexico is instead required to satisfy evaporative losses that are not reflected in the unreduced carryover amount. This practice is contradictory to standard reservoir accounting practices, including those employed by Reclamation in other Projects, in which each account or "pool" of water held in storage is assigned its proportional share of evaporation.

In practice, EPCWID has been the main beneficiary of carryover because in full-supply years EPCWID is allocated more water than it needs. In several years EPCWID's carryover account exceeded 200,000 acre-feet, while EBID has never carried over more than 40,000 acre-feet. Thus the benefits associated with the diversion ratio adjustment to carryover, and evaporation-free carryover, predominantly accrue to EPCWID to the detriment of EBID.

The impact of these aspects of the carryover accounting on the Project water allocation and Project water diversions to EBID should have been analyzed as part of the DEIS. Adjusting the following in the accounting procedures is a feasible alternative to continuing to implement the 2008 Operating Agreement as is: (1) water available for annual allocation; (2) evaporation; (3) paper accounting credits; and, (4) the diversion ratio. Failing to consider modifications to the accounting violates Reclamation's obligation to examine all reasonable and feasible alternatives. A supplemental draft environmental impact statement should be prepared including analysis of alternative formulations of the carryover storage provision of the 2008 Operating Agreement that reduce or eliminate the current negative effects of the carryover storage on EBID.

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### 3. *Changes in Drought Factor and Evaporation Calculations*

For reasons further described in Section IV.E. below, failing to examine changes to the Operations Manual is a fundamental flaw in the DEIS. In regard to the alternatives analysis, dismissing review of changes in the drought factor and evaporation calculations again demonstrates Reclamation's failure to analyze all reasonable alternatives.

The Operations Manual does more than merely implement the 2008 Operating Agreement. Again, as discussed in depth below, modifications to the Operations Manual have resulted in material changes in the operation of the Project. For example, a "drought factor" was added to the Operations Manual in May 2012 to reduce the D2 allocation in multiple drought years. This type of large scale change to Project operations should be analyzed in this NEPA process. The Operations Manual is intricately tied to the 2008 Operating Agreement. Accordingly, material changes to the Operations Manual should be evaluated under NEPA whether or not there is a corresponding formal change to the OA. Without conducting this analysis Reclamation has failed to examine the full range of alternatives.

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### 4. *San Juan - Chama Storage Contract Options*

The Commission does not agree that adequate analysis was conducted under Alternative 2 in regard to the San Juan - Chama Storage Contract Options or for San Juan Chama water, in general. The storage of San Juan - Chama Project water was analyzed by adding the lesser of 50,000 AF to Project Storage or the unused space available in storage to the Rincon Mesilla Basin Hydrologic Model results. There was no simulated delivery to or use of the San Juan - Chama water from storage in Elephant Butte Reservoir ("EBR"), nor was evaporation charged to the San Juan – Chama water from storage as required by San Juan - Chama accounting. Because the analysis procedure was so simplified, the results do not reasonably represent the effect of storage of San Juan - Chama water on the operation of the Project, especially during times of drought. Because EBR does not have an authorized minimum pool, water levels were historically and can currently be drawn down to very low levels. In the past, such operations had negative impacts on the reservoir fishery and recreation, at the minimum. San Juan -Chama water storage was authorized by Congress in EBR, in part, to reduce those impacts. They are not evaluated or discussed in the DEIS but should be.

The Commission recommends Reclamation simulate San Juan - Chama storage and use at EBR along with effects of the 2008 Operating Agreement on storage levels at EBR, particularly during drought, to fully assess the impacts on the local environment and economy.

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## III. The Scope of Review in the DEIS is Inadequate

An agency's choice of the geographic area of its analysis must "represent a reasoned decision and cannot be arbitrary." *Idaho Sporting Congress v. Rittenhouse*, 305 F.3d 957, 973 (9th Cir. 2002). Courts will strike down an environmental impact statement if a geographical limitation on the agency's analysis is not supported by the record. *Utahns for Better Transp. v. Dep't of Transp.*, 305 F.3d 1152, 1179-80 (10th Cir. 2002). For example, an environmental impact statement will be held invalid if the record reflects that an action is likely to have impacts beyond the geographical limitations selected by an agency and the agency fails to provide a reasoned analysis for the boundaries it selects. *Id.* Here, Reclamation inappropriately limited the geographic scope of impacts to the Project area in New Mexico downstream of EBR.[8]

### A. Failure to Include Areas South of American Dam

First, the DEIS fails to analyze the full Project area. While the Project extends nearly 160 miles from EBR south along the Rio Grande valley to the El Paso and Hudspeth County line in Texas, the DEIS analysis extends south only about 110 miles, ending at the International Boundary and Water Commission American Dam. The geographic scope of the technical analysis in the DEIS should be extended to include the area between American Dam and Fort Quitman. The following are among the reasons that the study area should be expanded downstream to Fort Quitman.

(1) The area is a major part of the Rio Grande Project - Over the 100-plus year history of Rio Grande Project (the "Project") operations, Reclamation made water deliveries as far south as Fabens Texas, over 40 miles south of American Dam....The impacts of activities upstream of Fabens, if not Hudspeth, that affected farm headgate deliveries as well as determination of reasonable operational waste within EPCWID to Hudspeth are necessary to assess the differences in Project Water supply available to the Districts between alternatives.

(2) Pumping Capacity in EPCWID - Contrary to statements in the DEIS, significant irrigation pumping capacity exists in the EPCWID service area. *See* Figure 1, attached. Therefore, differences in Project supply to EPCWID between the alternatives would result in changes in pumping costs in EPCWID rather than an economic loss of the full value of the water. It is necessary to model the irrigation and municipal water supply operations in the El Paso Valley to assess the

[8] Again, New Mexico has raised these geographic scope issues before to Reclamation. Attachment A at 6.

10 cont.

hydrologic and socioeconomic impacts of differences in Project water supply to EPCWID between the alternatives.[9]

(3) Effect of Water Operations Downstream of American Dam – Irrigation and municipal water supply operations in the El Paso Valley affect the deliveries of Project water to the farmers in those areas. For example, pumping in the El Paso Valley area can increase conveyance losses in the river, conveyance losses within the canal systems, and on-farm losses. These increases in conveyance and on-farm losses increase the amount of Project water that is required to be released to meet the delivery demands. This in turn affects the Project water allocations to the Districts. It is necessary to model the water supply operations in the El Paso Valley to assess the impacts of those operations on the Project water deliveries.

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In addition, operations below American Dam generate allocation terms and accounting credits that impact the allocation distribution of water throughout the Project. For example, the American Canal Extension Credit results from operations below American Dam, and this is an explicit term in Project allocation that increases the allocation to EPCWID and reduces the allocation to EBID. Other accounting credits based on operations below American Dam such as the Haskell Street Waste Water Treatment Plant Credit and El Paso Valley Credit, reduce the total Project allocation charges, reducing the diversion ratio and modifying the allocation between EBID and EPCWID. Some of EPCWID's credits are applied at the end of the accounting process, and end up in the EPCWID's carryover allocation for the next year. This transfers a credit given below American Dam into "carryover obligation" storage in EBR, directly impacting allocation and distribution of water throughout the Project.

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The DEIS states that "[g]roundwater pumping in the El Paso Valley portion of EPCWID does not affect RGP deliveries (Reclamation 2015a). This is because the effects of pumping occur downstream of RGP diversion points." Reclamation goes on to state "[t]he effects of pumping" did not "occur downstream of the RGP diversion points" during the historical period which forms the basis of the 2008 Operating Agreement (1951-1978). The Commission strongly disagrees. The Project had sources of supply downstream of even Riverside Diversion Dam during that historical period which are now either extinct due to groundwater pumping in the El Paso Valley, or are no longer counted as Project supply. And, major features that today reduce the effects of pumping on the river near El Paso were not constructed until a decade or two after the time period referenced by Reclamation. In either case, this change from historical conditions causes additional discrepancies in water supply which are all deducted from EBID's allocation in the 2008 Operating Agreement. Pumping in Texas by EPCWID

[9] See also Attachment C, references for Texas groundwater pumping data.

farmers, by the EPCWID itself, by municipalities, and others have reduced the delivery efficiency of the Texas part of the Project, and thus reduced Project supply.[10] Under the 2008 Operating Agreement, it is EBID alone that must bear the cost of all impacts to Project supply. This outcome must be analyzed in a supplemental draft environmental impact statement by extending the geographic scope of review.

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Another biased statement seeming to justify Reclamation's flawed geographic scope is the following statement, found on page 1-10 and 2-8 of the DEIS:
"While numerous factors affect RGP performance, recent changes in performance are predominantly driven by the actions of individual landowners within the EBID service area. These changes are as follows:

- Crop selection and related effects on crop irrigation requirement
- Irrigation practices and related effects on farm irrigation efficiency
- Widespread use of groundwater for supplemental irrigation, as permitted and regulated by the State of New Mexico."

Again, Reclamation cannot used such biased statements to justify its erroneous scope of review in the DEIS. These changes are found in EPCWID as well, and would also have an effect on Project performance. The DEIS does not include any analysis or quantification of the effect that these various factors have had on Project performance (or apparent performance). Therefore the conclusion that these changes are "predominantly driven" by actions within EBID is not supported.

14

It is not reasonable to reduce allocation to one district because of increases in efficiency that have taken place throughout the entire Project. The Project was designed and implemented as a pro-rata system; if one farmer becomes more efficient, and therefore the historical performance of the Project changes, this is a natural outcome of improved agricultural practices in the region. The language of the DEIS suggests that any impacts of improved agricultural processes should only be borne by EBID, even though the same practices have been implemented by farmers in both New Mexico and Texas. This constitutes a change to the pro-rata system employed by most (if not all) Reclamation projects, and it is so unusual that it clearly constitutes a significant difference within the Project. Limiting the geographical area to exclude the Texas portion of the Project forecloses a necessary assessment of this action. Reclamation's decision to limit the scope in this fashion is unreasonable and arbitrary.

[10] In addition to this pumping that occurs in the Texas portion of the Project, the City of El Paso also has large well fields in the Mesilla Bolson and Hueco Bolson. The City supplies about 25,000 AF per year of water to its service area from these wells, which again, is not noted in the DEIS. *See* http://www.epwu.org/water/water_resources.html.

15

### B. Failure to Analyze Impacts Upstream of Elephant Butte.

The upstream study limit in the DEIS precludes consideration of significant impacts associated with the proposed action and its alternatives. An environmental impact statement must evaluate the direct and indirect effects of the proposed action and its alternatives. *See* 40 CFR 1502.16; 1508.8 & 1508.25(c); Reclamation NEPA Handbook § 3.10, at 3-14; § 8.8.3, at 8-14 & 8-17. In order to do so, under a properly scoped EIS, "[t]he entire area of potential effect is included in the discussion of affected environment, including potentially affected areas outside the immediate project area." Reclamation NEPA Handbook § 8.7, at 8-13. *See also* 50 CFR 402.02 (defining the action area, for purposes of ESA Section 7 consultation, as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action"). *Accord* ESA Section 7 Consultation Handbook (USFWS/NMFS 1998) Glossary at x; § 4.5, at 4-17 & 4-18. Failure to adequately examine these impacts upstream of EBR is also a fundamental flaw in the Biological Opinion issued by the U.S. Fish and Wildlife Service, as addressed below in Section IV.F.

Despite the Commission's request during the scoping process that upstream impacts be evaluated, the study area for the DEIS is admittedly limited, with its upstream area of analysis stopping at the San Marcial Railroad Bridge above EBR. *See* DEIS § 1.10, at 1-14 (stating that "[t]he area of analysis for the OA and EBR storage is relatively limited within the broader RGP geographic area and varies by resource and resource issues…."). As described below, use of this truncated upstream study limit effectively precludes any examination in the DEIS of the potential direct and indirect and cumulative impacts that will occur upstream as a result of the proposed action and its alternatives.

The Rio Grande Compact (the "Compact") contains a number of Articles that are affected by storage in Project reservoirs, including New Mexico's delivery compliance under Article IV; the spill provision in Article VI; debit water operations from upstream reservoirs under Article VIII; and, the upstream storage restriction under Article VII. Changes in the operation of Elephant Butte and Caballo reservoirs contained in the 2008 Operating Agreement will impact Compact accounting, thereby affecting these Compact provisions. The 2008 Operating Agreement provisions relating to carryover storage, diversion allocations, allowing year round releases from Caballo Reservoir, and allowing for releases greater than 790,000 AF in a year without regard to beneficial use on Project lands have significant implications for Compact compliance and related water management operations.

Of particular concern is the impact on Article VII, which restricts the operation of almost all reservoirs in the Rio Grande Basin in New Mexico *upstream* of EBR based upon the

15 cont.

amount of Usable Water in Elephant Butte and Caballo Reservoirs. See Figure 2, map of major Rio Grande Basin reservoirs. The changes listed above impact the timing and duration of Article VII storage restrictions on upstream reservoirs and, consequently, the amount of water that can be stored and released from them. The Middle Rio Grande Basin is dependent upon these upstream reservoirs to meet irrigation demand, to deliver water to municipalities, and to provide water for endangered species in the middle Rio Grande valley of New Mexico. This has specific consequences for reservoirs used to store water for large water users in the middle Rio Grande valley of New Mexico including the Middle Rio Grande Conservancy District, the Albuquerque Bernalillo County Water Utility Authority, and the City of Santa Fe, as well as numerous other water users in New Mexico and Colorado. It also affects releases of water for use by these entities, as well as water releases for the Rio Grande silvery minnow and Southwestern willow flycatcher, and for federally designated critical habitat upstream of EBR. These considerations are hereinafter referred to collectively as "Upstream Impacts."

Reclamation appears to justify its exceedingly narrow scope of analysis in the DEIS based upon its characterization of Reclamation's limited discretion and limited effects associated with EBR operations under the 2008 Operating Agreement. Reclamation has characterized this as follows:

> Reclamation has limited discretion associated with normal EBR operations under the RGOA. Water stored in the RGP is the result of inflows dictated by Compact guidelines for New Mexico and Colorado. The needs of irrigators and irrigation delivery orders are non-discretionary and include treaty obligations to the Republic of Mexico. Irrigation release rates and times are determined by the two districts and Mexico, and are calculated to meet daily irrigation demands. **Reclamation cannot restrict or increase releases to affect Article VII restrictions on upstream States.** Reclamation's only discretionary actions associated with the RGOA are general operational guidelines and the two changes from historical operation ... the diversion ratio adjustments and the carry-over concept. Reclamation also has discretion over the storage of SJ-C water in EBR, and the timing of releases from EBR into Caballo Reservoir to maintain sufficient water in Caballo for irrigation demands." (Memorandum dated Aug. 20, 2015 transmitting Biological Assessment addressing effects of the OA on federally listed species) (emphasis added).

The above characterizations are incorrect in material respects, and Reclamation has acted arbitrarily in crafting a scope of analysis that ignores these Upstream Impacts.

15 cont. Reclamation's discretionary action of executing the 2008 Operating Agreement is the direct cause of changes in total storage amounts in EBR and changed reservoir releases, both of which affect Article VII restrictions on upstream storage and, potentially, other aspects of the Compact important to New Mexico and Colorado. Specifically, when Usable Water in Project storage exceeds the Article VII threshold of 400,000 acre-feet, New Mexico can store in upstream reservoirs; but when it goes below 400,000 acre-feet, upstream storage is restricted. This means that the 2008 Operating Agreement has affected Article VII restrictions on upstream storage and that Reclamation's representations above are incorrect.

16 The DEIS fails to adequately examine the effects of the 2008 Operating Agreement on evaporative charges under the Compact as well. A large volume of the water flowing into EBR each year is lost to evaporation. These evaporative losses are charged to New Mexico under the Compact because the delivery point under Article IV of the Compact is at the gage downstream of the dam. Operations under the 2008 Operating Agreement that result in more water being held in EBR for longer periods of time accordingly affect New Mexico's deliveries under the Compact. Again, this Compact implication of the 2008 Operating Agreement should have been evaluated as part of the DEIS.

17 Additionally, Reclamation's failure to simulate the effects of the 2008 Operating Agreement in Article VI, VII, and VIII conditions on upstream storage means that the model does not simulate differences in inflows to EBR and Compact credits caused by differing upstream storage conditions. The DEIS incorrectly assumes that the inflows to EBR and amount of Compact credit water in EBR are the same in each Alternative. Different specific Project operations under different Alternatives will produce different Article VI, VII and VIII conditions, different upstream storage restrictions, and different inflow to Elephant Butte.[11] The scope of Reclamation's analysis must include all direct and indirect upstream effects, including how those effects will impact the alternatives listed.[12]

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[11] Different inflows to EBR would result in different amount of Compact credit water in storage. Compact credit in EBR is generated by a monthly Powersim model (URGSIM) that simulates EBR and Caballo releases as average of historical releases for all climate scenarios, but does not specifically simulate EBR or Caballo operations.

[12] Furthermore, because the DEIS does not include analysis of the Compact, the alternatives simulated by Reclamation do not include any reduction of Compact credit water by evaporation during the year (see Appendix A: RESERVOIR_STORAGE.xlsx). This is inconsistent with Reclamation's actual operations during 2011 which reduced credit water by evaporation during the year when allocating water to the two districts. Therefore, failure to examine the Compact in the simulated alternatives does not represent Reclamation's actual allocation process. (Note that New Mexico strongly objects to the application of evaporation to Compact credit during the year by Reclamation, but if Reclamation plans to continue to do so, this must be simulated in the DEIS.)

As noted above, the concerns regarding the 2008 Operating Agreement's Upstream Impacts have consistently been raised by the Commission. The Commission requested that Reclamation's analysis consider impacts on ESA issues, on Articles VI, VII and VIII of the Rio Grande Compact, and on upstream water supplies in correspondence dated April 30, 2012, Attachment D, in comments on the draft Supplemental EA (Attachment E, June 6, 2013 letter from the Commission to Reclamation), and again during scoping for the DEIS (Attachment A).

18 No section in the DEIS describes or evaluates Upstream Impacts of any type. Potential Upstream Impacts should have been listed in the DEIS as a key issue and should have been described and evaluated, but were not. Similarly, under the "Resources Considered" section of the DEIS, Reclamation has failed to describe or evaluate the difference in effects among its alternatives on the operations of upstream reservoirs and, consequently, on the upstream human environment and resources including upstream endangered species-related water operations. Moreover, it failed to conduct this analysis even though impacts to special status species were among the key issues identified in the Supplemental EA prepared for the 2008 Operating Agreement and among the issues raised in comments received during internal and formal scoping and outreach for this DEIS (*see* DEIS § 1.13, at 1-16). The current lack of analysis with respect to Upstream Impacts is a glaring gap that undermines the ability of the DEIS to afford full public disclosure, to elicit meaningful public input, and to support informed federal agency decision making through the NEPA process.

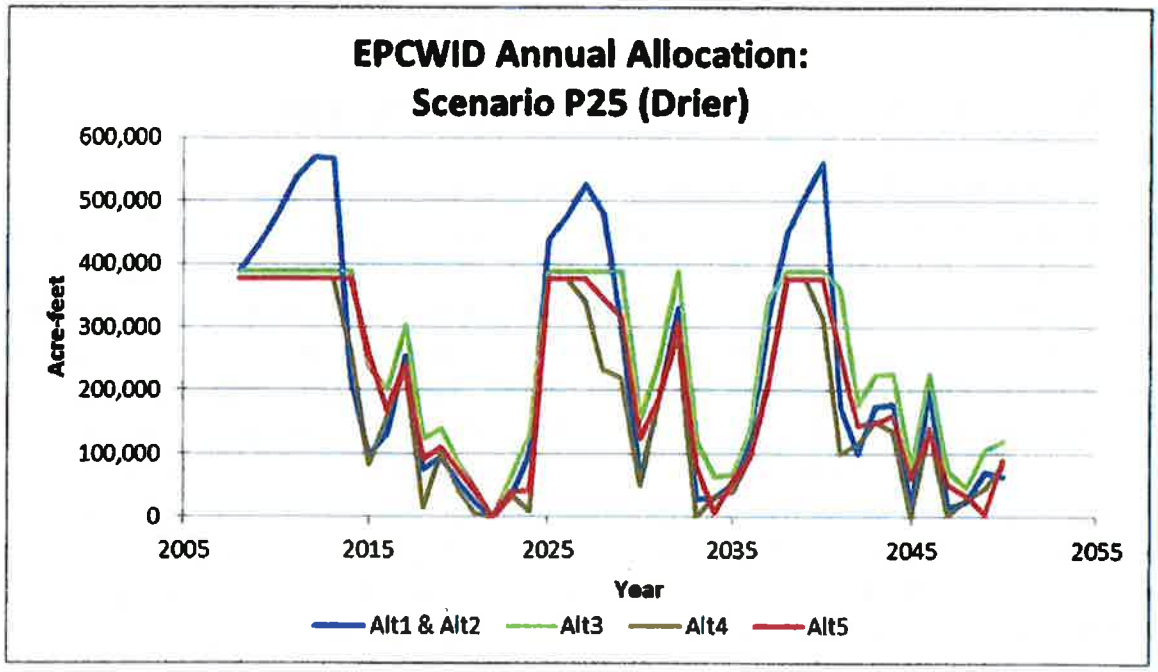
## IV. Reclamation Fails to Meet the Hard Look Standard.

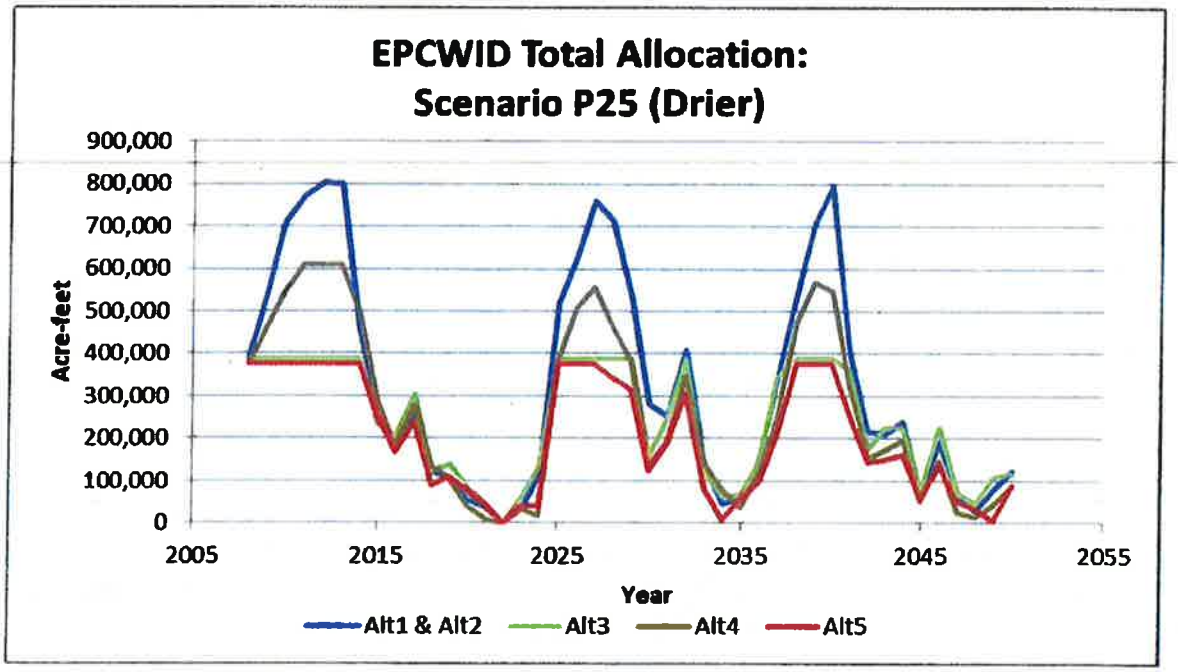
It is well established that NEPA requires federal agencies to take a "hard look" at the environmental consequences of a proposed action. *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989). The environmental impact statement serves three purposes. First, it must inform decision makers about the environmental implications of a proposed action in sufficient detail to aid in making the substantive decision of whether to proceed with the action. Second, the statement must be sufficiently detailed and available to provide the public with a meaningful disclosure of the proposed action's environmental impacts. And third, the environmental impact statement must demonstrate that a reasonable range of alternatives was developed and considered. *See generally Weinberger v. Catholic Action of Hawaii*, 454 U.S. 139 (1981). Along with all of the above comments, the items highlighted below make clear that Reclamation has not examined the 2008 Operating Agreement in sufficient detail to make an informed decision on how to proceed and has failed to provide the public with meaningful disclosure of the true impacts of the proposed action. For these reasons, the Commission requests preparation of a supplemental draft environmental impact statement.

### A. Reclamation's Modeling Outputs Contain Flaws.

19 As noted above, the Commission could not do a comprehensive review of Reclamation's hydrologic model because the information requested was not made available. That said, based on the information the Commission does have, it is clear that some of the modeling outputs in the analysis are flawed.

Allocation results from Reclamation's simulation of the 2008 Operating Agreement allocation procedures (Alt1 & Alt2 provided in Appendix A, Allocation.xlsx, with example figures shown below) show simulated annual allocations for EPCWID greater than 500,000 AF in several years. This is significantly higher than EPCWID's maximum annual allocation under the 2008 Operating Agreement (388,000 AF). (Note: Annual Allocation excludes Carryover Allocation. EPCWID's Total Allocation including Carryover is simulated to reach 800,000 acre-feet.) These results indicate that the allocation algorithm used in the modeling analysis is not correct, and therefore the evaluation process does not accurately represent the 2008 Operating Agreement procedures. Erroneous calculation of EPCWID's allocation will cause erroneous calculations of diversions, carryover, carryover transfer, etc., impacting all model results. Lacking full documentation and source codes for the SWOPS part of the model, the Commission cannot comment further concerning this issue at this time.






20 Additionally, all of the DEIS modeling scenarios assume that New Mexico will relinquish its Compact credit water in EBR if these Credits exceed 70,000 AF. The Commission disagrees with this assumption; proposing relinquishment of New Mexico Compact credit water is a decision of the New Mexico Compact Commissioner, not Reclamation. Moreover, the assumption is not reasonable given the current litigation regarding Compact credit water in EBR. Including this assumption as part of the simulated scenarios causes the model to overestimate the amount of water available to the Project, and therefore minimizes the impact of the 2008 Operating Agreement at the potential expense of New Mexican's upstream of EBR. Because the information necessary to examine the model in full was not provided, the Commission is unable to suggest methods to alleviate these flaws.

21 Finally, under Alternative 1, the total groundwater pumping under P50 conditions for the City of El Paso is 11,575 AF per year. Similar numbers are provided for the other alternatives. These numbers cannot be correct. The City of El Paso itself reports that it is using and will continue to use 25,000 AF per year from the Mesilla Bolson and Hueco Bolson. *See* http://www.epwu.org/water/water_resources.html.

**B. The DEIS Analysis Fails to Adequately Examine the Decrease in Project Supply to EBID.**

The DEIS does not give sufficient weight to the significant decrease in Project water supply to EBID demonstrated by Reclamation's 2015 technical memorandum (Appendix

C of the DEIS). What is most striking about this omission is that while the technical findings obtained in the analysis for the DEIS clearly demonstrate the reduction in

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Project water supply to EBID (Appendixes A and C of the DEIS), the text of the DEIS makes no mention of this enormous decrease. Specifically, the 2015 technical memorandum (Appendix A) demonstrates that the simulated average annual allocation to EBID under pre-OA operations (Alternative 5) was 314,327 AF, while under the 2008 Operating Agreement it was only 146,977 AF. This 167,350 AF reduction in EBID's average annual allocation is only 53% of pre-OA levels simulated in Alternative 5. Similarly, and also from Table 4-6, the average Farm Delivery of Project water to EBID farmers is simulated to change from 110,314 AF for pre-OA operations to 72,841 AF under the 2008 Operating Agreement, a reduction of 34%.

There are other modeling results from the DEIS that also show the large reduction in EBID supply caused by the 2008 Operating Agreement. Spreadsheets in Appendix A of the 2015 USBR Tech Memo No. 86-68210–2015-05 (DEIS Appendix C) ("Tech Memo") provide year-by-year model output. Data in ALLOCATION.xlsx show that EBID's Annual (or current year) allocation under the 2008 Operating Agreement (Alt1 & Alt2) is simulated to be lower than EBID's allocation under pre-OA operations (Alt 5) by very large amounts; as much as 460,000 AF, as shown in the EBID Annual Allocation graph below.[13]

The reduction of EBID's Annual Allocation is only partially mitigated by the potential benefit of carryover transfer from EPCWID, which is included in the Total Allocation shown in the graph below (Total Allocation includes both Annual Allocation and Carryover Allocation). Even this small mitigation is not guaranteed. Carryover transfer only occurs if EPCWID does not order a large part of its allocation and continues to accrue credit. If EPCWID increases its annual Project diversions above the levels assumed in the Tech Memo, then the resulting Carryover transfer would be much lower, and EBID's Total Allocation would be closer to its Annual Allocation. Note that these modeling results are in part suspect because of the questions raised in comment A (above) relating to the simulation of EPCWID's Annual Allocation. Since the model overestimates EPCWID's allocation, it is likely that the model also overestimates Carryover Allocation Transfer from EPCWID to EBID.

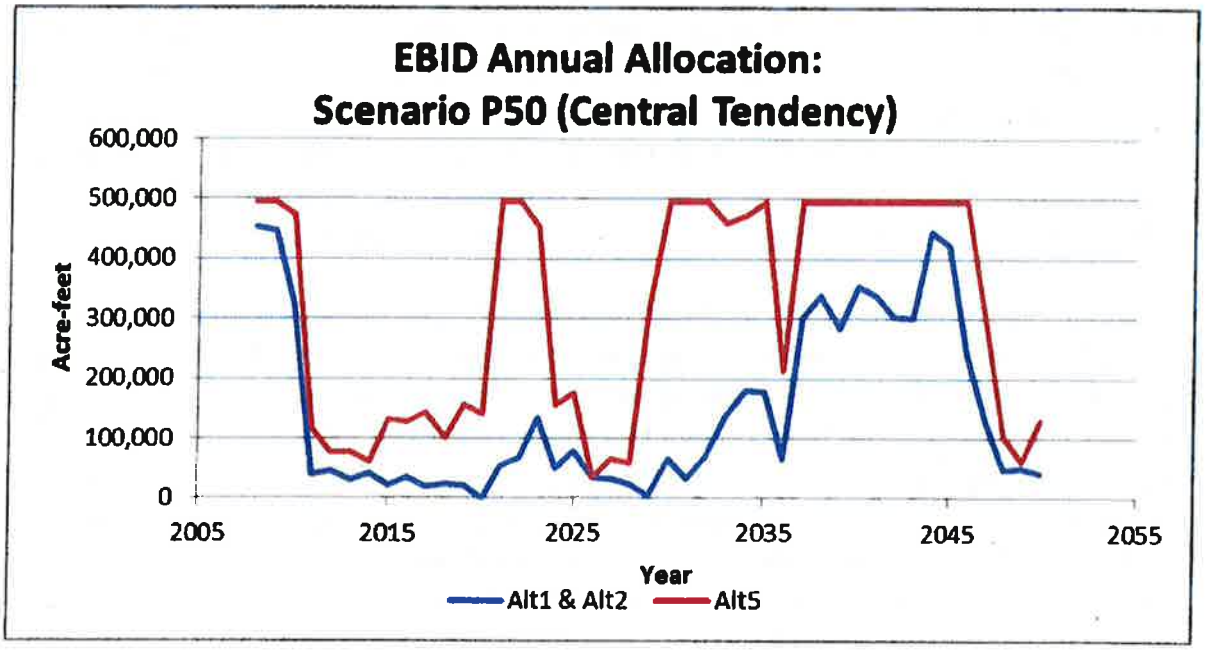
The large reductions in EBID's allocation predicted by the DEIS model are generally consistent with New Mexico's first amended complaint against Reclamation in *New Mexico v. United States*, No. 11-cv-00691-JAP-WDS (D.N.M., 2011). In Paragraph 48.b.

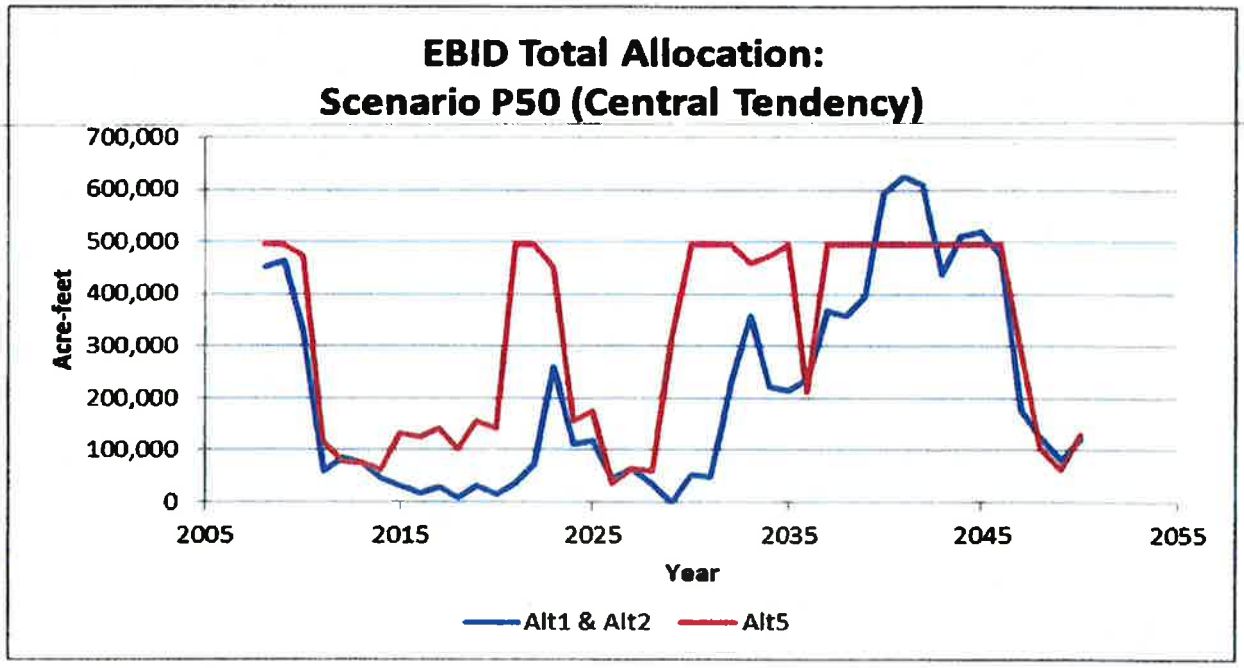
[13] The below graphs were extracted from Reclamation's Appendix A in the DEIS, ALLOCATION.xlsx, and modified for clarity by removing the curves for Alt3 and Alt4. The Summary Chart is taken directly from the DEIS without modification.

of its first amended complaint, New Mexico discusses the large decrease in EBID allocations that had already been observed at that time: *"EBID has incurred a decrease in annual Rio Grande Project allocations in the range of 149,160 up to 189,110 acre-feet, or -30.1% to -38.2% of its historical allocation. This decrease in allocation reflects operations that occurred during the past three years [2008, 2009 and 2010] as accounted by Reclamation."* Again, failing to highlight the findings of the DEIS modeling in the text is a glaring omission.

**Table 4-6. Summary of the No Action Alternative Compared with the Other Alternatives**

| | Alternative 1—No Action | Alternative 2—No San Juan–Chama Project Storage | Alternative 3—No Carryover Provision | Alternative 4—No Diversion Ratio Adjustment | Alternative 5—Prior Operating (Ad Hoc) Practices |
|---|---|---|---|---|---|
| **Section 4.4 Surface Water** | | | | | |
| Elephant Butte pool elevation (feet) | 4,318 | 4,312 | 4,314 | 4,312 | 4,313 |
| Total project storage (average annual acre-feet) | 409,453 | 409,453 | 399,510 | 371,591 | 389,109 |
| Annual allocation to EBID | 146,977 | 146,977 | 264,752 | 272,269 | 314,327 |
| Annual allocation to EPCWID | 266,327 | 266,327 | 267,973 | 207,296 | 239,317 |
| Project releases (mean annual acre-feet) | 524,597 | 524,597 | 525,808 | 531,229 | 527,421 |
| Net diversions to EBID (acre-feet) | 153,583 | 153,583 | 198,287 | 227,069 | 228,363 |
| Net diversions to EPCWID (acre-feet) | 46,703 | 46,703 | 34,805 | 29,491 | 25,543 |
| Farm surface water deliveries to EBID (acre-feet) | 72,841 | 72,841 | 94,477 | 110,782 | 110,314 |
| Farm surface water deliveries to EPCWID (acre-feet) | 15,954 | 15,954 | 15,029 | 14,964 | 13,896 |
| **Section 4.5 Groundwater** | | | | | |
| Mean monthly elevation at Rm-2 (feet) | 4,060 | 4,060 | 4,062 | 4,063 | 4,063 |
| Mean monthly elevation at Mes-6 (feet) | 3,814 | 3,814 | 3,815 | 3,816 | 3,815 |
| Groundwater storage in the Rincon and Mesilla Basins (cumulative change) | Decrease | Decrease | Decrease | Decrease | Decrease |
| **Section 4.6 Water Quality** | | | | | |
| Groundwater elevations decline seasonably during sustained dry periods but recover during wet periods | Negligible | Negligible | Negligible | Negligible | Negligible |






### C. The DEIS Groundwater Supply and Quality Analysis is flawed.

#### 1. *Groundwater Supply*

23 The DEIS downplays the impact on the shallow groundwater aquifer levels in New Mexico caused by the 2008 Operating Agreement. The DEIS hydrologic analysis suggests that under P50 and P75 climatic scenarios the aquifer will recover, however it is likely that the SWOPS modeling flaw described above (Comment A above) has led to under-estimation of the impact on the shallow groundwater aquifer. It should be noted that observed shallow ground water levels have already dropped 20 feet since the beginning of 2006, the year that Reclamation first reduced EBID's allocation by the diversion ratio method. (See Figure below: Final report to the New Mexico Legislature Interim Committee on Water and Natural Resources, by New Mexico Universities Working Group on Water Supply Vulnerabilities, August 31, 2015).

Reclamation's language in the DEIS demonstrates its bias on this issue. On page 3-12 of the DEIS, Reclamation, citing only its prior work, states "[a]nalysis based on historical measurements of groundwater elevations from monitoring wells in the RGP and surrounding areas of the Rincon and Mesilla Valleys demonstrates widespread and statistically significant negative trends in groundwater elevation from 1980 to the present. However, additional analysis of previous decades suggest that this trend is confined to the past decade, indicating that sustained groundwater pumping in excess of recharge (i.e., groundwater mining) was not prevalent in the RGP or adjacent lands

23 cont.

before the current drought (Reclamation 2013a; SEA Appendix F)." This statement fails to acknowledge the realities of water supply under the 2008 Operating Agreement and realistic, historical groundwater trends. Groundwater level trends before 2006 show a consistent historical trend: groundwater declines of 10-15 feet during drought, followed by recovery in full supply years. Since 2006 groundwater levels have shown no recovery during years of full supply to the Project (2008, 2009 and arguably 2010), followed by further decline during the following time of shortage. In short, the effect of 2 the 2008 Operating Agreement is to convert a sustainable aquifer into a mined aquifer.

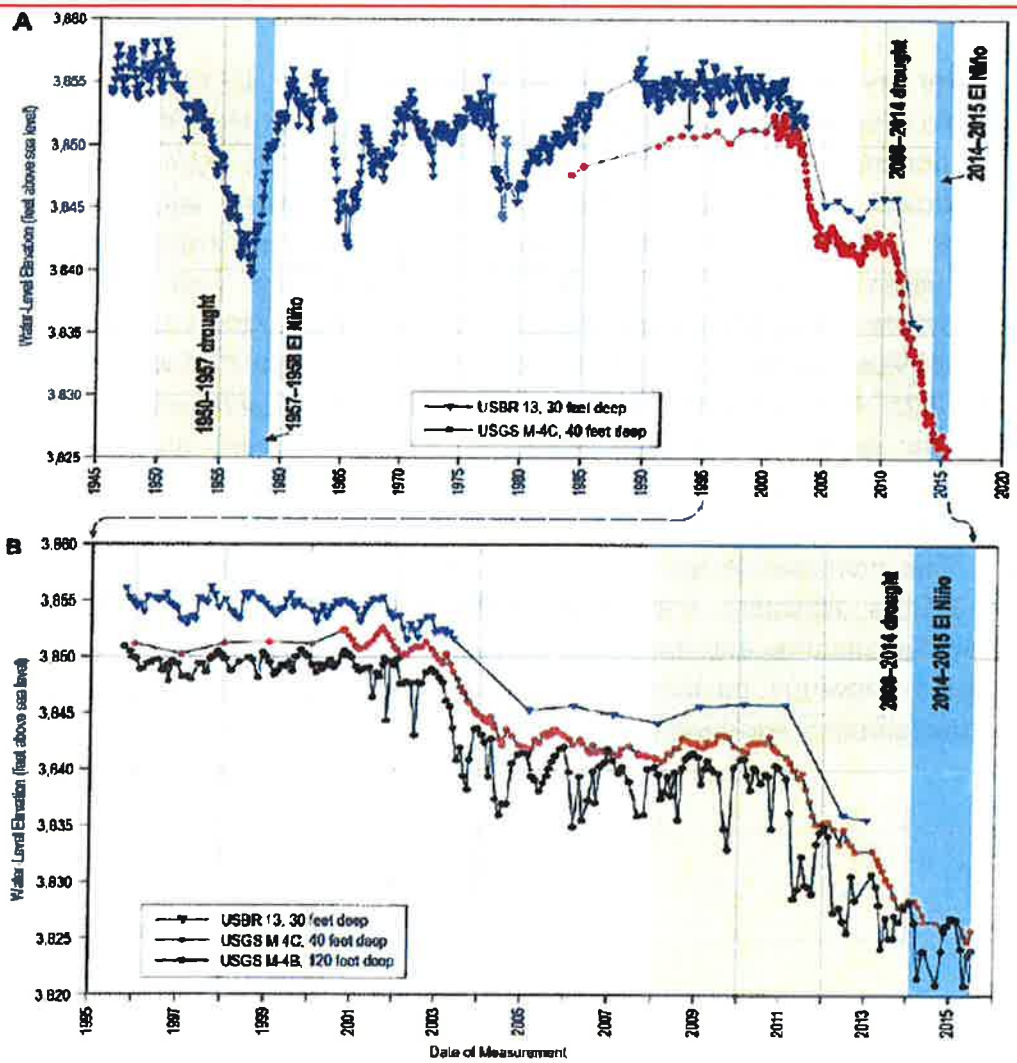
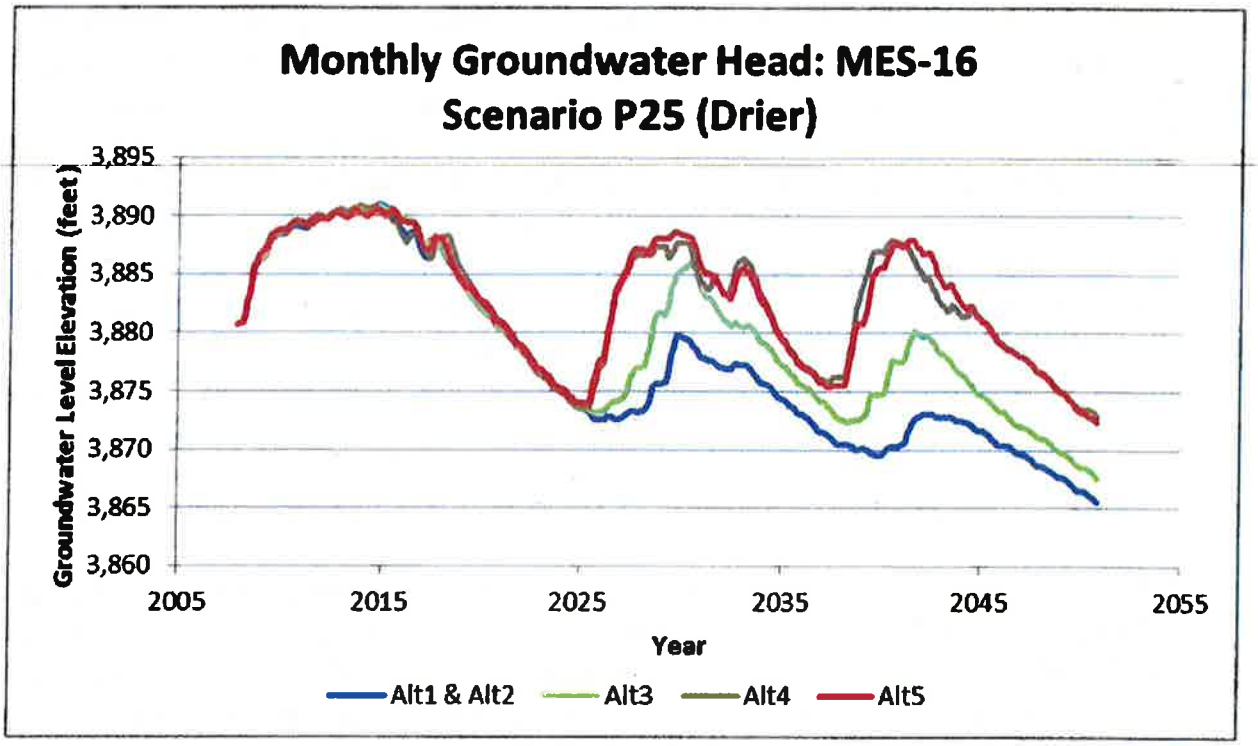



**Figure 9.** Hydrographs from wells USBR 13, M-4C, and M-4B are used to evaluate the effects of groundwater pumping and drought in the lower Mesilla Valley. A. The combined hydrograph (1946–2015) shows a 16-foot water-level decline and recovery during the 1950–1957 drought, a 16-foot water-level decline during the 2008–2014 drought, and a 7.5-foot decline between winter measurements in 2003–2005 prior to drought conditions. B. Seasonal water-level fluctuations in the 1995–2015 hydrograph for M-4B shift from a pattern of summer recharge to one of summer groundwater pumping during 2002–2003, indicating the pre-drought decline was due to groundwater pumping. The water level declined 26 feet from 2002 to June 2015and the aquifer had not yet recovered from the combined effects of pumping and drought.

24 Moreover, the DEIS modeling itself shows significant groundwater supply issues. Under the P25 climatic scenario, the DEIS shows that the groundwater levels will experience a drop of about 25 feet (Head.xlsx, Mes-16) under Alternatives 1 and 2 which will be on top of the already observed 20 foot drop since early 2006, see the figure below. This drop in the shallow groundwater levels represent a significant impact on groundwater resources in New Mexico that, just as with the lower Project supply numbers, is not mentioned in the text of the DEIS. Instead, the presentation of groundwater level results in the body of the DEIS is cursory, providing only an average groundwater level over a 40+ year period, and not discussing the actual predicted groundwater level declines.

Groundwater hydrographs found in Appendix A of the DEIS, HEAD.xlsx, show considerable drawdowns in some scenarios, drawdowns that should be added to those already experienced within EBID. Note that the P25 Scenario hydrograph for MES-16 (below) shows that for the 2008 Operating Agreement allocation alternative (Alternatives 1 and 2) the aquifer is being depleted unsustainably, i.e., drawdowns during dry years that do not recover in intervening wet years. This again is a concern that New Mexico has raised in *New Mexico v. United States*, No.11-cv-00691-JAP-WDS (D.N.M. 2011)(see Document 100-1, Filed 06/13/2012, Affidavit of Margaret Barroll: "*In effect, the 2007 OP and 2008 OA have converted a sustainable aquifer system into a mined aquifer system.*") A vicious cycle has begun, in which low apparent Project performance reduces EBID's supply (through the Diversion Ratio Allocation), thus causing complementary reductions in aquifer recharge due to increases in groundwater pumping. This increased stress on the aquifer may further impact Project performance, reducing EBID's allocation even more. While Reclamation's modeling confirms the Commission's concerns and the cycle, the DEIS fails to account for the problems in its review, again showing it has failed to truly take a hard look at the environmental effects of the 2008 Operating Agreement.[14]

[14] On Page 3-12 of the DEIS Reclamation also states that "[i]t is likely that recent groundwater declines are associated with the severe and sustained drought conditions that have affected the RGP since 2003 (Reclamation 2013a; SEA Appendix F). Again, the Commission disagrees. Based on the above analysis it is clear that these declines, while certainly enhanced by natural drought, have been compounded by reductions to EBID's allocation under the 2008 Operating Agreement.




25 Finally, in regard to groundwater supply, the DEIS does not consider any limitation or insufficiency in groundwater pumping capacity within EBID, either at present, or that may occur in the future, and instead assumes that any deficit in EBID's Project supply can, and always will be, compensated for by groundwater pumping. This is an erroneous assumption. In fact, not all EBID farmers have wells, there is an increase in cost associated to pump the wells as groundwater levels drop, and in some areas groundwater supplies are limited or groundwater quality can limit the usefulness of irrigation wells.

2. *Groundwater Quality*

26 The DEIS water quality analysis is also limited, again demonstrating that Reclamation did not conduct a meaningful review of all the environmental impacts of the 2008 Operating Agreement. Modeling did not contain information about groundwater quality or potential sources of contamination. Salinity is mentioned only briefly under existing conditions, but not evaluated under the alternatives. In particular, the DEIS does not consider the impact of the difference in quality between groundwater and surface water, specifically as it relates to farm productivity. EBID farmers have informed New Mexico that they are unable to germinate some crops with the lower quality groundwater available in their area, and other farmers report that when forced to use groundwater they are unable to grow crops of the same size and quality that they could with surface water (e.g. onion crops in the Rincon Valley). Therefore, the impact of a low surface

26 cont.

water allocation to EBID is not merely that the farmer has to pump groundwater, but also that the farmer may not be able to grow certain crops, or that the yield and quality of the crop may be reduced. This should have been included in the DEIS analysis.

Second, the DEIS did not analyze the effects on groundwater quality of EBID's large surface water allocation reductions under the 2008 Operating Agreement. Irrigation processes normally concentrate naturally occurring salts. Without sufficient Project water to flush these salts, they will remain in the soil and shallow aquifer. The DEIS has not considered how this change in groundwater quality will impact EBID farmers, or other groundwater users. In other words, the DEIS has not considered the long term effects of salinization of the Mesilla and Rincon valley aquifers, an environmental consequence of the 2008 Operating Agreement.

### D. Reclamation's Analysis of Alternative 1 Is Fundamentally Flawed.

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In its examination of Alternative 1, Reclamation fails to evaluate the full scale of what is included in the 2008 Operating Agreement. The DEIS evaluated the diversion ratio adjustment and carryover accounting provisions only. DEIS, pg. 2-3, lines 77-81. Whereas many additional changes to Project operations can occur under the 2008 Operating Agreement. For example, the 2008 Operating Agreement allows for release of both annual allocations (current year allocations) plus carryover allocation amounts for both Districts. These total allocations could amount to more than 1,400,000 AF per year. However, all DEIS model simulations limit releases from Caballo reservoir to 790,000 AF (files received from Reclamation, Notes.txt, under FMP subdirectory), significantly less than the 1,400,000 AF per year releases allowed for under the 2008 Operating Agreement. This discrepancy clearly demonstrates that the DEIS evaluation does not evaluate the full scale of operations that could occur under the 2008 Operating Agreement. Further, as has been noted above, the impacts of the 2008 Operating Agreement on water management and deliveries under the Compact have not been considered, another fundamental flaw in the analysis of Alternative 1.

### E. Reclamation Failed to Address the Operations Manual.

As discussed briefly above, the DEIS completely ignores the Project Operations Manual. The Operations Manual does more than merely implement the 2008 Operating Agreement; Reclamation has unilaterally imposed material changes in the operation of the Project through modifications to the Operations Manual that have adversely affected the deliveries to New Mexico and created a false assessment of the Project's water allocations and environmental impacts. For example, a "drought factor" was added to the Operations Manual in May 2012 to reduce the D2 allocation in multiple drought years. Other changes to the Manual are listed in Attachment F. These changes were not analyzed in prior environmental analyses and have not been analyzed in the DEIS.

Material changes to the Operations Manual should be evaluated under NEPA whether or not there is a corresponding formal change to the 2008 Operating Agreement. *See Kunaknana v. U.S. Army Corps of Eng'rs*, 23 F. Supp. 3d 1063 (D. Alaska 2014) (rejecting agency's argument that an supplemental environmental impact statement ("SEIS") was unnecessary where a modified project was "conceptually similar" to the original project; relocation of a well pad to a new site over a mile away, a 50% increase in the number of wells, and a new road alignment and bridge crossing were substantial changes requiring preparation of an SEIS). Thus, by not conducting this analysis here, Reclamation has again failed at taking a hard look at the environmental impacts in the DEIS.

28 Of greatest concern is that in addition to the changes already implemented through the Operations Manual, there is no known preclusion or bar to implementing more changes in the future.[15] For example, all of the following may be changed based on amendments to the Operations Manual: delivery points to EBID, EPCWID and Mexico; flood water diversions; accounting and charges procedures, including how credits are estimated; shortage sharing procedures; and, the end-date of the allocation process. The DEIS does not contain any analysis of these issues. The Council on Environmental Quality's NEPA implementation regulations require preparation of a SEIS if (1) "[t]he agency makes substantial changes in the proposed action relevant to environmental concerns" or (2) "[t]here are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts." 40 C.F.R. § 1502.9(c)(1). A change is substantial where it "presents a seriously different picture of the environmental impact" of the action. *In re Operation of Mo. River Sys. Litig.*, 516 F.3d 688, 693 (8th Cir. 2008). The Circuit Courts have considered whether the modification (1) affects a primary or secondary aspect of the proposed project, (2) is major or minor in scope, and (3) will have environmental impacts that the agency has not yet considered. *See, e.g., Russell Country Sportsmen v. U.S. Forest Serv.*, 668 F.3d 1037, 1048-49 (9th Cir. 2011). The Commission asserts that Reclamation has failed to analyze any of the impacts of the Operations Manual and a supplemental draft environmental impact statement is required.

[15] An additional concern is that the Operations Manual can be changed simply by agreement of the three parties to the 2008 Operating Agreement: Reclamation, EBID and EPCWID. Because any change under the Operations Manual necessarily involves a federal action, in principle each substantive change would require an analysis under NEPA, however none of the changes to date received this analysis until they were incorporated into the DEIS, which then carried out an incomplete analysis of those changes. The DEIS should explicitly recognize the possibility that changes have occurred, determine whether there were environmental impacts, discuss what future changes may be likely, and set a framework for the types of changes that require additional NEPA analysis and those that will not. Additionally, the Commission continues to raise concerns that the non-public meetings of these three entities to change the Operations Manual along with the process to amend the Manual violate the Federal Advisory Committee Act. 5 U.S.C. Appendix – Federal Advisory Committee Act; 86 Stat. 770, as amended.

### F. Reclamation's ESA Analysis is Flawed

Federal agencies should prepare "draft environmental impact statements concurrently with and integrated with environmental impact analyses. . .required by. . . the Endangered Species Act [ESA]." 40 C.F.R. § 1502.25. Here on November 18, 2015 a Biological Assessment ("BA") was submitted by Reclamation to the United States Fish and Wildlife Service (the "Service") to describe the proposed action and determine whether it "may affect" listed species or critical habitat in a manner justifying the initiation of formal ESA Section 7 consultation. The Service's Biological Opinion ("BO") is the concluding document for the ESA Section 7 consultation, and Reclamation is charged with considering the information in the BO as part of making its final decision. Unfortunately, the majority of the Commission's comments in this letter regarding the Section 7 consultation are related to the BA. That's because the BA is the only document the Commission had available to review regarding the consultation until the BO was made public on June 3, 2016, four business days before the close of the comment period for the DEIS.

The Commission repeatedly requested a copy of the BO starting on March 31, 2016. *See* Attachment G. In fact, the Commission requested the BO five times through Reclamation's official communications channel described in the notice federal register notice of availability. *See* Attachments B, G, and H. To date, the Commission has received no official administrative record communication from Reclamation notifying it of the public availability of the BO. And, while the BO is now on the Service's website, as of June 3, 2016, Reclamation has not updated its own website to notify the public of its availability.

Withholding the BO until this late date contradicted Reclamation's statements to the public regarding the BO. The notice of availability published March 18, 2016 stated that the BO was available at a listed URL address. However, contrary to the published notice of availability, the BO was not available on the listed website or through any other means. It did not become available until the date listed above, over two months after the notice of availability was published.

That said, the Commission has endeavored to comment on the BO as part of this letter. While the Commission has done its best in this short time frame, we reserve the right to supplement these comments if the Commission determines additional comments on the BO are warranted. The Commission will submit these additional comments by July 5, 2016, a reasonable period of time.

The most striking issue with the BO is the action area listed in the document. Under the ESA, the "action area" for the analysis of effects must address "all areas affected

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# NEW MEXICO INTERSTATE STREAM COMMISSION

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June 8, 2016

U.S. Bureau of Reclamation
Attn: Nancy Coulam
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**Submitted Via Email to: ncoulam@usbr.gov**

**RE: New Mexico Interstate Stream Commission's Comments on the Draft Environmental Impact Statement for the Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project, New Mexico and Texas**

Dear Ms. Coulam:

The New Mexico Interstate Stream Commission (the "Commission") submits the following comments on the draft environmental impact statement ("DEIS") for the continued implementation of the 2008 Operating Agreement for the Rio Grande Project, New Mexico and Texas (the "2008 Operating Agreement"). The notice of availability and announcement of public hearings was published in the Federal Register, 81 Fed. Reg. 14886 on March 18, 2016. The comment period was subsequently extended to June 8, 2016. 81 Fed. Reg. 27173 (May 5, 2016).

The 2008 Operating Agreement has had, and will continue to have, major effects on water users in New Mexico. The 2008 Operating Agreement also has implications for the Rio Grande Compact between Colorado, Texas and New Mexico. Therefore, the Commission has a vital interest in the DEIS for the 2008 Operating Agreement.

We hope the Commission's review of the document, and our comments contained herein, can aid the Bureau of Reclamation ("Reclamation") as it works to incorporate additional information in and corrections to the National Environmental Policy Act ("NEPA") documents for the 2008 Operating Agreement so they are completed in the spirit of full disclosure and support informed decision making. That said, for the reasons stated below, the Commission has fundamental objections to the DEIS. Due to the DEIS's inadequate analysis, a supplemental draft environmental impact statement should be prepared for public review and comment. If Reclamation does not prepare a

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supplemental draft environmental impact statement, it should at least provide the information and analysis requested by the Commission in this document and reopen the comment period for a reasonable time thereafter to allow for true meaningful review of the DEIS.

## I. Reclamation has Predetermined the Outcome of its NEPA Analysis

"Compliance with NEPA does not . . . justify a predetermined action. The NEPA process is intended to identify and evaluate alternatives in an impartial manner." Reclamation NEPA Handbook (DOI 2012) § 2.3.2, at 2-3. "An agency shall commence preparation of an environmental impact statement as close as possible to the time the agency is developing or is presented with a proposal so that preparation can be completed in time for the final statement to be included in any recommendation or report on the proposal. The statement shall be prepared early enough so that it can serve practically as an important contribution to the decision making process and will not be used to rationalize or justify decisions already made." 40 C.F.R. § 1502.5 (Council on Environmental Quality [CEQ] NEPA Regulations).

Reclamation cannot actually commit to a decision prior to completing its NEPA analysis and then use that analysis to "justify a predetermined action." Reclamation NEPA Handbook § 2.3.2, at 2-3. Instead, it must "identify and evaluate alternatives in an impartial manner." *Id.* Reclamation has not identified and evaluated alternatives in an impartial manner in the DEIS, but instead uses the analysis therein to justify a decision it made long ago to adopt the 2008 Operating Agreement.

The language of the DEIS purports to suggest that Reclamation has not predetermined the outcome. For instance, despite the CEQ NEPA Regulations recommendation that the agency identify a preferred alternative in the draft, if one exists, 40 C.F.R. § 1502.14(e), Reclamation does not indicate a preferred alternative in the DEIS. In choosing to not include a preferred alternative, Reclamation attempts to indicate that it has not fully made up its mind. Reclamation also frames the decision analyzed as whether to continue the 2008 Operating Agreement, again suggesting that it is truly examining this question.

Despite this language, upon in-depth review of the DEIS it becomes clear that Reclamation is attempting to paint a false portrait of the analysis undertaken in the document. The DEIS itself acknowledges that the purpose and need for the action is "to meet contractual obligations to EBID [Elephant Butte Irrigation District] and EPCWID [El Paso County Water Improvement District No. 1]." DEIS at ES-5, 1-12. These contractual obligations are in the 2008 Compromise and Settlement Agreement ("2008 Settlement") and the 2008 Operating Agreement. DEIS at ES-5, 1-7, 1-12. The former agreement

binds the parties to the terms and conditions in the 2008 Operating Agreement, and the 2008 Operating Agreement itself was executed by the parties on March 10, 2008. DEIS, App. A. The DEIS does not hide this fact, stating that "implementation of the OA is the result of settlement of litigation between Reclamation and the districts." *Id.* at 1-9. Reclamation clearly committed to a predetermined outcome by executing the 2008 Settlement and then implementing the 2008 Operating Agreement prior to completing its NEPA analysis, and it cannot justify or remedy that fact in the Draft EIS. *See, e.g., Metcalf v. Daley*, 214 F.3d 1135, 1144-45 (9th Cir. 2000) (holding that the federal agency involved violated NEPA when it irreversibly and irretrievably committed resources by entering into a contract before considering that contract's environmental consequences); *see also* 40 CFR § 1506.1 (stating that until a record of decision is issued, no action on the proposal shall be taken that would have an adverse environmental effect or limit the choice of reasonable alternatives).

This is further reflected in the alternatives that Reclamation examines in the DEIS. Alternatives 1 and 2 simply continue the 2008 Operating Agreement in accordance with the current manual while Alternatives 3 and 4 simply remove one major new feature of the 2008 Operating Agreement each. With the exception of Alternative 5, all alternatives involve continued implementation of the 2008 Operating Agreement in some form. DEIS at ES-7. This is because the 2008 Settlement and 2008 Operating Agreement bind Reclamation to implementation of the carryover storage and diversion ratio provisions through 2050. DEIS, App. A § 1.8, at 2 (carryover storage); § 2.5, at 5 (diversion ratio). The DEIS acknowledges that implementing Alternative 5 "would . . . breach the settlement agreement among the U.S., EBID, and EPCWID." DEIS at 2-6.

2 In short, because Reclamation executed a binding contract requiring implementation of the 2008 Operating Agreement prior to conducting a NEPA analysis it irretrievably and irreversibly committed itself to that decision. Reclamation's own handbook specifically counsels against this type of action, stating, "NEPA also requires that environmental concerns and impacts be considered during *planning* and *decision making* so steps may be more easily taken to correct or mitigate the impacts of an action." Reclamation NEPA Handbook § 2.3.1, at 2-2 (emphasis added). This is true for water contract negotiations just as with any other Reclamation Project. "At the very beginning of the contracting process . . . Reclamation should engage the NEPA process and include the consideration of environmental factors into development of a B[asis] O[f] N[egotiation]." *Id.* at § 4.12.2, at 4-9. Reclamation failed in this task by rushing into the 2008 Settlement and 2008 Operating Agreement. Reclamation tries to remedy its lack of planning by now claiming in the DEIS that the "decision to be made" is "whether to continue to implement the OA through 2050," yet it is clear that decision has already been made. This is a fundamental flaw in the DEIS and in Reclamation's NEPA process.

## II. The DEIS Fails to Adequately Examine the Full Range of Alternatives

The alternatives analysis "is the heart of the environmental impact statement." 40 C.F.R. § 1502.14. An agency must select and discuss a range of alternatives that "fosters informed decision making and informed public participation." *California v. Block*, 690 F.2d 753, 767 (9th Cir. 1982). It is contrary to the purpose of NEPA to fail to examine a range of alternatives, focusing rather on extremes or "straw man" alternatives that lead to a pre-ordained selection. *See Natural Resources Defense Council, Inc. v. Evans*, 232 F.Supp.2d 1003, 1038-41 (N.D. Cal. 2002). For the reasons discussed below, Reclamation has not demonstrated that it has analyzed a full range of alternatives, thereby failing to allow for informed decision making and public participation in regard to the 2008 Operating Agreement. The Commission requests that the DEIS be revised to include detailed consideration of additional alternatives as Reclamation continues its analysis.

### A. The Purpose and Need Statement in the DEIS is defined so narrowly as to preclude the consideration of a reasonable range of alternatives.

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An environmental impact statement must contain a statement that specifies the underlying purpose and need to which the agency is responding. 40 C.F.R. § 1502.13; Reclamation NEPA Handbook § 8.5, at 8-5. The purpose and need statement "is a critical element that sets the overall direction of the process and serves as an important screening criterion for determining which alternatives are reasonable." Reclamation NEPA Handbook § 8.5, at 8-5. Courts have long recognized that an agency may not define the purpose of and need for an action in unreasonably narrow terms because that will unduly constrain the range of alternatives considered in an environmental impact statement. *See, e.g., Simmons v. U.S. Army Corps of Engineers*, 120 F.3d 664 (7th Cir. 1997) (stating that "[o]ne obvious way for an agency to slip past the strictures of NEPA is to contrive a purpose so slender as to define competing 'reasonable alternatives' out of consideration…."). "If a purpose and need statement appears to allow only one reasonable solution, the statement, as well as the reasons for rejecting other alternatives, should be re-examined and confirmed or revised, as appropriate." Reclamation NEPA Handbook § 8.5, at 8-6.

The purpose and need statement in the DEIS is "to meet contractual obligations to EBID and EPCWID and comply with applicable law governing water allocation, delivery, and accounting." DEIS at ES-5, 1-12. The contractual obligations are the 2008 Settlement and the 2008 Operating Agreement, as the DEIS acknowledges. DEIS at ES-5, 1-7, 1-12. The DEIS specifically states that "implementation of the OA is the result of settlement of litigation between Reclamation and the districts." DEIS at 1-9.

3 cont. Defining the purpose and need as meeting prior contractual obligations to EBID and EPCWID artificially and unreasonably constrains the analysis in the DEIS by constraining the options available for examination to those that allow for "continued implementation through 2050 of the operating procedures defined in the OA and RGP [Rio Grande Project] operations manual." DEIS at ES-7. And, the only alternatives that satisfy the purpose and need of "meet[ing] contractual obligations to EBID and EPCWID" are Alternatives 1 and 2. Both of these alternatives involve continued implementation of the 2008 Operating Agreement in accordance with its terms. DEIS at ES-7, 2-3. The only difference between them is that Alternative 2 does not involve the storage of San Juan-Chama Project water in Elephant Butte Reservoir. DEIS at ES-7, 2-3. This is not a meaningful difference and demonstrates that Reclamation, contrary to its own NEPA Handbook, has artificially constrained the purpose and need statement as to allow for "only one reasonable solution"— continued implementation of the 2008 Operating Agreement. Reclamation must revise the purpose and need statement in the DEIS to allow for analysis of a meaningful range of alternatives, such as those addressed below in Section II.C.

### B. Reclamation Improperly Defined the No-Action Alternative.

4 The CEQ's NEPA regulations require agencies to consider "the alternative of no action" in every environmental impact statement. 40 C.F.R. § 1502.14(d). When Reclamation is considering adopting a new contract, the no action alternative "represents conditions as they would be with no contract." Reclamation NEPA Handbook § 4.12.2, at 4-9. Only when Reclamation is considering renewing a contract should the no-action alternative mean "continuing the existing contract." *Id.* § 4.12.2, at 4-9. Reclamation's 2007 Environmental Assessment,[1] although it was prepared to analyze adhoc changes to Project operations rather than the 2008 Operating Agreement, properly stated that, under the no-action alternative, "the Rio Grande Project would continue to operate under Reclamation's previously imposed operation procedures as it has for more than 20 years." 2007 Environmental Assessment at 6. The 2013 Supplemental Environmental Assessment,[2] which did address the 2008 Operating Agreement, also properly stated the no-action alternative "would continue Project operations according to pre-OA conditions." Reclamation's analysis in 2013 examined pre-Operating Agreement ("pre-OA") conditions even though it was prepared five years after adoption of the 2008 Operating Agreement, because it was intended to analyze the environmental effects of

[1] In 2007 Reclamation issued an Environmental Assessment and Finding of No Significant Impact for a set of operating procedures that constituted a material departure from historic operations. Its focus was a five-year period, but the procedures were superseded by the 2008 Operating Agreement without additional NEPA review.

[2] In 2013 a Supplemental Environmental Assessment and Finding of No Significant Impact was issued for continued implementation of the 2008 Operating Agreement for the three-year period 2013-2015.

4 cont. a new contract—the 2008 Operating Agreement. 2013 Supplemental Environmental Assessment at 10.

However, in the DEIS Reclamation has dramatically shifted its position and improperly characterized its no-action alternative as "continued implementation through 2050 of the operating procedures defined in the OA and RGP Operations Manual." DEIS at ES-7. Because Reclamation is still analyzing the effects of entering into the 2008 Operating Agreement, not renewing it, it is improper and logically inconsistent for Reclamation to assume the existence of this very action as part of the no-action baseline. It is also misleading to the public regarding the nature of the proposed action and its environmental impacts. Reclamation should revise the DEIS to include operation of the Project according to pre-OA conditions as its no-action alternative so that it can properly compare the environmental impacts of the 2008 Operating Agreement to true baseline conditions.

### C. Reclamation Failed to Fully Consider Feasible Alternatives

Federal agencies must "[r]igorously explore and objectively evaluate all reasonable alternatives." 40 C.F.R. § 1502.14(a). While the range of alternatives must be reasonable and feasible, Reclamation should "include alternatives based upon input from other agencies, the public at large and local community interests. If one or more community alternative(s) exist, and it is feasible and practical, it should be included in the EIS." Reclamation NEPA Handbook § 8.6.2, at 8-9. When Reclamation limits the range of alternatives, "the criteria used to limit the alternatives should be explicitly defined by Reclamation and logically supported." *Id.*

Section 2.5 of the DEIS describes alternatives considered but eliminated from detailed study. Analysis of this Section indicates Reclamation's continued failure to comply with its own NEPA Handbook. Reclamation fails to examine several alternatives that are reasonable and feasible and were suggested by the Commission in the scoping 5 process.[3] Moreover, Reclamation eliminates several reasonable alternatives arbitrarily and without any suggested criteria for doing so. Reclamation should reconsider its decision to eliminate the following alternatives in a supplemental draft environmental impact statement. The Commission also suggests ways to expand on the alternatives analysis, including additional alternatives.

Prior to delving into the Commission's analysis of the DEIS alternatives, it is important to note that on April 7, 2016 the Commission requested additional information regarding the hydrologic modeling used in the DEIS analysis. See Attachment B, (April 7, 2015

[3] See Attachment A, (February 14, 2014 letter from the Commission to Reclamation).

letter from the Commission to Reclamation). The Commission asked for specific data files, source code, and documentation for Model Enhancements, Model Calibration, Model Sensitivity Analyses, GIS Files, and Hydrologic Inputs to the Model.[4] Reclamation performed hydrologic analysis of the Rincon and Mesilla basins using the United State Geologic Survey ("USGS") groundwater flow modeling software MODFLOW-OWHM (Hanson et al., 2014), with additional software features developed and implemented by Reclamation in collaboration with the USGS. This additional software is used to simulate the surface and ground water operations for the area of the Project analyzed by Reclamation for each of the DEIS alternatives. To fully analyze simulated Project operations, we must have access to the new software code, its documentation and full information on its linkage to MODFLOW-OWHM. Absent this information, the Commission is not able to fully evaluate whether proposed alternatives correctly simulate the full scale of the operations under the 2008 Operating Agreement, and operations prior to the Agreement. Accordingly, the Commission's analysis of the modeling scenarios is limited to the model outputs received from Reclamation.

1. *Removing Credits and Charges and Using Actual Deliveries of Water in Accounting*

The system of credits and charges is a significant aspect of the Project water accounting under the 2008 Operating Agreement, and is therefore explicitly within the scope of the DEIS analysis. However, the alternative described in the DEIS is poorly framed as an all or nothing proposition; Reclamation states that examining such credits and charges did not meet the purpose and need and is outside the scope. The Commission disagrees. The credits and charges could and should be evaluated for potential revision or refinement to the 2008 Operating Agreement, an easy alternative to examine in the DEIS. Moreover, adjustments to some of these credits and charges to reflect actual deliveries would make the accounting of Project water use by EBID and EPCWID more reasonable and more equitable under the 2008 Operating Agreement.

5 cont. To adequately address this alternative, the Commission recommends that the system of charges and credits in the 2008 Operating Agreement and the Rio Grande Project Operations Manual ("Operations Manual")[5] be evaluated by considering whether or not the associated operations are reflected in the data used to develop the D1 and D2

[4] The Commission has actually been requesting specific information on the modeling tools used to conduct the analysis in the DEIS since the scoping period, but Reclamation has continued to withhold this information. See Attachment A, at 3-4 (Commission's Comments on Scoping).

[5] The Operations Manual is a companion document that is intricately tied to the 2008 Operating Agreement. The Operations Manual is further discussed in Section IV.E., below.

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curves.[6] For example, data behind the D2 regression analysis is not well documented, but appears to be based on annual total canal heading diversions from 1951 – 1978. This historical diversion data would not include the same credit and charge system that the Project employs today, and therefore there is a systematic difference between the "diversions" of the D2 data set and the "charged diversions" that calculate today's diversion ratio. The effects of this systematic difference should be evaluated, especially given the fact that the 2008 Operating Agreement charges EBID for all discrepancy from the D2 curve. By simply eliminating this proposed alternative from analysis in the DEIS, Reclamation is ignoring a reasonable adjustment to the 2008 Operating Agreement and failing to "[r]igorously explore and objectively evaluate all reasonable alternatives." 40 C.F.R. § 1502.14(a).

The inequitable effect of the current application of credits and charges under the 2008 Operating Agreement is easily demonstrable. The diversion data from which the D2 curve was derived include diversions made by EPCWID in winter months. Current accounting no longer includes off-season diversion, and the resulting discrepancy is charged to EBID. The D2 diversion data includes drain flows diverted into the EPCWID canal system. Such diversion of drain flows either no longer occurs or is no longer accounted for, and the resulting discrepancy is charged to EBID. Furthermore, the 2008 Operating Agreement awards EPCWID the American Canal Extension credit, which in theory accounts for delivery efficiency improvements in the El Paso Valley. It is unclear how this credit is applied, but as described in the 2008 Operating Agreement, this credit causes an equal reduction in EBID's allocation.

In general, credits tend to reduce charged diversion below actual diversions, and tend to reduce the diversion ratio. Under the 2008 Operating Agreement, reductions to the diversion ratio result in reductions to EBID's allocation. In addition, credits that EPCWID receives at the end of the year, or in excess of the district's needs, go directly into the EPCWID's carryover account. The carryover account, plus additional water designated to ensure delivery of the carryover water, is sequestered early in the following year's allocation process, leaving less water available for current year allocation, thus reducing EBID's potential allocation.

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[6] The D1 curve is a linear regression of annual Project release data and Project delivery data, using data on delivery to U.S. farms, and to Mexico at Acequia Madre, from 1951-1978.The purpose of the D1 curve was to estimate the delivery shortage based on the amount of Project water available for release from Caballo Dam, which was in turn used to determine the Mexican Allocation. The D2 curve is a linear regression of annual Project release data and total canal diversion data for the same period of time. The purpose of the D2 curve was to determine the amount of water to be allocated for diversion at canal headings in New Mexico, Texas and Mexico, based on the amount of Project water available for release from Caballo Dam. To the best of the Commission's knowledge, Reclamation has accepted the curves as definitive determinations of historical system performance, but the Commission is unaware of a detailed analysis supporting the determination.

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a. *Additional Alternative*

An important feature that should be simulated as part of an alternative is a modified allocation procedure that assigns deficits in Project performance equitably between EBID and EPCWID, instead of assigning them all to EBID as the current allocation procedure does. The Commission suggests the following alternative process be conducted in a supplemental draft environmental impact statement:

(1) Determination of the factors that cause discrepancy between current Project performance, as measured by the diversion ratio, and historic Project performance, as reflected by the D2 curve;

(2) Quantification of D2 discrepancy effects, i.e., the quantification of the effect of these factors on current Project performance relative to historical Project performance;

(3) Equitable assignment of these D2 discrepancy effects between EBID and EPCWID based on the causes of the factors; and

(4) Revision of the allocation procedure so that both EBID and EPCWID are allocated their D2 shares, reduced by the equitable assignment of D2 discrepancy effects.

Specific factors that need analysis under this proposed alternative include:

(1) Accounting Artifacts: factors present in current accounting have caused systematic differences between the net allocation charges currently used in determining Project performance and the diversions used to determine historical Project performance;

(2) Groundwater pumping and/or increased depletions: changes in groundwater pumping, depletion, and irrigation practices that have impacted all historical sources of Project Supply in the Rincon, Mesilla and Hueco basins; and

(3) Credits: Allocation or accounting terms which increase the total amount that one District can divert but may have negative impacts on the allocation of the other District (such negative impacts are most likely to impact EBID under the diversion ratio allocation).

2. *Change Carryover Accounting to Reflect Actual Conservation*

6 The Carryover Accounting provision of the 2008 Operating Agreement was not adequately analyzed in the DEIS, or Reclamation's earlier NEPA efforts, to determine its full impact on Project operations. As summarized in Section 4.4.7 of the DEIS, the

carryover provision of the 2008 Operating Agreement is projected to result in the following average annual impacts on EBID (P50 Scenario):

6 cont.

| EBID Supply | Alternative 3 (No Carryover Accounting) | Alternative 1 (2008 OA) | Impact of Carryover Accounting | % Impact of Carryover Accounting |
|---|---|---|---|---|
| Total Allocation | 264,752 | 213,053 | -51,699 | -19.5% |
| Net Diversions | 198,287 | 153,583 | -44,704 | -22.6% |
| Farm Deliveries | 94,477 | 72,841 | -21,636 | -22.5% |

The simulated impact of carryover accounting on the estimated Project water allocation, diversions, and deliveries to EBID shown in the above table is substantial. The Commission requests, as it did during the scoping process for the DEIS,[7] a full evaluation of the carryover accounting practices under the 2008 Operating Agreement. The DEIS only analyzed complete removal of the carryover provision. DEIS, Section 2.3, at 2-3. While changes in the Project authorization may be needed, adjusting the carryover accounting provisions in the 2008 Operating Agreement is a reasonable alternative that should have been considered in the DEIS to address the current inequities of the 2008 Operating Agreement for EBID and its farmers, as well as to provide EPCWID a savings account for use in very dry years. The following outlines the evaluation the Commission believes is warranted in a supplemental draft environmental impact statement.

Under the 2008 Operating Agreement, unused allocation is accounted for as carryover in Project storage whether or not this water is physically available in the Project reservoirs at the end of the year (i.e., "paper carryover"). In the following year, these paper carryover accounts are filled first with the available physical supply in the reservoir and inflow to the reservoir. To the extent that paper carryover needs to be filled with wet water during a calendar year, this reduces the annual allocation of Project water in the current year to both districts and to Mexico.

The adverse impacts of the carryover accounting on Project water allocations to Project supply are magnified by the diversion ratio adjustment portion of the 2008 Operating Agreement. The actual diversion ratio varies from year to year depending on hydrologic conditions, pumping, irrigation efficiencies, irrigation return flows, and other factors. The

[7] Attachment A, at 6.

magnified impact occurs when a district calls for delivery of water in a year with a lower diversion ratio than the year in which the water was saved. For example, if EPCWID calls for delivery of 100,000 acre-feet ("AF") of water in a year with a diversion ratio of 1.0, then 100,000 AF must be released from storage to make that delivery. If EPCWID instead carries that water over in storage because its demand was presumably fulfilled with less water in a "wet" year and calls for its delivery in a subsequent year under dry hydrologic conditions with a diversion ratio of 0.7, then 142,800 AF would have to be released in order to deliver 100,000 AF to EPCWID. This increased release would reduce the annual allocation to EBID in the current year and/or subsequent years and inappropriately shifts the equitable management of Project water during periods of dry or drought conditions, when the value of water for crop irrigation is acute.

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A related factor is the absence of any charge or reduction for evaporation on carryover allocations under the Operating Agreement. Because no evaporation is charged to the carryover, water that would otherwise be available for annual allocation to the Districts and Mexico is instead required to satisfy evaporative losses that are not reflected in the unreduced carryover amount. This practice is contradictory to standard reservoir accounting practices, including those employed by Reclamation in other Projects, in which each account or "pool" of water held in storage is assigned its proportional share of evaporation.

In practice, EPCWID has been the main beneficiary of carryover because in full-supply years EPCWID is allocated more water than it needs. In several years EPCWID's carryover account exceeded 200,000 acre-feet, while EBID has never carried over more than 40,000 acre-feet. Thus the benefits associated with the diversion ratio adjustment to carryover, and evaporation-free carryover, predominantly accrue to EPCWID to the detriment of EBID.

The impact of these aspects of the carryover accounting on the Project water allocation and Project water diversions to EBID should have been analyzed as part of the DEIS. Adjusting the following in the accounting procedures is a feasible alternative to continuing to implement the 2008 Operating Agreement as is: (1) water available for annual allocation; (2) evaporation; (3) paper accounting credits; and, (4) the diversion ratio. Failing to consider modifications to the accounting violates Reclamation's obligation to examine all reasonable and feasible alternatives. A supplemental draft environmental impact statement should be prepared including analysis of alternative formulations of the carryover storage provision of the 2008 Operating Agreement that reduce or eliminate the current negative effects of the carryover storage on EBID.

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### 3. *Changes in Drought Factor and Evaporation Calculations*

For reasons further described in Section IV.E. below, failing to examine changes to the Operations Manual is a fundamental flaw in the DEIS. In regard to the alternatives analysis, dismissing review of changes in the drought factor and evaporation calculations again demonstrates Reclamation's failure to analyze all reasonable alternatives.

The Operations Manual does more than merely implement the 2008 Operating Agreement. Again, as discussed in depth below, modifications to the Operations Manual have resulted in material changes in the operation of the Project. For example, a "drought factor" was added to the Operations Manual in May 2012 to reduce the D2 allocation in multiple drought years. This type of large scale change to Project operations should be analyzed in this NEPA process. The Operations Manual is intricately tied to the 2008 Operating Agreement. Accordingly, material changes to the Operations Manual should be evaluated under NEPA whether or not there is a corresponding formal change to the OA. Without conducting this analysis Reclamation has failed to examine the full range of alternatives.

### 4. *San Juan - Chama Storage Contract Options*

9

The Commission does not agree that adequate analysis was conducted under Alternative 2 in regard to the San Juan - Chama Storage Contract Options or for San Juan Chama water, in general. The storage of San Juan - Chama Project water was analyzed by adding the lesser of 50,000 AF to Project Storage or the unused space available in storage to the Rincon Mesilla Basin Hydrologic Model results. There was no simulated delivery to or use of the San Juan - Chama water from storage in Elephant Butte Reservoir ("EBR"), nor was evaporation charged to the San Juan – Chama water from storage as required by San Juan - Chama accounting. Because the analysis procedure was so simplified, the results do not reasonably represent the effect of storage of San Juan - Chama water on the operation of the Project, especially during times of drought. Because EBR does not have an authorized minimum pool, water levels were historically and can currently be drawn down to very low levels. In the past, such operations had negative impacts on the reservoir fishery and recreation, at the minimum. San Juan -Chama water storage was authorized by Congress in EBR, in part, to reduce those impacts. They are not evaluated or discussed in the DEIS but should be.

The Commission recommends Reclamation simulate San Juan - Chama storage and use at EBR along with effects of the 2008 Operating Agreement on storage levels at EBR, particularly during drought, to fully assess the impacts on the local environment and economy.

10

## III. The Scope of Review in the DEIS is Inadequate

An agency's choice of the geographic area of its analysis must "represent a reasoned decision and cannot be arbitrary." *Idaho Sporting Congress v. Rittenhouse*, 305 F.3d 957, 973 (9th Cir. 2002). Courts will strike down an environmental impact statement if a geographical limitation on the agency's analysis is not supported by the record. *Utahns for Better Transp. v. Dep't of Transp.*, 305 F.3d 1152, 1179-80 (10th Cir. 2002). For example, an environmental impact statement will be held invalid if the record reflects that an action is likely to have impacts beyond the geographical limitations selected by an agency and the agency fails to provide a reasoned analysis for the boundaries it selects. *Id*. Here, Reclamation inappropriately limited the geographic scope of impacts to the Project area in New Mexico downstream of EBR.[8]

### A. Failure to Include Areas South of American Dam

First, the DEIS fails to analyze the full Project area. While the Project extends nearly 160 miles from EBR south along the Rio Grande valley to the El Paso and Hudspeth County line in Texas, the DEIS analysis extends south only about 110 miles, ending at the International Boundary and Water Commission American Dam. The geographic scope of the technical analysis in the DEIS should be extended to include the area between American Dam and Fort Quitman. The following are among the reasons that the study area should be expanded downstream to Fort Quitman.

(1) The area is a major part of the Rio Grande Project - Over the 100-plus year history of Rio Grande Project (the "Project") operations, Reclamation made water deliveries as far south as Fabens Texas, over 40 miles south of American Dam....The impacts of activities upstream of Fabens, if not Hudspeth, that affected farm headgate deliveries as well as determination of reasonable operational waste within EPCWID to Hudspeth are necessary to assess the differences in Project Water supply available to the Districts between alternatives.

(2) Pumping Capacity in EPCWID - Contrary to statements in the DEIS, significant irrigation pumping capacity exists in the EPCWID service area. *See* Figure 1, attached. Therefore, differences in Project supply to EPCWID between the alternatives would result in changes in pumping costs in EPCWID rather than an economic loss of the full value of the water. It is necessary to model the irrigation and municipal water supply operations in the El Paso Valley to assess the

[8] Again, New Mexico has raised these geographic scope issues before to Reclamation. Attachment A at 6.

10 cont.

hydrologic and socioeconomic impacts of differences in Project water supply to EPCWID between the alternatives.[9]

(3) Effect of Water Operations Downstream of American Dam – Irrigation and municipal water supply operations in the El Paso Valley affect the deliveries of Project water to the farmers in those areas. For example, pumping in the El Paso Valley area can increase conveyance losses in the river, conveyance losses within the canal systems, and on-farm losses. These increases in conveyance and on-farm losses increase the amount of Project water that is required to be released to meet the delivery demands. This in turn affects the Project water allocations to the Districts. It is necessary to model the water supply operations in the El Paso Valley to assess the impacts of those operations on the Project water deliveries.

11

In addition, operations below American Dam generate allocation terms and accounting credits that impact the allocation distribution of water throughout the Project. For example, the American Canal Extension Credit results from operations below American Dam, and this is an explicit term in Project allocation that increases the allocation to EPCWID and reduces the allocation to EBID. Other accounting credits based on operations below American Dam such as the Haskell Street Waste Water Treatment Plant Credit and El Paso Valley Credit, reduce the total Project allocation charges, reducing the diversion ratio and modifying the allocation between EBID and EPCWID. Some of EPCWID's credits are applied at the end of the accounting process, and end up in the EPCWID's carryover allocation for the next year. This transfers a credit given below American Dam into "carryover obligation" storage in EBR, directly impacting allocation and distribution of water throughout the Project.

12

The DEIS states that "[g]roundwater pumping in the El Paso Valley portion of EPCWID does not affect RGP deliveries (Reclamation 2015a). This is because the effects of pumping occur downstream of RGP diversion points." Reclamation goes on to state "[t]he effects of pumping" did not "occur downstream of the RGP diversion points" during the historical period which forms the basis of the 2008 Operating Agreement (1951-1978). The Commission strongly disagrees. The Project had sources of supply downstream of even Riverside Diversion Dam during that historical period which are now either extinct due to groundwater pumping in the El Paso Valley, or are no longer counted as Project supply. And, major features that today reduce the effects of pumping on the river near El Paso were not constructed until a decade or two after the time period referenced by Reclamation. In either case, this change from historical conditions causes additional discrepancies in water supply which are all deducted from EBID's allocation in the 2008 Operating Agreement. Pumping in Texas by EPCWID

[9] See also Attachment C, references for Texas groundwater pumping data.

farmers, by the EPCWID itself, by municipalities, and others have reduced the delivery efficiency of the Texas part of the Project, and thus reduced Project supply.[10] Under the 2008 Operating Agreement, it is EBID alone that must bear the cost of all impacts to Project supply. This outcome must be analyzed in a supplemental draft environmental impact statement by extending the geographic scope of review.

13

Another biased statement seeming to justify Reclamation's flawed geographic scope is the following statement, found on page 1-10 and 2-8 of the DEIS:
"While numerous factors affect RGP performance, recent changes in performance are predominantly driven by the actions of individual landowners within the EBID service area. These changes are as follows:

- Crop selection and related effects on crop irrigation requirement
- Irrigation practices and related effects on farm irrigation efficiency
- Widespread use of groundwater for supplemental irrigation, as permitted and regulated by the State of New Mexico."

Again, Reclamation cannot used such biased statements to justify its erroneous scope of review in the DEIS. These changes are found in EPCWID as well, and would also have an effect on Project performance. The DEIS does not include any analysis or quantification of the effect that these various factors have had on Project performance (or apparent performance). Therefore the conclusion that these changes are "predominantly driven" by actions within EBID is not supported.

14

It is not reasonable to reduce allocation to one district because of increases in efficiency that have taken place throughout the entire Project. The Project was designed and implemented as a pro-rata system; if one farmer becomes more efficient, and therefore the historical performance of the Project changes, this is a natural outcome of improved agricultural practices in the region. The language of the DEIS suggests that any impacts of improved agricultural processes should only be borne by EBID, even though the same practices have been implemented by farmers in both New Mexico and Texas. This constitutes a change to the pro-rata system employed by most (if not all) Reclamation projects, and it is so unusual that it clearly constitutes a significant difference within the Project. Limiting the geographical area to exclude the Texas portion of the Project forecloses a necessary assessment of this action. Reclamation's decision to limit the scope in this fashion is unreasonable and arbitrary.

[10] In addition to this pumping that occurs in the Texas portion of the Project, the City of El Paso also has large well fields in the Mesilla Bolson and Hueco Bolson. The City supplies about 25,000 AF per year of water to its service area from these wells, which again, is not noted in the DEIS. *See* http://www.epwu.org/water/water_resources.html.

15

### B. Failure to Analyze Impacts Upstream of Elephant Butte.

The upstream study limit in the DEIS precludes consideration of significant impacts associated with the proposed action and its alternatives. An environmental impact statement must evaluate the direct and indirect effects of the proposed action and its alternatives. *See* 40 CFR 1502.16; 1508.8 & 1508.25(c); Reclamation NEPA Handbook § 3.10, at 3-14; § 8.8.3, at 8-14 & 8-17. In order to do so, under a properly scoped EIS, "[t]he entire area of potential effect is included in the discussion of affected environment, including potentially affected areas outside the immediate project area." Reclamation NEPA Handbook § 8.7, at 8-13. *See also* 50 CFR 402.02 (defining the action area, for purposes of ESA Section 7 consultation, as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action"). *Accord* ESA Section 7 Consultation Handbook (USFWS/NMFS 1998) Glossary at x; § 4.5, at 4-17 & 4-18. Failure to adequately examine these impacts upstream of EBR is also a fundamental flaw in the Biological Opinion issued by the U.S. Fish and Wildlife Service, as addressed below in Section IV.F.

Despite the Commission's request during the scoping process that upstream impacts be evaluated, the study area for the DEIS is admittedly limited, with its upstream area of analysis stopping at the San Marcial Railroad Bridge above EBR. *See* DEIS § 1.10, at 1-14 (stating that "[t]he area of analysis for the OA and EBR storage is relatively limited within the broader RGP geographic area and varies by resource and resource issues…."). As described below, use of this truncated upstream study limit effectively precludes any examination in the DEIS of the potential direct and indirect and cumulative impacts that will occur upstream as a result of the proposed action and its alternatives.

The Rio Grande Compact (the "Compact") contains a number of Articles that are affected by storage in Project reservoirs, including New Mexico's delivery compliance under Article IV; the spill provision in Article VI; debit water operations from upstream reservoirs under Article VIII; and, the upstream storage restriction under Article VII. Changes in the operation of Elephant Butte and Caballo reservoirs contained in the 2008 Operating Agreement will impact Compact accounting, thereby affecting these Compact provisions. The 2008 Operating Agreement provisions relating to carryover storage, diversion allocations, allowing year round releases from Caballo Reservoir, and allowing for releases greater than 790,000 AF in a year without regard to beneficial use on Project lands have significant implications for Compact compliance and related water management operations.

Of particular concern is the impact on Article VII, which restricts the operation of almost all reservoirs in the Rio Grande Basin in New Mexico *upstream* of EBR based upon the

15 cont.

amount of Usable Water in Elephant Butte and Caballo Reservoirs. See Figure 2, map of major Rio Grande Basin reservoirs. The changes listed above impact the timing and duration of Article VII storage restrictions on upstream reservoirs and, consequently, the amount of water that can be stored and released from them. The Middle Rio Grande Basin is dependent upon these upstream reservoirs to meet irrigation demand, to deliver water to municipalities, and to provide water for endangered species in the middle Rio Grande valley of New Mexico. This has specific consequences for reservoirs used to store water for large water users in the middle Rio Grande valley of New Mexico including the Middle Rio Grande Conservancy District, the Albuquerque Bernalillo County Water Utility Authority, and the City of Santa Fe, as well as numerous other water users in New Mexico and Colorado. It also affects releases of water for use by these entities, as well as water releases for the Rio Grande silvery minnow and Southwestern willow flycatcher, and for federally designated critical habitat upstream of EBR. These considerations are hereinafter referred to collectively as "Upstream Impacts."

Reclamation appears to justify its exceedingly narrow scope of analysis in the DEIS based upon its characterization of Reclamation's limited discretion and limited effects associated with EBR operations under the 2008 Operating Agreement. Reclamation has characterized this as follows:

> Reclamation has limited discretion associated with normal EBR operations under the RGOA. Water stored in the RGP is the result of inflows dictated by Compact guidelines for New Mexico and Colorado. The needs of irrigators and irrigation delivery orders are non-discretionary and include treaty obligations to the Republic of Mexico. Irrigation release rates and times are determined by the two districts and Mexico, and are calculated to meet daily irrigation demands. **Reclamation cannot restrict or increase releases to affect Article VII restrictions on upstream States.** Reclamation's only discretionary actions associated with the RGOA are general operational guidelines and the two changes from historical operation … the diversion ratio adjustments and the carry-over concept. Reclamation also has discretion over the storage of SJ-C water in EBR, and the timing of releases from EBR into Caballo Reservoir to maintain sufficient water in Caballo for irrigation demands." (Memorandum dated Aug. 20, 2015 transmitting Biological Assessment addressing effects of the OA on federally listed species) (emphasis added).

The above characterizations are incorrect in material respects, and Reclamation has acted arbitrarily in crafting a scope of analysis that ignores these Upstream Impacts.

15 cont. Reclamation's discretionary action of executing the 2008 Operating Agreement is the direct cause of changes in total storage amounts in EBR and changed reservoir releases, both of which affect Article VII restrictions on upstream storage and, potentially, other aspects of the Compact important to New Mexico and Colorado. Specifically, when Usable Water in Project storage exceeds the Article VII threshold of 400,000 acre-feet, New Mexico can store in upstream reservoirs; but when it goes below 400,000 acre-feet, upstream storage is restricted. This means that the 2008 Operating Agreement has affected Article VII restrictions on upstream storage and that Reclamation's representations above are incorrect.

16 The DEIS fails to adequately examine the effects of the 2008 Operating Agreement on evaporative charges under the Compact as well. A large volume of the water flowing into EBR each year is lost to evaporation. These evaporative losses are charged to New Mexico under the Compact because the delivery point under Article IV of the Compact is at the gage downstream of the dam. Operations under the 2008 Operating Agreement that result in more water being held in EBR for longer periods of time accordingly affect New Mexico's deliveries under the Compact. Again, this Compact implication of the 2008 Operating Agreement should have been evaluated as part of the DEIS.

17 Additionally, Reclamation's failure to simulate the effects of the 2008 Operating Agreement in Article VI, VII, and VIII conditions on upstream storage means that the model does not simulate differences in inflows to EBR and Compact credits caused by differing upstream storage conditions. The DEIS incorrectly assumes that the inflows to EBR and amount of Compact credit water in EBR are the same in each Alternative. Different specific Project operations under different Alternatives will produce different Article VI, VII and VIII conditions, different upstream storage restrictions, and different inflow to Elephant Butte.[11] The scope of Reclamation's analysis must include all direct and indirect upstream effects, including how those effects will impact the alternatives listed.[12]

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[11] Different inflows to EBR would result in different amount of Compact credit water in storage. Compact credit in EBR is generated by a monthly Powersim model (URGSIM) that simulates EBR and Caballo releases as average of historical releases for all climate scenarios, but does not specifically simulate EBR or Caballo operations.

[12] Furthermore, because the DEIS does not include analysis of the Compact, the alternatives simulated by Reclamation do not include any reduction of Compact credit water by evaporation during the year (see Appendix A: RESERVOIR_STORAGE.xlsx). This is inconsistent with Reclamation's actual operations during 2011 which reduced credit water by evaporation during the year when allocating water to the two districts. Therefore, failure to examine the Compact in the simulated alternatives does not represent Reclamation's actual allocation process. (Note that New Mexico strongly objects to the application of evaporation to Compact credit during the year by Reclamation, but if Reclamation plans to continue to do so, this must be simulated in the DEIS.)

As noted above, the concerns regarding the 2008 Operating Agreement's Upstream Impacts have consistently been raised by the Commission. The Commission requested that Reclamation's analysis consider impacts on ESA issues, on Articles VI, VII and VIII of the Rio Grande Compact, and on upstream water supplies in correspondence dated April 30, 2012, Attachment D, in comments on the draft Supplemental EA (Attachment E, June 6, 2013 letter from the Commission to Reclamation), and again during scoping for the DEIS (Attachment A).

18 No section in the DEIS describes or evaluates Upstream Impacts of any type. Potential Upstream Impacts should have been listed in the DEIS as a key issue and should have been described and evaluated, but were not. Similarly, under the "Resources Considered" section of the DEIS, Reclamation has failed to describe or evaluate the difference in effects among its alternatives on the operations of upstream reservoirs and, consequently, on the upstream human environment and resources including upstream endangered species-related water operations. Moreover, it failed to conduct this analysis even though impacts to special status species were among the key issues identified in the Supplemental EA prepared for the 2008 Operating Agreement and among the issues raised in comments received during internal and formal scoping and outreach for this DEIS (*see* DEIS § 1.13, at 1-16). The current lack of analysis with respect to Upstream Impacts is a glaring gap that undermines the ability of the DEIS to afford full public disclosure, to elicit meaningful public input, and to support informed federal agency decision making through the NEPA process.

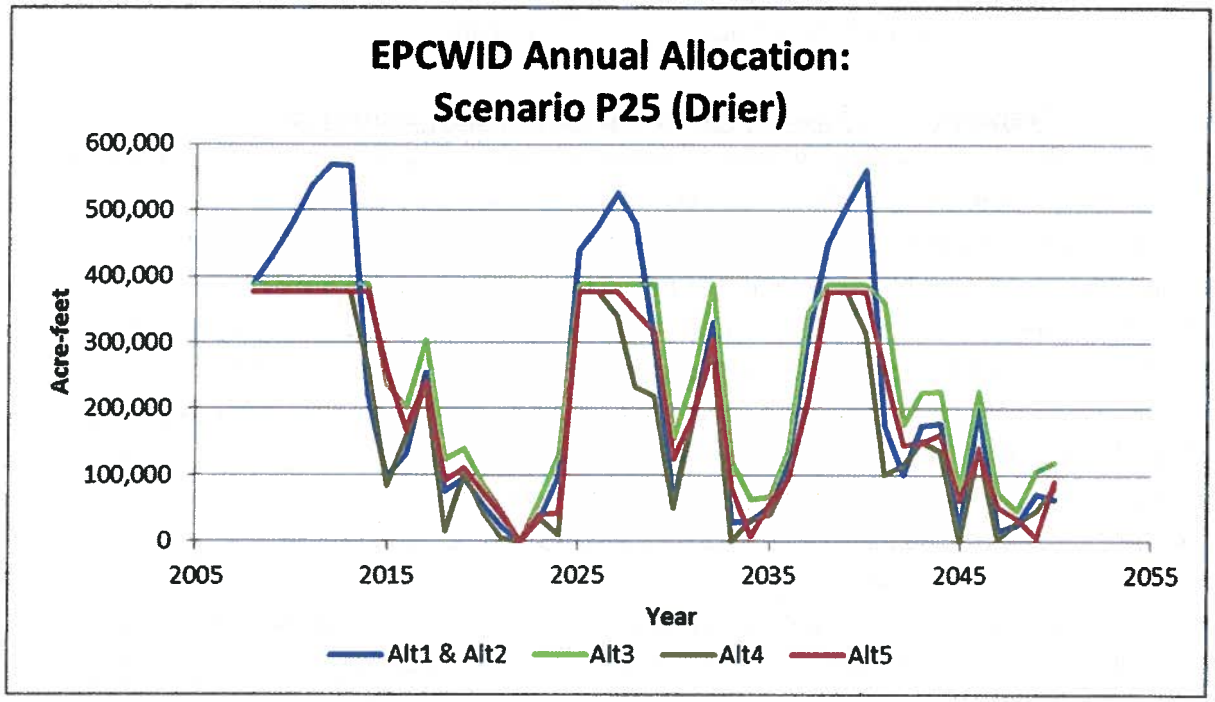
## IV. Reclamation Fails to Meet the Hard Look Standard.

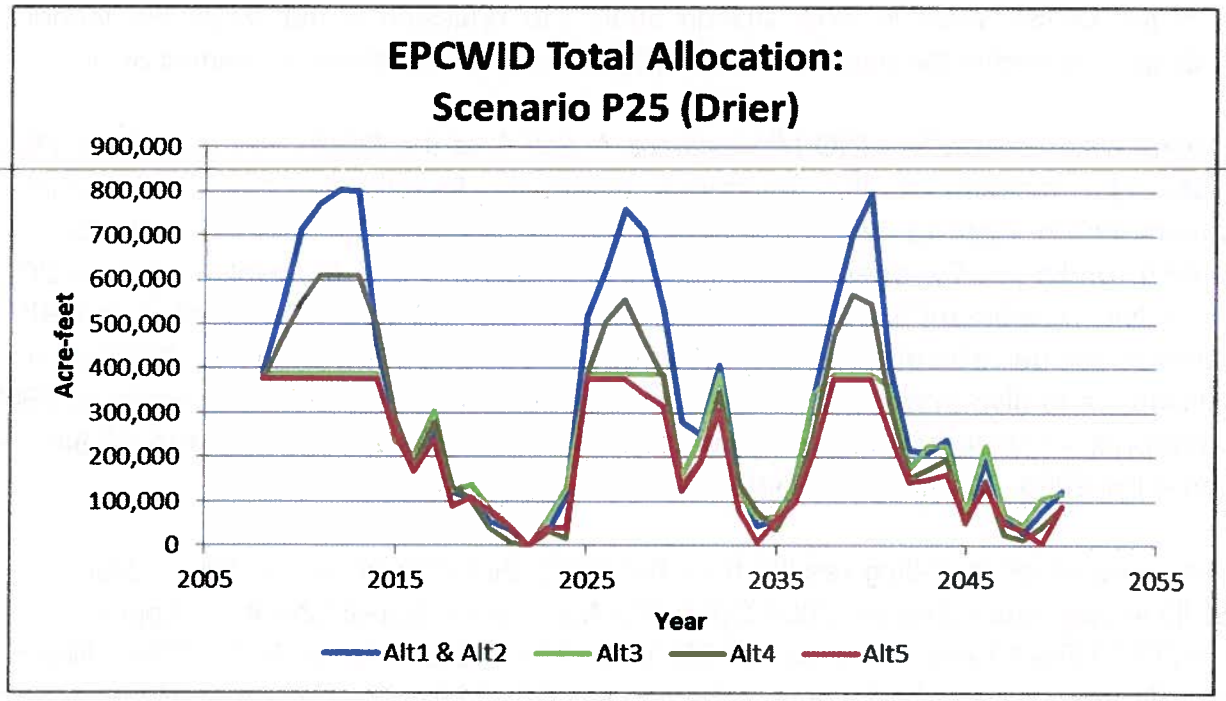
It is well established that NEPA requires federal agencies to take a "hard look" at the environmental consequences of a proposed action. *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989). The environmental impact statement serves three purposes. First, it must inform decision makers about the environmental implications of a proposed action in sufficient detail to aid in making the substantive decision of whether to proceed with the action. Second, the statement must be sufficiently detailed and available to provide the public with a meaningful disclosure of the proposed action's environmental impacts. And third, the environmental impact statement must demonstrate that a reasonable range of alternatives was developed and considered. *See generally Weinberger v. Catholic Action of Hawaii*, 454 U.S. 139 (1981). Along with all of the above comments, the items highlighted below make clear that Reclamation has not examined the 2008 Operating Agreement in sufficient detail to make an informed decision on how to proceed and has failed to provide the public with meaningful disclosure of the true impacts of the proposed action. For these reasons, the Commission requests preparation of a supplemental draft environmental impact statement.

### A. Reclamation's Modeling Outputs Contain Flaws.

19 As noted above, the Commission could not do a comprehensive review of Reclamation's hydrologic model because the information requested was not made available. That said, based on the information the Commission does have, it is clear that some of the modeling outputs in the analysis are flawed.

Allocation results from Reclamation's simulation of the 2008 Operating Agreement allocation procedures (Alt1 & Alt2 provided in Appendix A, Allocation.xlsx, with example figures shown below) show simulated annual allocations for EPCWID greater than 500,000 AF in several years. This is significantly higher than EPCWID's maximum annual allocation under the 2008 Operating Agreement (388,000 AF). (Note: Annual Allocation excludes Carryover Allocation. EPCWID's Total Allocation including Carryover is simulated to reach 800,000 acre-feet.) These results indicate that the allocation algorithm used in the modeling analysis is not correct, and therefore the evaluation process does not accurately represent the 2008 Operating Agreement procedures. Erroneous calculation of EPCWID's allocation will cause erroneous calculations of diversions, carryover, carryover transfer, etc., impacting all model results. Lacking full documentation and source codes for the SWOPS part of the model, the Commission cannot comment further concerning this issue at this time.






20 Additionally, all of the DEIS modeling scenarios assume that New Mexico will relinquish its Compact credit water in EBR if these Credits exceed 70,000 AF. The Commission disagrees with this assumption; proposing relinquishment of New Mexico Compact credit water is a decision of the New Mexico Compact Commissioner, not Reclamation. Moreover, the assumption is not reasonable given the current litigation regarding Compact credit water in EBR. Including this assumption as part of the simulated scenarios causes the model to overestimate the amount of water available to the Project, and therefore minimizes the impact of the 2008 Operating Agreement at the potential expense of New Mexican's upstream of EBR. Because the information necessary to examine the model in full was not provided, the Commission is unable to suggest methods to alleviate these flaws.

21 Finally, under Alternative 1, the total groundwater pumping under P50 conditions for the City of El Paso is 11,575 AF per year. Similar numbers are provided for the other alternatives. These numbers cannot be correct. The City of El Paso itself reports that it is using and will continue to use 25,000 AF per year from the Mesilla Bolson and Hueco Bolson. *See* http://www.epwu.org/water/water_resources.html.

**B. The DEIS Analysis Fails to Adequately Examine the Decrease in Project Supply to EBID.**

The DEIS does not give sufficient weight to the significant decrease in Project water supply to EBID demonstrated by Reclamation's 2015 technical memorandum (Appendix

C of the DEIS). What is most striking about this omission is that while the technical findings obtained in the analysis for the DEIS clearly demonstrate the reduction in

22

Project water supply to EBID (Appendixes A and C of the DEIS), the text of the DEIS makes no mention of this enormous decrease. Specifically, the 2015 technical memorandum (Appendix A) demonstrates that the simulated average annual allocation to EBID under pre-OA operations (Alternative 5) was 314,327 AF, while under the 2008 Operating Agreement it was only 146,977 AF. This 167,350 AF reduction in EBID's average annual allocation is only 53% of pre-OA levels simulated in Alternative 5. Similarly, and also from Table 4-6, the average Farm Delivery of Project water to EBID farmers is simulated to change from 110,314 AF for pre-OA operations to 72,841 AF under the 2008 Operating Agreement, a reduction of 34%.

There are other modeling results from the DEIS that also show the large reduction in EBID supply caused by the 2008 Operating Agreement. Spreadsheets in Appendix A of the 2015 USBR Tech Memo No. 86-68210–2015-05 (DEIS Appendix C) ("Tech Memo") provide year-by-year model output. Data in ALLOCATION.xlsx show that EBID's Annual (or current year) allocation under the 2008 Operating Agreement (Alt1 & Alt2) is simulated to be lower than EBID's allocation under pre-OA operations (Alt 5) by very large amounts; as much as 460,000 AF, as shown in the EBID Annual Allocation graph below.[13]

The reduction of EBID's Annual Allocation is only partially mitigated by the potential benefit of carryover transfer from EPCWID, which is included in the Total Allocation shown in the graph below (Total Allocation includes both Annual Allocation and Carryover Allocation). Even this small mitigation is not guaranteed. Carryover transfer only occurs if EPCWID does not order a large part of its allocation and continues to accrue credit. If EPCWID increases its annual Project diversions above the levels assumed in the Tech Memo, then the resulting Carryover transfer would be much lower, and EBID's Total Allocation would be closer to its Annual Allocation. Note that these modeling results are in part suspect because of the questions raised in comment A (above) relating to the simulation of EPCWID's Annual Allocation. Since the model overestimates EPCWID's allocation, it is likely that the model also overestimates Carryover Allocation Transfer from EPCWID to EBID.

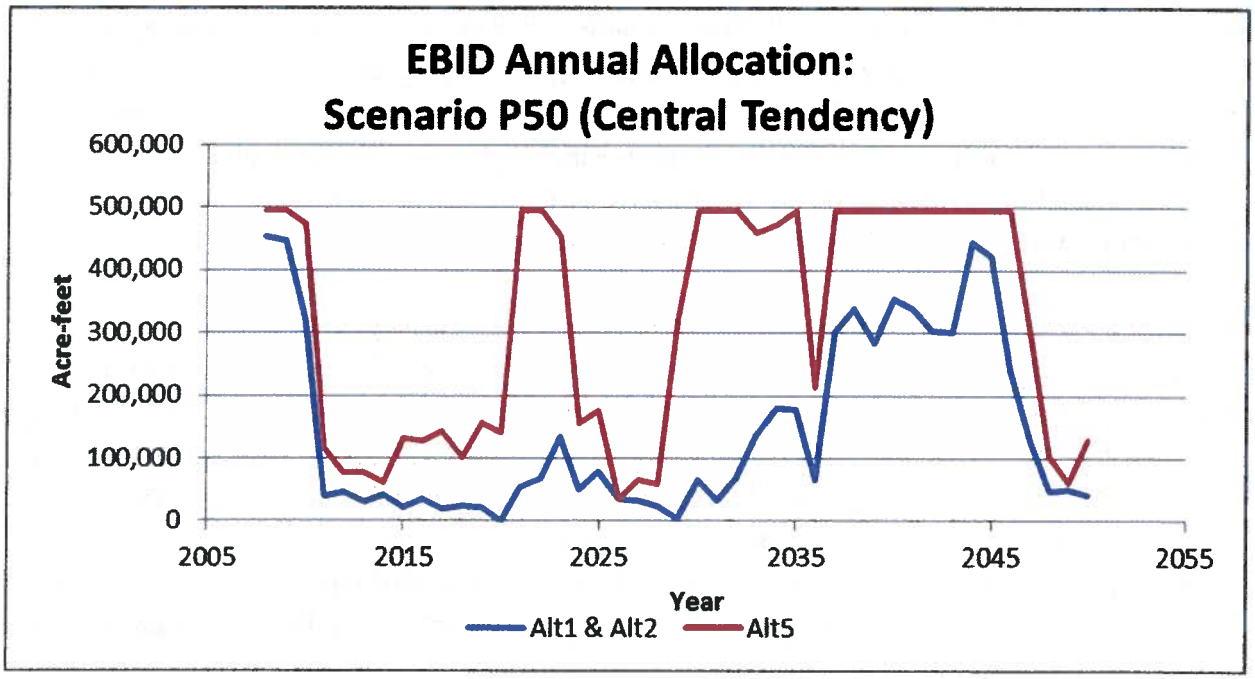
The large reductions in EBID's allocation predicted by the DEIS model are generally consistent with New Mexico's first amended complaint against Reclamation in *New Mexico v. United States*, No. 11-cv-00691-JAP-WDS (D.N.M., 2011). In Paragraph 48.b.

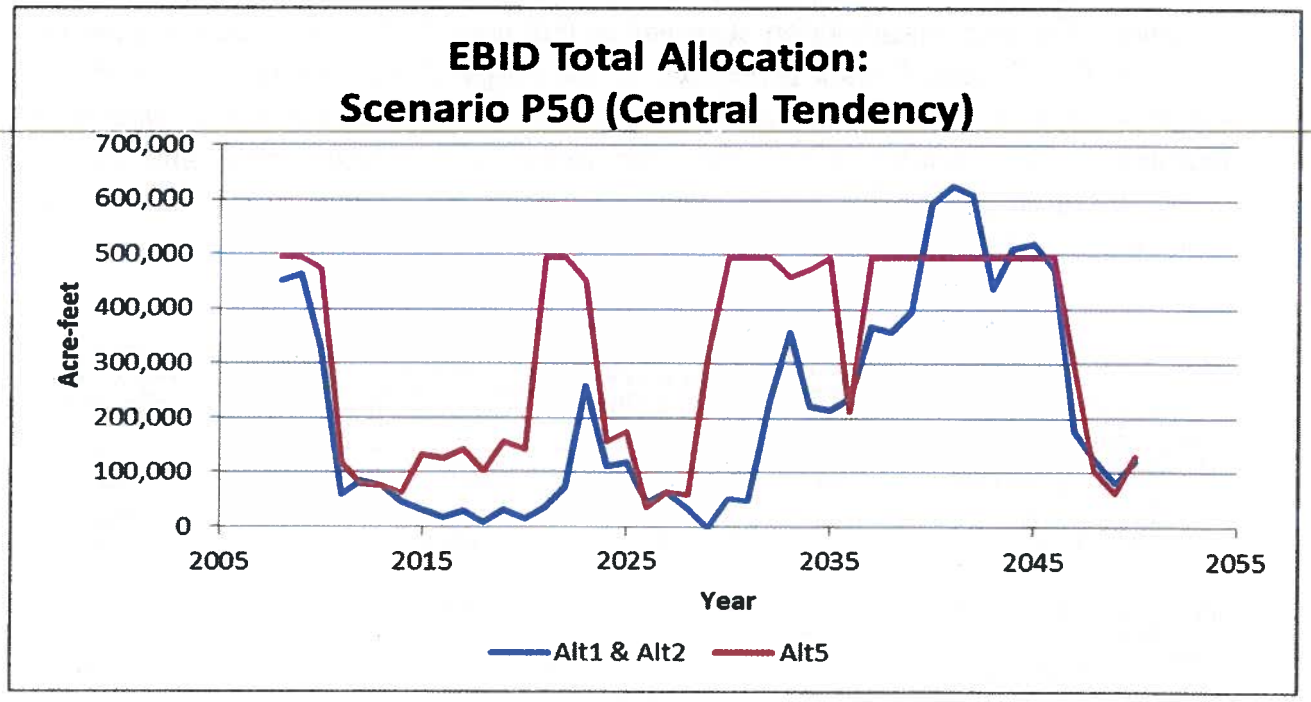
[13] The below graphs were extracted from Reclamation's Appendix A in the DEIS, ALLOCATION.xlsx, and modified for clarity by removing the curves for Alt3 and Alt4. The Summary Chart is taken directly from the DEIS without modification.

of its first amended complaint, New Mexico discusses the large decrease in EBID allocations that had already been observed at that time: *"EBID has incurred a decrease in annual Rio Grande Project allocations in the range of 149,160 up to 189,110 acre-feet, or -30.1% to -38.2% of its historical allocation. This decrease in allocation reflects operations that occurred during the past three years [2008, 2009 and 2010] as accounted by Reclamation."* Again, failing to highlight the findings of the DEIS modeling in the text is a glaring omission.

**Table 4-6. Summary of the No Action Alternative Compared with the Other Alternatives**

| | Alternative 1—No Action | Alternative 2—No San Juan–Chama Project Storage | Alternative 3—No Carryover Provision | Alternative 4— No Diversion Ratio Adjustment | Alternative 5—Prior Operating (Ad Hoc) Practices |
|---|---|---|---|---|---|
| **Section 4.4 Surface Water** | | | | | |
| Elephant Butte pool elevation (feet) | 4,318 | 4,312 | 4,314 | 4,312 | 4,313 |
| Total project storage (average annual acre-feet) | 409,453 | 409,453 | 399,510 | 371,591 | 389,109 |
| Annual allocation to EBID | 146,977 | 146,977 | 264,752 | 272,269 | 314,327 |
| Annual allocation to EPCWID | 266,327 | 266,327 | 267,973 | 207,296 | 239,317 |
| Project releases (mean annual acre-feet) | 524,597 | 524,597 | 525,808 | 531,229 | 527,421 |
| Net diversions to EBID (acre-feet) | 153,583 | 153,583 | 198,287 | 227,069 | 228,363 |
| Net diversions to EPCWID (acre-feet) | 46,703 | 46,703 | 34,805 | 29,491 | 25,543 |
| Farm surface water deliveries to EBID (acre-feet) | 72,841 | 72,841 | 94,477 | 110,782 | 110,314 |
| Farm surface water deliveries to EPCWID (acre-feet) | 15,954 | 15,954 | 15,029 | 14,964 | 13,896 |
| **Section 4.5 Groundwater** | | | | | |
| Mean monthly elevation at Rm-2 (feet) | 4,060 | 4,060 | 4,062 | 4,063 | 4,063 |
| Mean monthly elevation at Mes-6 (feet) | 3,814 | 3,814 | 3,815 | 3,816 | 3,815 |
| Groundwater storage in the Rincon and Mesilla Basins (cumulative change) | Decrease | Decrease | Decrease | Decrease | Decrease |
| **Section 4.6 Water Quality** | | | | | |
| Groundwater elevations decline seasonably during sustained dry periods but recover during wet periods. | Negligible | Negligible | Negligible | Negligible | Negligible |






### C. The DEIS Groundwater Supply and Quality Analysis is flawed.

#### 1. *Groundwater Supply*

23 The DEIS downplays the impact on the shallow groundwater aquifer levels in New Mexico caused by the 2008 Operating Agreement. The DEIS hydrologic analysis suggests that under P50 and P75 climatic scenarios the aquifer will recover, however it is likely that the SWOPS modeling flaw described above (Comment A above) has led to under-estimation of the impact on the shallow groundwater aquifer. It should be noted that observed shallow ground water levels have already dropped 20 feet since the beginning of 2006, the year that Reclamation first reduced EBID's allocation by the diversion ratio method. (See Figure below: Final report to the New Mexico Legislature Interim Committee on Water and Natural Resources, by New Mexico Universities Working Group on Water Supply Vulnerabilities, August 31, 2015).

Reclamation's language in the DEIS demonstrates its bias on this issue. On page 3-12 of the DEIS, Reclamation, citing only its prior work, states "[a]nalysis based on historical measurements of groundwater elevations from monitoring wells in the RGP and surrounding areas of the Rincon and Mesilla Valleys demonstrates widespread and statistically significant negative trends in groundwater elevation from 1980 to the present. However, additional analysis of previous decades suggest that this trend is confined to the past decade, indicating that sustained groundwater pumping in excess of recharge (i.e., groundwater mining) was not prevalent in the RGP or adjacent lands

23 cont.

before the current drought (Reclamation 2013a; SEA Appendix F)." This statement fails to acknowledge the realities of water supply under the 2008 Operating Agreement and realistic, historical groundwater trends. Groundwater level trends before 2006 show a consistent historical trend: groundwater declines of 10-15 feet during drought, followed by recovery in full supply years. Since 2006 groundwater levels have shown no recovery during years of full supply to the Project (2008, 2009 and arguably 2010), followed by further decline during the following time of shortage. In short, the effect of 2 the 2008 Operating Agreement is to convert a sustainable aquifer into a mined aquifer.

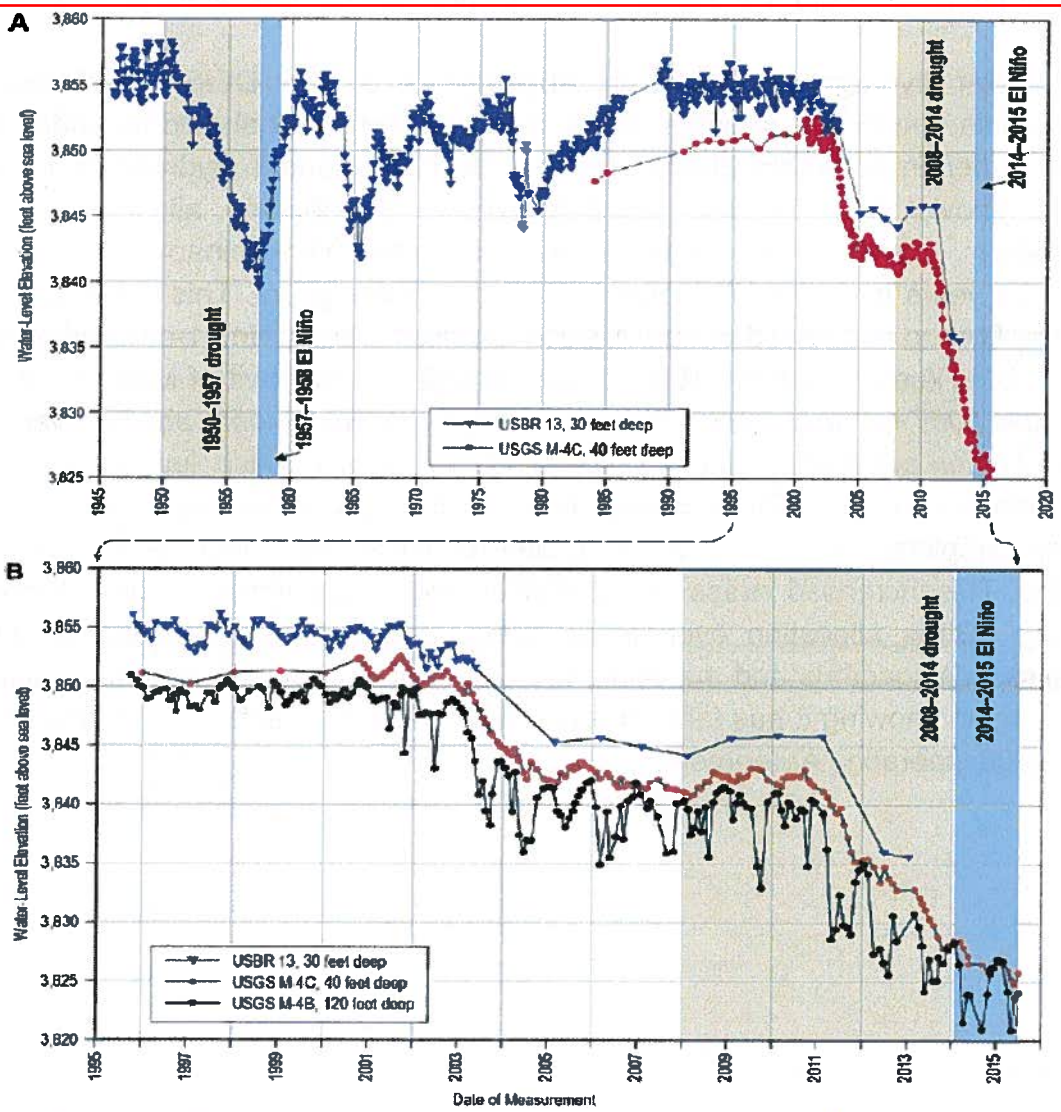
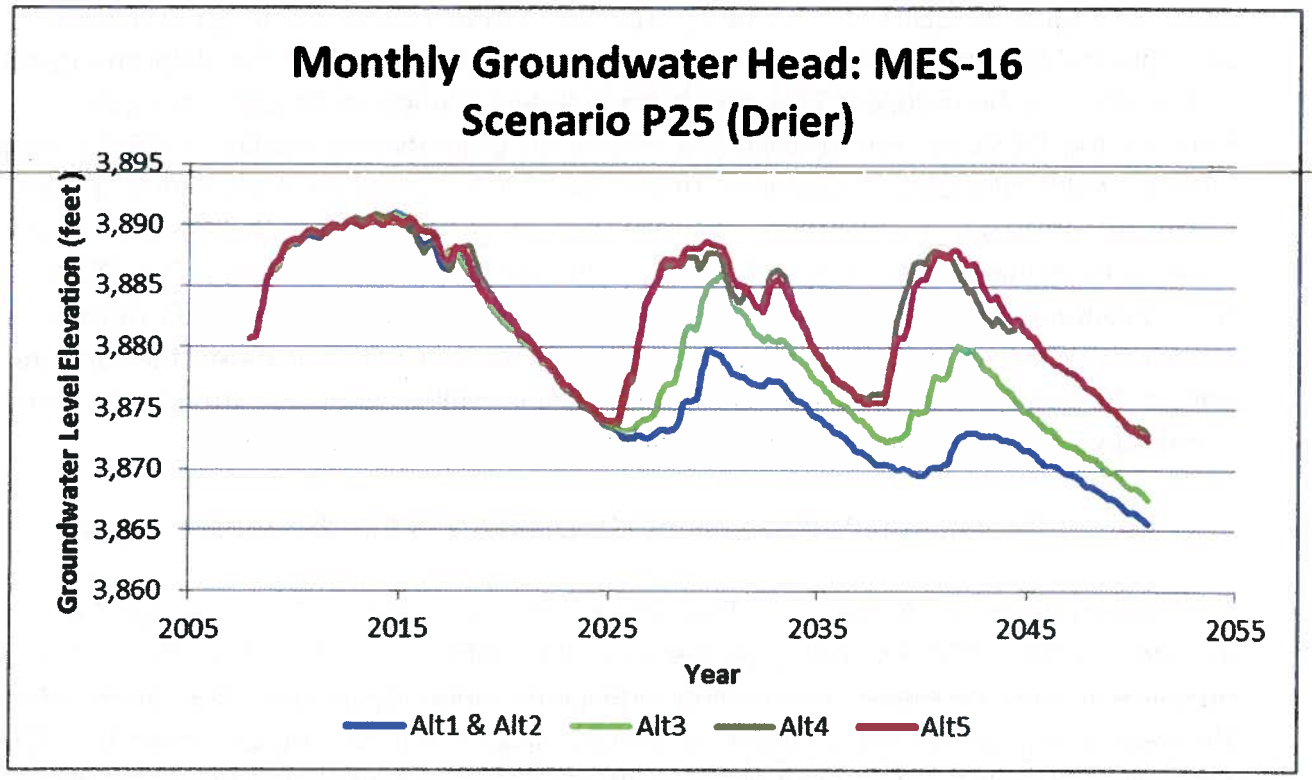



**Figure 9.** Hydrographs from wells USBR 13, M-4C, and M-4B are used to evaluate the effects of groundwater pumping and drought in the lower Mesilla Valley. **A.** The combined hydrograph (1946–2015) shows a 16-foot water-level decline and recovery during the 1950–1957 drought, a 16-foot water-level decline during the 2008–2014 drought, and a 7.5-foot decline between winter measurements in 2003–2005 prior to drought conditions. **B.** Seasonal water-level fluctuations in the 1995–2015 hydrograph for M-4B shift from a pattern of summer recharge to one of summer groundwater pumping during 2002–2003, indicating the pre-drought decline was due to groundwater pumping. The water level declined 26 feet from 2002 to June 2015and the aquifer had not yet recovered from the combined effects of pumping and drought.

24 Moreover, the DEIS modeling itself shows significant groundwater supply issues. Under the P25 climatic scenario, the DEIS shows that the groundwater levels will experience a drop of about 25 feet (Head.xlsx, Mes-16) under Alternatives 1 and 2 which will be on top of the already observed 20 foot drop since early 2006, see the figure below. This drop in the shallow groundwater levels represent a significant impact on groundwater resources in New Mexico that, just as with the lower Project supply numbers, is not mentioned in the text of the DEIS. Instead, the presentation of groundwater level results in the body of the DEIS is cursory, providing only an average groundwater level over a 40+ year period, and not discussing the actual predicted groundwater level declines.

Groundwater hydrographs found in Appendix A of the DEIS, HEAD.xlsx, show considerable drawdowns in some scenarios, drawdowns that should be added to those already experienced within EBID. Note that the P25 Scenario hydrograph for MES-16 (below) shows that for the 2008 Operating Agreement allocation alternative (Alternatives 1 and 2) the aquifer is being depleted unsustainably, i.e., drawdowns during dry years that do not recover in intervening wet years. This again is a concern that New Mexico has raised in *New Mexico v. United States*, No.11-cv-00691-JAP-WDS (D.N.M. 2011)(see Document 100-1, Filed 06/13/2012, Affidavit of Margaret Barroll: "*In effect, the 2007 OP and 2008 OA have converted a sustainable aquifer system into a mined aquifer system.*") A vicious cycle has begun, in which low apparent Project performance reduces EBID's supply (through the Diversion Ratio Allocation), thus causing complementary reductions in aquifer recharge due to increases in groundwater pumping. This increased stress on the aquifer may further impact Project performance, reducing EBID's allocation even more. While Reclamation's modeling confirms the Commission's concerns and the cycle, the DEIS fails to account for the problems in its review, again showing it has failed to truly take a hard look at the environmental effects of the 2008 Operating Agreement.[14]

[14] On Page 3-12 of the DEIS Reclamation also states that "[i]t is likely that recent groundwater declines are associated with the severe and sustained drought conditions that have affected the RGP since 2003 (Reclamation 2013a; SEA Appendix F). Again, the Commission disagrees. Based on the above analysis it is clear that these declines, while certainly enhanced by natural drought, have been compounded by reductions to EBID's allocation under the 2008 Operating Agreement.




25 Finally, in regard to groundwater supply, the DEIS does not consider any limitation or insufficiency in groundwater pumping capacity within EBID, either at present, or that may occur in the future, and instead assumes that any deficit in EBID's Project supply can, and always will be, compensated for by groundwater pumping. This is an erroneous assumption. In fact, not all EBID farmers have wells, there is an increase in cost associated to pump the wells as groundwater levels drop, and in some areas groundwater supplies are limited or groundwater quality can limit the usefulness of irrigation wells.

2. *Groundwater Quality*

26 The DEIS water quality analysis is also limited, again demonstrating that Reclamation did not conduct a meaningful review of all the environmental impacts of the 2008 Operating Agreement. Modeling did not contain information about groundwater quality or potential sources of contamination. Salinity is mentioned only briefly under existing conditions, but not evaluated under the alternatives. In particular, the DEIS does not consider the impact of the difference in quality between groundwater and surface water, specifically as it relates to farm productivity. EBID farmers have informed New Mexico that they are unable to germinate some crops with the lower quality groundwater available in their area, and other farmers report that when forced to use groundwater they are unable to grow crops of the same size and quality that they could with surface water (e.g. onion crops in the Rincon Valley). Therefore, the impact of a low surface

26 cont.

water allocation to EBID is not merely that the farmer has to pump groundwater, but also that the farmer may not be able to grow certain crops, or that the yield and quality of the crop may be reduced. This should have been included in the DEIS analysis.

Second, the DEIS did not analyze the effects on groundwater quality of EBID's large surface water allocation reductions under the 2008 Operating Agreement. Irrigation processes normally concentrate naturally occurring salts. Without sufficient Project water to flush these salts, they will remain in the soil and shallow aquifer. The DEIS has not considered how this change in groundwater quality will impact EBID farmers, or other groundwater users. In other words, the DEIS has not considered the long term effects of salinization of the Mesilla and Rincon valley aquifers, an environmental consequence of the 2008 Operating Agreement.

### D. Reclamation's Analysis of Alternative 1 is Fundamentally Flawed.

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In its examination of Alternative 1, Reclamation fails to evaluate the full scale of what is included in the 2008 Operating Agreement. The DEIS evaluated the diversion ratio adjustment and carryover accounting provisions only. DEIS, pg. 2-3, lines 77-81. Whereas many additional changes to Project operations can occur under the 2008 Operating Agreement. For example, the 2008 Operating Agreement allows for release of both annual allocations (current year allocations) plus carryover allocation amounts for both Districts. These total allocations could amount to more than 1,400,000 AF per year. However, all DEIS model simulations limit releases from Caballo reservoir to 790,000 AF (files received from Reclamation, Notes.txt, under FMP subdirectory), significantly less than the 1,400,000 AF per year releases allowed for under the 2008 Operating Agreement. This discrepancy clearly demonstrates that the DEIS evaluation does not evaluate the full scale of operations that could occur under the 2008 Operating Agreement. Further, as has been noted above, the impacts of the 2008 Operating Agreement on water management and deliveries under the Compact have not been considered, another fundamental flaw in the analysis of Alternative 1.

### E. Reclamation Failed to Address the Operations Manual.

As discussed briefly above, the DEIS completely ignores the Project Operations Manual. The Operations Manual does more than merely implement the 2008 Operating Agreement; Reclamation has unilaterally imposed material changes in the operation of the Project through modifications to the Operations Manual that have adversely affected the deliveries to New Mexico and created a false assessment of the Project's water allocations and environmental impacts. For example, a "drought factor" was added to the Operations Manual in May 2012 to reduce the D2 allocation in multiple drought years. Other changes to the Manual are listed in Attachment F. These changes were not analyzed in prior environmental analyses and have not been analyzed in the DEIS.

Material changes to the Operations Manual should be evaluated under NEPA whether or not there is a corresponding formal change to the 2008 Operating Agreement. *See Kunaknana v. U.S. Army Corps of Eng'rs*, 23 F. Supp. 3d 1063 (D. Alaska 2014) (rejecting agency's argument that an supplemental environmental impact statement ("SEIS") was unnecessary where a modified project was "conceptually similar" to the original project; relocation of a well pad to a new site over a mile away, a 50% increase in the number of wells, and a new road alignment and bridge crossing were substantial changes requiring preparation of an SEIS). Thus, by not conducting this analysis here, Reclamation has again failed at taking a hard look at the environmental impacts in the DEIS.

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Of greatest concern is that in addition to the changes already implemented through the Operations Manual, there is no known preclusion or bar to implementing more changes in the future.[15] For example, all of the following may be changed based on amendments to the Operations Manual: delivery points to EBID, EPCWID and Mexico; flood water diversions; accounting and charges procedures, including how credits are estimated; shortage sharing procedures; and, the end-date of the allocation process. The DEIS does not contain any analysis of these issues. The Council on Environmental Quality's NEPA implementation regulations require preparation of a SEIS if (1) "[t]he agency makes substantial changes in the proposed action relevant to environmental concerns" or (2) "[t]here are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts." 40 C.F.R. § 1502.9(c)(1). A change is substantial where it "presents a seriously different picture of the environmental impact" of the action. *In re Operation of Mo. River Sys. Litig.*, 516 F.3d 688, 693 (8th Cir. 2008). The Circuit Courts have considered whether the modification (1) affects a primary or secondary aspect of the proposed project, (2) is major or minor in scope, and (3) will have environmental impacts that the agency has not yet considered. *See, e.g., Russell Country Sportsmen v. U.S. Forest Serv.*, 668 F.3d 1037, 1048-49 (9th Cir. 2011). The Commission asserts that Reclamation has failed to analyze any of the impacts of the Operations Manual and a supplemental draft environmental impact statement is required.

[15] An additional concern is that the Operations Manual can be changed simply by agreement of the three parties to the 2008 Operating Agreement: Reclamation, EBID and EPCWID. Because any change under the Operations Manual necessarily involves a federal action, in principle each substantive change would require an analysis under NEPA, however none of the changes to date received this analysis until they were incorporated into the DEIS, which then carried out an incomplete analysis of those changes. The DEIS should explicitly recognize the possibility that changes have occurred, determine whether there were environmental impacts, discuss what future changes may be likely, and set a framework for the types of changes that require additional NEPA analysis and those that will not. Additionally, the Commission continues to raise concerns that the non-public meetings of these three entities to change the Operations Manual along with the process to amend the Manual violate the Federal Advisory Committee Act. 5 U.S.C. Appendix – Federal Advisory Committee Act; 86 Stat. 770, as amended.

### F. Reclamation's ESA Analysis is Flawed

Federal agencies should prepare "draft environmental impact statements concurrently with and integrated with environmental impact analyses. . .required by. . . the Endangered Species Act [ESA]." 40 C.F.R. § 1502.25. Here on November 18, 2015 a Biological Assessment ("BA") was submitted by Reclamation to the United States Fish and Wildlife Service (the "Service") to describe the proposed action and determine whether it "may affect" listed species or critical habitat in a manner justifying the initiation of formal ESA Section 7 consultation. The Service's Biological Opinion ("BO") is the concluding document for the ESA Section 7 consultation, and Reclamation is charged with considering the information in the BO as part of making its final decision. Unfortunately, the majority of the Commission's comments in this letter regarding the Section 7 consultation are related to the BA. That's because the BA is the only document the Commission had available to review regarding the consultation until the BO was made public on June 3, 2016, four business days before the close of the comment period for the DEIS.

The Commission repeatedly requested a copy of the BO starting on March 31, 2016. *See* Attachment G. In fact, the Commission requested the BO five times through Reclamation's official communications channel described in the notice federal register notice of availability. *See* Attachments B, G, and H. To date, the Commission has received no official administrative record communication from Reclamation notifying it of the public availability of the BO. And, while the BO is now on the Service's website, as of June 3, 2016, Reclamation has not updated its own website to notify the public of its availability.

Withholding the BO until this late date contradicted Reclamation's statements to the public regarding the BO. The notice of availability published March 18, 2016 stated that the BO was available at a listed URL address. However, contrary to the published notice of availability, the BO was not available on the listed website or through any other means. It did not become available until the date listed above, over two months after the notice of availability was published.

That said, the Commission has endeavored to comment on the BO as part of this letter. While the Commission has done its best in this short time frame, we reserve the right to supplement these comments if the Commission determines additional comments on the BO are warranted. The Commission will submit these additional comments by July 5, 2016, a reasonable period of time.

The most striking issue with the BO is the action area listed in the document. Under the ESA, the "action area" for the analysis of effects must address "all areas affected

29 directly or indirectly by a Federal action." 50 C.F.R. § 402.02. Both the BO and the BA analysis of effects focus on a restrictive geographic area at EBR, Caballo Reservoir, and certain areas downstream. Neither analyze baseline conditions or the effects of the action related to resources upstream in the Middle Rio Grande that stand to be affected by the 2008 Operating Agreement, nor does it specify the possible implications for upstream flow regimes of San Juan - Chama water storage in EBR. Because of this, the BA and BO analysis is incomplete. As such, it is impossible to reasonably assess all material impacts to biological resources.

30 This restrictive action area limits the Service's examination in the BO of the Rio Grande Silvery Minnow ("Minnow"), and allows the Service to completely ignore the New Mexico Jumping Mouse ("Jumping Mouse"). The Service is usually very conservative in its evaluation of threats to a listed species potentially affected by a proposed action. This approach—erring on the side of the species—has been referred to as the "precautionary approach" to species management. However, the Service's exclusion of the Jumping Mouse and limited review of the Minnow do not demonstrate adhesion to this principle.

31 In regard to the Minnow, in the BA, Reclamation found that the proposed action "may affect, but is not likely to adversely affect" the Minnow. Reclamation's finding was based on its rationale that it was impossible to measure (or model) changes in reservoir elevations due solely to the 2008 Operating Agreement as opposed to (1) changes in elevations influenced by climate change or (2) changes associated with the storage of water for the Project, which are part of the environmental baseline. Thus, Reclamation proposed that effects of the 2008 Operating Agreement could not be meaningfully measured and would therefore be insignificant.

32 In addition to limiting its review of effects on the Minnow, the findings in the BA were also outdated and inadequate. Many key publications with pertinent information were not cited, and information in those publications is critical to understanding the potential effects of the 2008 Operating Agreement on the minnow. *See* Attachment I. For example, many more recent publications relevant to the Minnow than those cited in the BA (USFWS 2003 was the primary citation used by Reclamation) offer expanded and greatly refined perspectives on factors with demonstrated effects on the Minnow, including those that can alter rates of population growth. Of note, Cowley et al. (2009) report that survival of minnow eggs declined sharply at salinities greater than 3.0 practical salinity units (PSU), and egg survival was only 5% at a salinity of 8.0 PSU. Likewise, Buhl (2002, 2006) offers a vastly refined account of the physiological tolerances of life stages beyond the embryo stage. These studies were should have been highlighted in the BA and at least a minor level of impact should have been assigned to the Minnow from implementation of the 2008 Operating Agreement.

33 Instead, Reclamation anticipated that Minnows in the delta reach of EBR would have the ability to move upstream (in the BO the Service tacitly agrees by saying "they flee") towards moving water (lotic) conditions during periods of reservoir filling. No empirical evidence is presented in either the BA or the BO that supports the notion that the Minnow can move upstream from the EBR delta to avoid rising reservoir levels and standing water (lentic) conditions. There is plenty of evidence, however, that the Minnow is present in this inflow area and must respond to rising reservoir levels (Reclamation 2015). Yet, the BO states that "[g]iven the available information, the USFWS concurs with Reclamation's finding that the Operating Agreement, as described, may affect, but is not likely to adversely affect, silvery minnows that occupy the delta channel areas."

34 While agreeing with the BA's assessment in the BO the Service goes on to recommend that Reclamation further model and quantify the relative proportions of changing EBR elevations on riverine habitat that is suitable for Minnows in the delta areas. The Service also states that "should additional scientific information become available about any particular lentic condition, predators, or other factors, associated with a rising reservoir elevations [sic] that are attributable to the Operating Agreement, then Reclamation must re-assess its findings and reinitiate consultation, as appropriate…." Had Reclamation done a better job of pursuing the current literature and been more forthcoming about the known utilization by minnows of the EBR delta area and the relatively unknown impacts of scheduled and unscheduled water deliveries to EBR, it is likely that the effect call would have been "may affect, likely to adversely affect" the Minnow. The Service should have fixed these omissions by Reclamation in the BO, but did not. Instead the Service simply agreed with Reclamation that, since it was too difficult to meaningfully measure impacts, there would be no impacts. This seems far from supporting the precautionary approach the Service usually employs.

Furthermore, the analysis in the BA and BO regarding effects of the exotic, introduced tamarisk leaf beetles (*Diorhabda* sp.) is inadequate. At least two species of these beetles are documented to be recent invaders within the Southwestern Willow Flycatcher ("Flycatcher") and Western Yellow-Billed Cuckoo ("Cuckoo") occupied habitats. The beetles have the proven ability to defoliate and eliminate much of the tamarisk (known to be utilized by the Flycatcher) in the Elephant Butte region. One of the species of beetles has been responsible for almost eliminating a healthy population of Flycatchers in the Virgin River Basin (McLeod and Pellegrini 2014), and the potential for major impacts to the Flycatchers and possibly the Cuckoos from the beetles in the region is extremely likely.

In the case of the potential impacts of the tamarisk leaf beetles, the Service in the BO, consistent with the analysis in the BA, implies that the release of beetles into the

Flycatcher and Cuckoo habitats is not a serious threat to species recovery. Under "Cumulative Effects" the BO states on page 3 that "[t]he removal of non-native vegetation (i.e., saltcedar or Russian olive) through mechanical or biological control (i.e., saltcedar leaf beetle (*Diorhabda* sp.), can adversely affect the amount of available flycatcher and cuckoo habitat." But then the BO fails to fully address the beetle. If mechanical removal or biological control can adversely affect these species, then so too can the beetle.

35 cont.

There are two different species of *Diorhabda* converging on the EBR area: the northern tamarisk leaf beetle (*D. carinulata*) from the north, and the subtropical tamarisk leaf beetle (*D. sublineata*) from the south (M. Mcleod personal communication to S.W. Carothers, 2016). Both species converged in 2015 in the EBR area (Tamarisk Coalition 2016).[16] A June 2, 2016, conversation with the Tamarisk Coalition in Albuquerque, New Mexico, indicates that the subtropical beetle emerged at Caballo Reservoir in February of 2016, and at least six complete life cycles of the beetle reproduction are expected in 2016 (Personal communication M. Mcleod to S.W. Carothers).

The effects of the tamarisk leaf beetle on Flycatcher occupancy and productivity within the action area must be analyzed. Although the majority of Flycatcher territories to date are in stands dominated by native vegetation, Flycatchers within the action area are increasingly moving into saltcedar as EBR elevation drops and the native vegetation dies. This has been documented in the action area as late as 2015. Therefore, the combined effects of lower reservoir elevations during dry periods, die-off of native vegetation, Flycatchers moving into saltcedar-dominated habitat, and colonization of the beetle must be determined. Flycatcher nest desertion, abandonment, and subsequent reduced productivity have been shown along the Virgin River in Nevada (McLeod and Pellegrini 2014) and Utah (Dobbs et al. 2012).

Moreover, the information cited in the BO in regard to the Flycatcher is out of date. On page 13, the BO states that there are 288 known flycatcher breeding sites in California, Nevada, Arizona, Utah, New Mexico, and Colorado holding an estimated 1,299 territories and cites Durst et al. (2008). At least nine breeding seasons have come and gone since that publication. The numbers of breeding sites and territories cannot possibly be the same today as they were in 2007 when the breeding estimates were generated. Reliance on a data set almost a decade old for a neotropical migrant species that is known to display variable numbers in breeding territories from one year to the next is questionable. While the data from a decade ago is interesting, those data should

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[16] It is not known what will happen when the two species meet in the EBR area in 2016. The two species are known to hybridize, but with <40% F2 egg viability and also reduced F2 female survival (Bean et al. 2013). At EBR in 2016 and beyond, hybridization is a possibility; competitive exclusion or coexistence are other possibilities. The effects of each of those scenarios on saltcedar in the area are unknown.

not be used to estimate current demographics for the species. The Service should make the effort to update the Flycatcher numbers with more current information.

36 Finally, both the BO and BA fail to adequately address climate change and predicted impacts of climate change to water resources and the biological species, beyond the three model predictions. Specifically, the analysis in the BA does not adequately address the significance of predicted climate change to the region on water resources (e.g., Llewellyn and Vaddey 2013) and special status species.

*General Comments on the BA Analysis*

General comments on the BA are summarized below. Attached in Appendix A are additional comments related to the ESA analysis in the BA and DEIS.

37

1. The Rincon and Mesilla Basins Hydrological Model used to predict the hydrologic response to three different climate scenarios, which were then used to predict project effects to special status species, is not adequately described or referenced in this BA. There is essentially no information about the model, why it was chosen, or how the output relates to climate models for the region. Again, without this information the public cannot meaningfully review the analysis in the DEIS.

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2. Project effects focus on high or low water levels in EBR, but they do not address the temporal dynamics of water level fluctuations. Reservoir shorelines are known to be areas of constant disturbance from water level fluctuations, and it is the dynamics of those fluctuations that affect vegetation that provides habitat to special status species. The BA fails to address such disturbance dynamics (e.g., Hill et al. 1998), focusing instead only on inundation or recession effects.

3. The effects of sedimentation in the delta reach of EBR when reservoir levels are high is not addressed relative to the effects of Rio Grande sediment aggradation on changing aquatic and riparian habitats in the delta.

### G. Reclamation's Socioeconomic Modeling is Biased

Reclamation refused to provide the IMPLAN model utilized for the socioeconomic modeling conducted for the DEIS, stating that the IMPLAN model was proprietary. The Commission's April 7, 2016 written comments dispute Reclamation's assertion that the IMPLAN model is proprietary.[17] *See* 40 CFR § 1502.21 ("Material based on proprietary

[17] The USDA Forest Service in the mid-70s developed IMPLAN for community impact analysis. The current IMPLAN input-output database and model is maintained and sold by Minnesota IMPLAN Group,

data which is not itself available for review and comment shall not be incorporated by reference."); *see also* 43 CFR § 46.135(c) (requires that publications incorporated into a NEPA analysis by reference "be readily available for review" or "be made available for review.") The Commission continues to assert this position and Reclamation's failure to provide the model again severely hinders review of the DEIS.

39 The DEIS does contain a high-level description of the IMPLAN Model and its application to the study. DEIS, pgs. 4-74 and 4-75. While this discussion is helpful, it is not adequate to facilitate meaningful review of the analysis of the effects of each of the alternatives on the regional economy. It is not possible to conduct a substantive and meaningful review of the regional economic impact analysis without being provided the IMPLAN model and all of the input files, input parameters, output files, and post-processing analyses.

IMPLAN is a regional model that has been used to assess the effect on the regional economy that results from a particular action. The mechanism that is used in IMPLAN to estimate the effect on the regional economy from a local action is based on assumed interrelationships between various economic activities in the regional economy and the multipliers that are used to estimate the effect of one activity on another facet of the economy. The relationships and multipliers used in the IMPLAN model are based on a snapshot in time; in this case, 2013 for the analysis described in the DEIS. These detailed data and assumptions used in IMPLAN modeling must be provided in order to allow for a meaningful review the economic analysis.[18]

Although details of the IMPLAN model and all of the associated input and output files were not provided, the following initial comments on the economic analysis and modeling were developed based on the limited description of the results that were provided on pages 4-70 through 4-93 of the DEIS.

1. *Local Economic Impacts*

It was assumed in the EIS modeling that reductions in Project water deliveries to EBID can be fully offset by increased pumping. Therefore, the economic impacts of reduced Project deliveries to EBID are computed based on increased pumping costs. The increased pumping costs averaged $30.88 per acre-foot pumped and $20.54 per acre-

Inc. The Commission does not dispute that it may need to purchase a software license to run the IMPLAN model, however, the inputs and outputs to the model are not proprietary.

[18] Also significant is the geographic area that is analyzed in the model, which without the input files the Commission cannot determine from the material provided in the DEIS. The magnitude of the regional impacts can be affected by the extent of the study area. According to the description on page 4-74 (lines 2405-2408) of the DEIS, the IMPLAN analysis is based on data for "counties encompassing the study areas." It is unclear which specific counties this includes. Again, without more specific information on geographic areas selected for the analysis it is impossible to conduct a complete analysis of the socioeconomic results in the DEIS.

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foot of reduced diversions. These figures were derived from the results shown on pages 4-88 and 4-89 as summarized in the attached Table 1.

Analysis of changes in Project supply to the El Paso Valley portion of the EPCWID was analyzed differently. It was assumed that there is no significant irrigation pumping in Texas, and therefore the economic impacts of changes in Project supply to EPCWID were computed based on the total value of water for irrigation or municipal use. The estimated value of water in the El Paso Valley was estimated at $112 acre-foot for irrigation (page 4-73, line 2308) and $574 per acre-foot for municipal use (page 4-73, line 2319). The average computed value of water in the El Paso Valley was $130 per acre-foot of changed diversions. This amount was derived from the results shown on pages 4-89 and 4-90 as summarized in the attached Table 2.

The disparity in the computed value of Project water in the El Paso Valley compared to the increased pumping costs in EBID results in a significant difference in the value of project water between Districts, and consequently the economic analysis favors reductions in Project supply to EBID over reductions to EPCWID. The difference in computed value of Project water between EBID and EPCWID is largely due to the assumption that there is no significant irrigation pumping in the El Paso Valley, and therefore El Paso Valley farmers could not pump to replace reductions in Project supply. This assumption is contradicted by various reports and data sources that indicate there is substantial irrigation pumping in the El Paso Valley. Again, a list of reports that describe the irrigation pumping in the El Paso Valley is provided in Attachment C.

The Texas Water Development Board ("TWDB") maintains a database of wells in the State. Information from this database was downloaded and summarized as shown in Figure 1. The information in the foregoing reports and in the TWDB database indicates there is substantial irrigation pumping in the El Paso Valley, and therefore the assumption that farmers could not pump to replace reductions in Project supply is unreasonable.

2. *Regional Economic Impacts*

As described above, the impacts of the five alternatives on the regional economy were analyzed using the IMPLAN model. The IMPLAN model results were reviewed to assess the regional economic impacts as a percentage of the direct impacts in EBID compared to those in the El Paso Valley portion of EPCWID. This comparison was performed by tabulating the difference in economic impacts between Scenario 5 versus Scenario 1 for the P50 condition as follows.

According to the description in the DEIS, the economic impacts on the regional economy are comprised of two components; (a) Impacts on Labor Income, and (b) Impacts on Economic Output.

The following is a summary of the regional economic impact in EBID. The average annual change in regional economic impacts on **EBID** for Scenario 5 compared to

Scenario 1 was tabulated from page 4-93 as follows (the positive value means that Scenario 5 would positively affect the economy in the Rincon-Mesilla Valleys compared to Scenario 1):

- Labor Income = $0.269 million
- Economic Output = $0.865 million
- Total Regional Impact = $1.134 million
- Direct Impact = $1.3 million
- **Regional Impact (%Direct) = 87%**

The following is a summary of the regional economic impact in the El Paso Valley portion of EPCWID. The average annual change in regional economic impacts on **EPCWID** (Ag + Municipal) for Scenario 5 compared to Scenario 1 was computed as follows (negative value means Scenario 5 would negatively affect the regional economy in the El Paso Valley compared to Scenario 1):

- Labor Income = -$2.347 million
- Economic Output = -$7.484 million
- Total Regional Impact = -$9.832 million
- Direct Impact = -$4.2 million
- **Regional Impact (%Direct) = 234%**

41 The difference in regional economic impacts (expressed as a % of direct impacts) is substantial (234% vs. 87%) and was not explained in the DEIS.[19] This difference increases the disparity between how the DEIS valued water in the El Paso Valley vs. EBID. As far as the Commission can determine without the information requested on the IMPLAN model, this disparity appears extremely biased. Such a biased finding again demonstrates Reclamation's failure to take a hard look at the environmental effects of the 2008 Operating Agreement. Moreover, because the IMPLAN model and the associated input and output files were not provided, it was impossible to understand why the regional economic impacts were so different between the EBID and the El Paso Valley in EPCWID. Again, Reclamation has not provided the public with a chance for meaningful review of this issue.

[19] Also, as discussed above in Section III.B., EBR operations are greatly impacted by the 2008 Operating Agreement and can have negative impacts on the reservoir fishery and recreation, at the minimum. These are regional economic impacts that should have been accounted for in this modeling.

## V. Reclamation has Failed to Provide Necessary Information

As noted throughout these comments, Reclamation has failed to provide necessary information needed to conduct a full, meaningful review of the DEIS. This is despite numerous requests by the Commission for such information. Below is a list of the requests made by the Commission and Reclamation's response, if any.

- April 1, 2016 (Attachment G) – The Commission requested the BO, the IMPLAN model used for the socioeconomic modeling, certain hydrologic modeling information, and references listed in the DEIS that did not contain websites and the Commission could not easily locate.
    - April 6, 2016 (Attachment J) - Reclamation partially responded by providing the digital appendix files from the DEIS Appendix A and B along with some of the references the Commission had requested. Reclamation refused to provide the IMPLAN model, asserting that it was proprietary. Reclamation also did not provide the BO, stating that it would notify the Commission when the BO was publicly available.
- April 7, 2016 (Attachment B) – The Commission requested, both verbally through statements made at the public hearing held in Albuquerque, New Mexico, and in writing, additional hydrologic modeling information (as described in more detail above), renewed its request for the BO, and disputed Reclamation's claims that the IMPLAN model is proprietary. Reclamation never responded.
- April 13, April 20, and May 5, 2016 (Attachment H) - The Commission reiterated the requests made April 7, 2016. Reclamation never responded.

By not supplying the requested information, or providing it at such a late date, Reclamation has failed to act in a transparent manner and to provide the Commission and the general public with a meaningful disclosure of the materials necessary to review the DEIS and therefore examine comprehensively the environmental impacts of the 2008 Operating Agreement. We request, again, that this information be provided and that the public comment period be reopened for a reasonable time thereafter to allow further review and input on these issues or for a supplemental draft environmental impact statement to be issued for comment, along with all necessary supporting documentation.

## VI. Conclusion

For the reasons discussed above, the DEIS does not meet the requirements of NEPA. First, Reclamation predetermined the outcome of the NEPA analysis in the DEIS and then failed to provide the public with an opportunity for meaningful review by withholding information vital to understanding the analysis in the DEIS. Reclamation also failed to

adequately examine the full range of alternatives and unreasonably limited the scope of its review. Finally, Reclamation's analysis does not meet the hard look standard required of all federal agencies undertaking a proposed action.

The Commission is hopeful that its feedback will assist Reclamation in making a more informed decision regarding the 2008 Operating Agreement. Due to the significance of the issues the Commission has raised with the DEIS, we respectfully request that Reclamation either (1) provide the information and analysis requested by the Commission and reopen the comment period for a reasonable time thereafter to allow for true meaningful review of the DEIS, or (2) issue a supplemental draft environmental impact statement and supporting documentation with adequate time for public comment.

Please contact Kim Bannerman at (505) 827-4004 or kim.bannerman@state.nm.us if you have questions regarding our comments.

Sincerely,

Deborah K. Dixon, P.E., Director
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DKD\kmb

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Steve Farris, New Mexico Attorney General's Office
Jennifer Faler, Reclamation
Wally Murphy, U.S. Fish and Wildlife Service
Jay Stein, Las Cruces Attorney
Jorge Garcia, Las Cruces Utilities Manager

Attachment
A

# NEW MEXICO INTERSTATE STREAM COMMISSION

**COMMISSION MEMBERS**

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SCOTT A. VERHINES, Secretary, Santa Fe
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February 14, 2014

U.S. Bureau of Reclamation
Albuquerque Area Office
555 Broadway NE, Suite 100
Mail Stop: ALB-103
Albuquerque, NM 87102

**Submitted Via Email to: rgraham@usbr.gov**

**RE: Comments on the Scoping for the Environmental Impact Statement for the Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project, New Mexico and Texas**

To Whom It May Concern:

The New Mexico Interstate Stream Commission ("NMISC") submits the following comments on the environmental impact statement ("EIS") for the continued implementation of the 2008 Operating Agreement for the Rio Grande Project, New Mexico and Texas (the "2008 Operating Agreement"). The notice of intent to prepare the EIS and announcement of public scoping meetings was published in the Federal Register, Vol. 79, No. 10 on January 15, 2014. The NMISC has a vital interest in the EIS because the 2008 Operating Agreement has had, and will continue to have, major effects on water users in New Mexico and relates to the Rio Grande Compact between Colorado, Texas and New Mexico (the "Compact").

For the reasons highlighted below, and as set forth in our earlier comments to the U.S. Bureau of Reclamation ("BOR") on the EIS, the NMISC continues to have fundamental objections regarding the EIS.

## I. Previous Communications Regarding the EIS and Related Analysis

The NMISC has communicated in depth with the BOR on environmental compliance for the 2008 Operating Agreement. For instance, although the inadequate public notice kept us from timely participating before issuance, we later commented extensively when: (1) the BOR inappropriately and illegally applied its Finding of No Significant Impact ("FONSI") and environmental assessment for a 2007 Operating Agreement ("2007 EA") to the 2008 Operating Agreement; (2) when the BOR conducted the first environmental assessment for the 2008 Operating Agreement in 2013 and inappropriately termed it a supplemental environmental assessment ("SEA") based on the erroneously conducted 2007 EA, and; (4) prior to issuance of

the notice for scoping of the EIS, the NMISC communicated with BOR regarding the scope of the EIS. We do not intend to duplicate those comments in detail here. However, as many of those comments are pertinent to the scope of the current EIS, we have attached the following correspondence:

1. June 6, 2013 letter from NMISC to Jim Wilber, BOR;
2. October 30, 2013 letter from BOR to Scott Verhines, New Mexico State Engineer;
3. December 6, 2013 letter from NMISC to BOR, and;
4. January 17, 2014 letter from BOR to NMISC.

Moreover, NMISC staff attended the public scoping meeting in Albuquerque, NM on January 30, 2014, on the current EIS ("Albuquerque scoping meeting") and NMISC staff and contractors previously attended public meetings on the SEA.

## II. General Comments

The BOR was required under the National Environmental Policy Act ("NEPA") to have conducted a review of the 2008 Operating Agreement, which was a discretionary federal action, prior to taking that action, i.e., executing the Agreement. In conducting this after-the-fact review, the BOR has made a series of changing decisions related to studies of the 2008 Operating Agreement. For example, BOR did not perform proper NEPA analysis or conduct required public comment procedures for the 2008 Operating Agreement until the SEA was issued in June 2013. Until that time, the BOR maintained that the 2007 EA and FONSI was sufficient to meet NEPA requirements. Yet, the SEA described the 2008 Operating Agreement very differently than the 2007 EA. The SEA did admit some of the foreseen and now unfolding consequences of the 2008 Operating Agreement, but did not remedy those consequences. From preliminary communications regarding the scope of the EIS and the Albuquerque scoping meeting, the scope of the EIS again looks very different from either the SEA or the 2007 EA. This is especially true of the inclusion of the San Juan Chama Project ("SJCP") storage contracts in Elephant Butte Reservoir (the "Reservoir") within the scope of this EIS. This ongoing series of changing decisions makes it impossible for the NMISC, other affected public entities like the City of Las Cruces, and the general public to track an understandable BOR position on NEPA compliance for the initial federal action and continued operations of the Rio Grande Project (the "Project").

More importantly, the BOR's positions and actions have demonstrated that it has already determined the outcome of the EIS, in violation of NEPA. The BOR irretrievably committed to a course of action before engaging in a valid NEPA process. BOR signed the 2008 Operating Agreement on March 10, 2008 and only now, almost six years later, is drafting an EIS on that major federal action. The Council on Environmental Quality Regulations on NEPA ("CEQ Regulations") expressly state that an EIS "shall serve as the means of assessing the environmental impact of proposed agency actions, rather than justifying decisions already made." 40 C.F.R. § 1502.2(g) (2004) (emphasis added). All of the BOR's actions indicate the EIS is merely an attempt to justify the 2008 Operating Agreement after the fact, which the BOR continues to implement despite failing to conduct proper environmental review. While now acknowledging such review is required, the BOR nevertheless proposes to continue implementing the 2008 Operating Agreement in the interim.

In addition, the BOR's ongoing operations under the 2008 Operating Agreement are an express violation of NEPA because an EIS must precede implementation of major federal actions significantly affecting the human environment. The BOR's NEPA compliance handbook states in section 11.5., "Doing NEPA on Decisions Already Made—NEPA compliance is required before any discretionary Federal action with potentially significant environmental impacts is initiated. Decisions should not be made without full compliance with NEPA. To do this is illegal and a violation of NEPA." BOR's NEPA Handbook at 11-4 (2012) (emphasis added).

Finally, the BOR has continually ignored the concerns of entities affected by the 2008 Operating Agreement. For example, the concerns and comments of the City of Las Cruces have not been addressed by the BOR. Furthermore, the City of Las Cruces has never been asked to be a cooperating agency.

## III. Baseline for Analysis and Modeling

To date, the BOR has not provided specific information on the baseline for its analysis of the environmental changes caused by the proposed action or its alternatives as identified in the EIS or the modeling tools it will use to conduct its analysis. The BOR is now planning to scope and prepare an EIS to analyze the environmental effects of the remainder of the 50-year term of the 2008 Operating Agreement while also analyzing SJCP storage in the Reservoir. In conducting the current review, the prior environmental review for the 2007 EA and SEA, the BOR has never reverted to its pre-2008 Operating Agreement operations, and thereby continuing to change the environmental baseline. By proceeding with the NEPA process while continuing to operate the Project under the terms of the 2008 Operating Agreement, the BOR has biased the baseline information for the EIS evaluation and violated NEPA's prohibition against predetermined outcomes. *Forest Guardians v. U.S. Fish & Wildlife Service*, 611 F.3d 692, 713 (10th Cir. 2010) ("[I]f an agency predetermines the NEPA analysis by committing itself to an outcome, the agency likely has failed to take a hard look at the environmental consequences of its actions due to its bias in favor of that outcome and, therefore, has acted arbitrarily and capriciously.") (citing *Davis v. Mineta*, 302 F.3d 1104 (10th Cir. 2002)).

Furthermore, the baseline analysis used by the BOR in the past has many flaws that the NMISC previously communicated to BOR. In the SEA, there are substantial technical issues associated with the no-action baseline analysis used. There are demonstrably false assumptions (e.g. that the Elephant Butte Irrigation District historically ordered all the water it was allocated) and a problematic initial condition (the year used was 2007, by which time the Project operations had already been modified ad hoc by BOR from historic operations as then described in the 2007 EA). Accordingly, these baseline assumptions and analysis should be reconsidered and rigorously evaluated in the EIS.

The NMISC still needs additional information regarding the full scope of the modeling effort underway for analysis of the 2008 Operating Agreement. Although the NMISC staff specifically asked for this information at the Albuquerque scoping meeting, we were told that the BOR representatives present did not know the answer, and in any event that no information on the specifics of the model will be released until the model report is published. The model will be the central element of the BOR's analysis and is vital to determining if the scope of the EIS is

correct. Again, it is impossible to comment on whether the modeling effort is adequate without additional information. NMISC again requests disclosure of the specific models, modeling tools, and relevant data sets for surface water and groundwater quantity and quality.

The NMISC has considerable expertise in surface water and groundwater modeling and would like to be included in any technical advisory committee or other stakeholder group created for the EIS analysis.

## IV. Diversion Ratio

The BOR admits that the 2008 Operating Agreement introduces a new and significant factor in water allocation calculations. Regardless of the rationale for the changes, the 2008 Operating Agreement decreases Elephant Butte Irrigation District's ("EBID") allocation and creates real or apparent reductions in the Project performance, as quantified by the "diversion ratio". The effect of each individual factor that affects the diversion ratio should be evaluated and quantified. Specifically, and discussed more in depth below, the evaluation of the 2008 Operating Agreement must: (1) quantify the effects of groundwater pumping in Texas and Mexico (not just in New Mexico) in both the Mesilla and Hueco Basins; (2) examine changes in Project measurement, reporting, and accounting practices since the D1/D2 period[1]; and, (3) quantify the amount by which EBID's allocation has been reduced as a result of these impacts.

In line with this analysis, EBID's allocation under the 2008 Operating Agreement in full-supply years must be quantified. Since this allocation is less than the amount needed to supply the irrigated acreage in EBID, as BOR admits, the 2008 Operating Agreement necessarily results in increased irrigation well pumping within EBID. The BOR admits the proposed action encourages increased groundwater pumping but fails to propose any real analysis of those effects and its cumulative impacts on the human environment.

## V. Surface Water Allocations

At the Albuquerque scoping meeting, the information provided by BOR indicates that one of the issues to be analyzed in the EIS is the surface water allocations made to the irrigation districts affected by the 2008 Operating Agreement - EBID and the El Paso County Water Improvement District No. 1 ("EP No. 1"). The BOR's vague statement on analysis of surface water allocations to EBID and EP No. 1 provides no indication of how this analysis will be conducted.

To truly demonstrate the effects of the 2008 Operating Agreement on the two irrigation district's surface supply, the BOR must review and evaluate pre-2008 Operating Agreement distribution of Project water. The BOR indicates that its analysis will include pumping from the D1/D2 period. However, its analysis does not appear to use that time period as the baseline. If this is BOR's intent, it should analyze the period from 1951 to 1978 as its pre-2008 Operating Agreement distribution. The NMISC specifically requests that the BOR evaluate the impact of the 2008 Operating Agreement on the historic distribution of the Rio Grande Project water in equal amounts to all irrigable land within the Project; that is, based on irrigable acreage within the Project, the historic and equal distribution is 57% to EBID and 43% to EP No. 1.

[1] The D1/D2 time period is defined as 1951 through 1978.

## VI. Groundwater

In the materials presented during the public scoping meeting in Albuquerque, the BOR states that as part of the EIS it plans to analyze groundwater levels, recharge, and groundwater pumping in the Rincon and Mesilla Basins. At that meeting, NMISC staff asked the BOR representatives whether these same issues would be examined in the Texas portion of the Project area. BOR staff stated that at this time the Texas portion had not been considered in the modeling effort. The Project extends many miles into Texas in the Hueco Basin and two of the Project's 5 diversion dams are located in Texas. Moreover, Mexico's use of groundwater also has impacts on the Project and, accordingly, also effects of the 2008 Operating Agreement. The NEPA requires review of the entire affected environment, and does not allow the BOR to only review parts of the human environment impacted. *See* 40 C.F.R. §§ 1502.4(a) & 1502.15 (2004). The federal action, i.e., the 2008 Operating Agreement, affects the entire Project area and the area receiving tail water, Hudspeth Irrigation District, and, therefore, the EIS must include the Texas portion of the Project, Hudspeth, and the impact of Mexico's groundwater use.

## VII. Alternatives Evaluation

The CEQ Regulations require the BOR to "[r]igorously explore and objectively evaluate all reasonable alternatives." 40 C.F.R. § 1502.14(a) (2004) (emphasis added). The CEQ Regulations also state that "[a]gencies shall not commit resources prejudicing selection of alternatives before making a final decision." *Id.* at § 1502.2(f). In the recently completed SEA, only two alternatives were considered, "no action" and continued implementation of the EA. In the final SEA Response to Comments NM-009, BOR concludes that consideration of other alternatives is not reasonable because implementation of any alternative other than the proposed action would require renegotiation of the 2008 Operating Agreement and the related settlement agreement. First, this appears to be evidence that the BOR has taken action and committed resources that clearly prejudice its selection of alternatives in the EIS. Furthermore, this response is untrue and inadequate.

According to the SEA, the 2008 Operating Agreement describes how the BOR allocates water between EBID, EP No. 1 and Mexico. However, based on the statement in the SEA Response to Comments NM-009, the BOR now alleges no control over the document that governs its actions related to the Project. The BOR has more authority to change the 2008 Operating Agreement than it states. The BOR is a signatory to the 2008 Operating Agreement, which specifically includes a provision allowing for modification of the agreement (Paragraph 6.7). Thus, these additional alternatives are within reason as the BOR has the ability to work to negotiate the additional alternatives with the other parties to the 2008 Operating Agreement. Moreover, even if the alternative were outside the legal jurisdiction of the BOR, the Council on Environmental Quality's guidance document, "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations", specifically states that "[a]n alternative that is outside the legal jurisdiction of the lead agency must still be analyzed in the EIS if it is reasonable. A potential conflict with local or federal law does not necessarily render an alternative unreasonable . . . .". 46 Fed. Reg. at 18026-01. Thus, the BOR is required to examine these alternatives even if it does not think it has the legal authority to implement them. Again, asserting that the BOR has absolutely no authority to alter anything within the 2008

Operating Agreement further demonstrates that it has already pre-determined the outcome of the EIS, in violation of NEPA.

To comply with NEPA and CEQ Regulations, the EIS should consider more than the two alternatives examined in the SEA. There are numerous reasonable alternatives to the proposed action, including: (1) inclusion of a no carryover storage provision in the 2008 Operating Agreement in accordance with historic operations; (2) adding carryover storage for actual conservation (i.e., as measured by reduction in agricultural depletions); (3) removing credits and charges and using actual deliveries of water in accounting; (4) requiring BOR to consider impairment actions against groundwater pumpers in Texas and New Mexico whenever it suspects groundwater pumping is depleting Project supply; (5) a different allocation of water within the 2008 Operating Agreement; (6) accounting fairly for changes in Project efficiency caused by climate change; (7) including a full technical and legal analysis of how the 2008 Operating Agreement effects Compact credit water accounting, and; (8) bringing the allocation committee into compliance with the Federal Advisory Committee Act, 5 U.S.C. App. §§ 1-15 . All these reasonable alternatives should be examined. *See Davis v. Mineta*, 302 F.3d 1104, 1118-19 (10th Cir. 2002) (holding that the NEPA analysis conducted for a highway project was inadequate in part for failing to examine "reasonable alternatives to the Project").

## VIII. 2008 Operating Agreement Carryover Provision Impact

The effects of the carryover accounts provided for in the 2008 Operating Agreement need to be examined very carefully in the EIS.[2] Project carryover accounts do not fully correspond to water in reservoir storage, in part due to the failure of the 2008 Operating Agreement to account for evaporation of these accounts, and, in part due to Project accounting credits. As a result, since 2006, some quantity of water flowing into the Reservoir has been sequestered directly into these carryover accounts to make up for this discrepancy. As an effect, this inflow was not made available for allocation between EBID and EP No. 1. The net effect of these issues on allocation to both EBID and EP No. 1 should be quantified in this analysis.

In addition, the NMISC has the following questions and comments related to review of the carryover provisions:

(1) The BOR must critically examine the effects to Articles VII and VIII of the Compact in its evaluation of carryover; the additional amount of water New Mexico would need to deliver to the Reservoir to meet compact delivery obligations; and, the effects on upstream storage in post-Compact reservoirs that result when all allocation and carryover is called for by EBID and EP No. 1 in a given year.

(2) The BOR, the NMISC, and others are engaged in addressing endangered species compliance issues in the Middle Rio Grande. Because of the linkage in the Compact of Project storage operations to upstream reservoirs operations, changes in Project operations may have an impact on the ability of BOR to meet its middle Rio Grande endangered species obligations

[2] Current Congressional authorization for the Project does not allow for this type of storage, so Congressional authorization for this major change is required.

and, potentially, its tribal trust responsibility to Pueblos and Tribes. The EIS should evaluate these issues.

(3) Under the Compact, New Mexico bears all evaporative losses of the Rio Grande water (i.e., non San Juan Chama water) in the Reservoir. The BOR must evaluate the impact of the 2008 OA on New Mexico's obligations under the Compact due to increasing Reservoir evaporative loss?

## IX. Endangered Species Issues

The BOR has articulated inconsistent and mutually exclusive positions on whether this EIS will include analyses of impacts to affected endangered species and their habitat. For example, Mike Hamman's October 30, 2013 letter to the Compact Commissioner's for New Mexico, Texas and Colorado indicated that Endangered Species Act ("ESA") issues, including Southwestern Willow Flycatcher ("SWFL") will be considered in the EIS. The materials presented at the public scoping meeting stated that the SWFL, Western yellow-billed cuckoo, silvery minnow and meadow jumping mouse will all be analyzed in the EIS. However, in its January 17, 2014 letter to the NMISC, the BOR stated that SWFL critical habitat is outside the scope of the EIS. Moreover, in the SEA, the BOR examined the effects on two species it has not mentioned in relation to the EIS; the interior least tern and the piping plover. Does the BOR intend to examine these same species here? The BOR should clarify its position relative to review of the species in this EIS.

According to the CEQ Regulations, the BOR is required to include discussion of environmental effects, including ecological effects. 40 C.F.R. § 1502.16 (2004). Accordingly, all of these species should be examined in depth, including, as discussed above impacts on upstream storage due to the 2008 Operating Agreement, and resultant effects on the species in the middle Rio Grande valley.

## X. Water Quality Issues

The BOR acknowledges the interconnection between groundwater and surface water, yet it has not adequately analyzed the effects of the 2008 Operating Agreement on water quality. The EIS must consider the impact of reduced water allocation on the water quality of surface water in New Mexico. The BOR must also evaluate and quantify the impact of reduced surface water allocation and the consequential increased groundwater pumping on groundwater quality in New Mexico and Texas (if any) and any resulting salinization of Project lands. Groundwater quality modeling should be performed to evaluate impacts of pumping on water quality in the future.

## XI. Inclusion of the San Juan Chama Project Storage Contracts

In its January 17, 2014 letter to the NMISC, as well as in the materials available at the public scoping meetings, the BOR asserts that the SJCP storage contracts are included in the EIS because they are "similar actions". Without agreeing that the contracts are similar actions, the NMISC asserts that the CEQ Regulations specifically preclude inclusion of those contracts in the EIS. The CEQ Regulations require that a federal agency "[i]dentify and eliminate from detailed study the issues which are not significant or which have been covered by prior

environmental review." 40 C.F.R. § 1501.7(a)(3) (2004) (emphasis added). The Albuquerque Bernalillo County Water Utility Authority ("ABCWUA") SJCP contract has already been covered by a prior environmental review, as evidenced by the Environmental Assessment issued for the contract in January 2010. As part of the assessment, a FONSI was issued. *See* http://www.usbr.gov/uc/albuq/envdocs/ea/bernalillo/sjc/index.html. Accordingly, the ABCWUA SJCP storage contract has already been covered by prior environmental review, and, even if determined to be similar, according to the CEQ Regulations should be eliminated from the scope of the EIS.

Similarly, the City of Santa Fe SJCP storage contract should also be eliminated from review in the EIS. The full effect of the Santa Fe storage contract was included in the Environmental Assessment and FONSI issued for the ABCQUA SJCP contract. Thus, it too has been covered by prior environmental review and the CEQ Regulations require it to be eliminated from review here.

## XII. NMISC Inclusion in Technical or Stakeholder Committees

As indicated by separate letter to Mike Hamman, for many of the reasons outlined above, the NMISC will not be a cooperating agency in the EIS. However, the NMISC offers special expertise in matters related to water management in the lower and middle Rio Grande and, the NMISC, is the only entity that can fully represent the Compact issues in the lower Rio Grande as they relate to New Mexico. The NMISC hereby requests to be included in any technical and stakeholder subcommittees that may be assembled regarding the EIS.

Thank you for the opportunity to comment on the scope of the EIS.

Sincerely,

Estevan R. López, P.E., Director
New Mexico Interstate Stream Commission

ERL/kmb/lmt

Attachments

cc: Mike Hamman, BOR
Steve Farris, New Mexico Attorney General's Office
Sarah Bond, New Mexico Attorney General's Office
Rolf Schmidt-Petersen, NMISC Rio Grande Bureau Chief
Amy Haas, NMISC General Counsel
Kim Bannerman, NMISC Attorney, Lower Rio Grande

**Attachment**
**B**

# NEW MEXICO INTERSTATE STREAM COMMISSION

**COMMISSION MEMBERS**

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To: Bureau of Reclamation Staff
From: New Mexico Interstate Stream Commission
Date: April 7, 2016
Re: Information Request - Draft EIS for 2008 Operating Agreement

Biological Opinion

In its March 31, 2016 letter the New Mexico Interstate Stream Commission (NMISC) requested the Biological Opinion (BO) issued by the U.S. Fish and Wildlife Service and supporting data from which the analysis in the Biological Opinion was developed. The NMISC noted that the Notice of Availability published March 18, 2016 stated that the BO is available at http://www.fws.gov/southwest/es/NewMexico/ES_bio_op.cfm, however, the document was not located on the link.

In its response to the March 31, 2016 letter, Bureau of Reclamation (Reclamation) staff again failed to include the BO. The response stated that the URL link was included in the Notice of Availability merely to "share where the document *would* be posted." The document is still not posted to the given link. Moreover, the NMISC requested the BO from the U.S. Fish & Wildlife Service and was again denied access. This document is an integral part of the Draft EIS and should be released to the public immediately.

IMPLAN Model

In its March 31, 2016 letter the NMISC also requested the IMPLAN model utilized to analyze the socioeconomic environmental consequences of the five alternatives, including all input and output files. Specifically the NMISC requests the model, all input and output data and files, and all post-processing files and analyses. In its response, BOR staff asserted that the IMPLAN model and data are proprietary and that the output and input were adequately described in the Draft EIS. The NMISC does not argue that the IMPLAN software is proprietary as described on their website and purchase of a software license may be necessary to run the model. That is not the issue.

The assumptions made in the model cannot be reviewed in a meaningful manner without access to the model utilized in the Draft EIS. Merely stating the outputs of the model does not allow analysis of the various assumptions that go into any economic model. Again, this model is an integral part of the Draft EIS and should be released to the public immediately.

Additional Hydrologic Model Information

The NMISC thanks BOR for release of the model files requested in the March 31, 2016 letter. Based on our initial review of the model the NMISC requests the following additional information related to the model:

1. Model Enhancements - All computer files, source code, and documentation for all "new features" and "enhancements" to the MODFLOW-OWHM Model that were made in developing the Rincon and Mesilla Basins Hydrologic Model ("RMBHM"), including those described in the Addendum section of Technical Memorandum No. 86-68210-2015-05, Simulation of Rio Grande Project Operations in the Rincon and Mesilla Basins: Summary of Model Configuration and Results ("RMBHM Technical Memo") (see pages 55-58).

2. Model Calibration - All model files, input and output files, PEST input and output files, post-processing spreadsheets, statistical analyses, and documentation related to parameterization, correlation, and calibration of the RMBHM, including all comparisons of historical data and simulated data at monthly, seasonal, annual, and other time intervals. This includes comparisons that were documented in the RMBHM Technical Memo and all other available comparisons. (see pages 18-21 of the RMBHM Technical Memo).

3. Model Sensitivity Analyses - All model files, input and output files, post-processing spreadsheets, statistical analyses, and documentation related to the sensitivity analysis that were conducted using the RMBHM. (see pages 19-20 of the RMBHM Technical Memo).

4. GIS Files - All GIS files related to or used in developing the RMBHM, and displaying spatial information and results from the model.

5. Hydrologic Inputs to Model – All computer files and analyses related to all hydrology and climate inputs to the RMBHM, including (a) historical data used in calibrating the model and (b) projected future data used in the MBHM simulation runs for the 5 alternatives described in 2016 Draft EIS. This includes all of the downscaled temperature and precipitation projections from global climate models, all hydrologic modeling to develop projects of future streamflow at selected locations within the Rio Grande Basin, including analyses performed with the Upper Rio Grande Simulation Model (URGSiM) (see pages 22 – 28 of the RMBHM Technical Memo)

Again the NMISC asks you please provide all the requested information in electronic format, if available, to Kim Bannerman at kim.bannerman@state.nm.us. If you do not have the information electronically, please send a hard copy to her at the address listed above.

Thank you for your time and attention.

## ATTACHMENT C

REFERENCES FOR TEXAS GROUNDWATER PUMPING

1. Blair, A. 2011. Rio Grande Alluvium Aquifer in El Paso County, Texas. Presentation for CLE Law of the Rio Grande in Santa Fe, New Mexico.

2. International Boundary Water Commission, November 1989. Ground Water Conditions and Resources in El Paso/Juarez Valley. Prepared by Hydraulics Branch, Planning Division, U.S. Section.

- Table IV-4 (p.30; PDF p. 35) - Estimated average irrigation pumping 43,360 af/y ranging from 3,000 af/y (1970) to 130,140 af/y (1964) from 1950 – 1984 by IBWC (1950 – 1953 and 1974 – 1984) and Texas Department of Water Resources (1954 – 1973)

3. Texas Department of Water Resources, June 1980. Ground-Water Development in the El Paso Region, Texas with Emphasis on the Lower El Paso Valley, Report 246, by Henry J. Alvarez, and A. Wayne Buckner.

- Table 1 (report p.8) – Ground Water Pumpage From the Hueco Bolson and Rio Grande Alluvium In and Adjacent to the Lower El Paso Valley, Texas, and Ciudad Juarez Chihuahua, 1954 – 1973

4. Texas Water Development Board and New Mexico Water Resources Research Institute, October 1997. Transboundary Aquifers of the El Paso/Cuidad Juarez/Las Cruces Region. Prepared for U.S. Environmental Protection Agency, Region VI. Prepared in Cooperation with Comision Nacional Del Agua, Junta Municipal de Agua y Saneamiento de Ciudad Juarez, International Boundary and Water Commission, and Comision International de Limites y Aguas.

- Several references to Rio Grande alluvium irrigation pumping (see Chapter 5, p.102) including map of well locations and water level hydrographs

Attachment
D

# NEW MEXICO INTERSTATE STREAM COMMISSION

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April 30, 2012

VIA EMAIL

Ms. Molly Thrash
Bureau of Reclamation
Albuquerque Area Office
555 Broadway NE, Suite 100
Albuquerque, NM 87102-2352

Subject: Response to Reclamation's April 23 Email to the New Mexico Interstate Stream Commission Inviting Public "...Comment on the Scope and Concerns that should be Included in the EA" in reference to Reclamation's initiation of its 2012 Environmental Assessment of the Rio Grande Project 2008 Operating Agreement

Dear Ms. Thrash:

The New Mexico Interstate Stream Commission (NMISC) received an email from the U. S. Bureau of Reclamation's (Reclamation) Albuquerque Area Office after the close of the business day on April 23 notifying the NMISC of the public scoping meetings in El Paso and Las Cruces on April 25 and 26 and Reclamation's April 30, 2012 deadline for comments regarding the Environmental Assessment scoping. The public notice says, "The public is invited to comment on the scope and concerns that should be included in the EA."

The NMISC provided written comments to Reclamation at these public meetings and indicated it would be providing additional written descriptions of the State of New Mexico's comments regarding the scope of the federal action that is the subject of Reclamation's NEPA compliance activities. Please include the three letters I provided to you by e-mail on April 24, 2012, the written comments and attachments submitted at the public scoping meetings, and this letter as the NMISC's response to Reclamation's request for public input regarding the scope of Reclamation's current National Environmental Policy Act (NEPA) compliance effort.

## OVERARCHING CONCERNS

The NMISC has several overarching concerns regarding Reclamation's preparation of this Environmental Assessment. We note Reclamation has modified the scope of the Environmental Assessment from

Reclamation's January 2012 proposal so that it is now appears to be a NEPA compliance effort to address Reclamation's decision to continue to use the 2008 Operating Agreement for the remaining years of its 50-year term rather than for the next five years. Is that correct?

The NMISC's first overarching concern is that, to date, Reclamation has not articulated a clear statement of purpose and need for the action that is subject to NEPA analysis. What is the purpose and need of the 2008 Operating Agreement? NEPA regulations require Reclamation to be clear in stating its purpose. The clear statement of purpose and need for the action is necessary to help guide the definition of the federal action and the NEPA analysis and documentation intended to provide substantive information to the Reclamation decision-maker. Without such definition of the purpose and need for federal action, it is difficult for the public or state interests to understand if the alternatives and selected action may affect their interests and for Reclamation's technical staff to scope the technical work and analysis required for NEPA compliance. Please provide a refined statement and need as a part of the scoping report.

Second, what Federal discretionary action is Reclamation's current NEPA compliance effort intended to analyze? There isn't a clear Federal discretionary action associated with continuing to keep in place a 50-year agreement that does not expire or provide for periodic reviews. Are both the action alternative and the no-action alternative to continue with the 2008 Operating Agreement? What parts of the 2008 Operating Agreement and/or the Environmental Assessment and FONSI on the 2007 Operating Agreement require or allow for a five-year review resulting in a potential Federal discretionary action?

Third, Reclamation should evaluate the proposed federal action against the baseline of conditions that existed prior to the 2008 Operating Agreement in order to analyze the cumulative environmental and socioeconomic impacts of the federal action. An alternative to continue the water management practices that were in place before either the 2007 or the 2008 Operating Agreements were imposed would help to document these cumulative effects and would help Reclamation to foresee the future conditions these cumulative effects may cause. Will Reclamation define the baseline as the D1/D2 period (1951-1978), or the period from 1979 through 1992 before Reclamation handed over measurement and reporting responsibilities to the irrigation districts, or from that time until 2007? How will Reclamation account for the degradation of accuracy and adequacy of flow measurements, other pertinent information such as crop reports, and flow measurement and apportionment reporting that has occurred since 1992?

Fourth, will Reclamation conduct its NEPA analysis using different sets of climate conditions that represent the range of what we may experience over a 50-year time period? For example, please see the 50-year hydrologic model sequences recently developed for URGWOM. Use of those data sets in modeling analysis for the current NEPA could help Reclamation, the public, and affect stakeholders understand and address potential longer term impacts of proposed alternative operations. Mr. Bert Cortez, Reclamation's El Paso Field Division Manager, stated at the public scoping meetings that Reclamation and the districts did not plan for extended drought and the 2008 Operating Agreement does not work under extended drought conditions, as we are currently experiencing. The URGWOM sequences and modeling could help to technically address such issues.

Fifth, will Reclamation utilize factual data from the first four years of operations under the 2008 Operating Agreement to document the cumulative effects to date that Mr. Cortez identified at the scoping meetings? Please note the documents transmitted by the April 25, 2012, NMISC letter to Ms. Molly Thrash as part of the NMISC's scoping comments may help in this task.

Our sixth overarching concern relates to the specific aspects of the environment that Reclamation will assess through this NEPA analysis. The NMISC requests that Reclamation evaluate, at a minimum, the annual and cumulative effects of the proposed action through comparison to the pre-agreement operations baseline and other alternatives that the NMISC has requested that Reclamation develop, including an alternative that addresses the New Mexico issues list, attached, which was previously provided to Reclamation. Reclamation's impact analysis should address the following resources and receptors:

1) Downstream water users—water supply impacts and socioeconomic impacts
   a) EBID and EP#1
   b) Other New Mexico and Texas water users with valid water rights
   c) The Republic of Mexico
2) All relevant portions of the Rio Grande Compact, including but not limited to Articles VI, VII, and VIII such that, as envisioned but not fulfilled by the 2007 Environmental Assessment, the proposed operations will do no harm to upstream water supply and the endangered species that depend on that supply
3) Flood operations and sediment movement/control
4) Endangered Species Act issues including habitat for migratory birds and proposed Southwestern Willow Flycatcher critical habitat
5) Water uses and water users at Elephant Butte and Caballo Reservoirs
   a) Effects of operations on Reclamation partners such as NM State Parks, concessions at Elephant Butte Reservoir, etc.

Finally, will Reclamation continue to assert its 2007 NEPA analysis is also applicable to and sufficient for the 2008 Operating Agreement? That deficient analysis led to a decision that subsequent history has shown to be fundamentally flawed. The June 2007 FONSI decision says on its first page that because "...the adjustment of Operating Procedures is a continuation of ongoing operations which will cause no change to the amount of water released or stored outside the range of historic operations, the Proposed Action Alternative would not have any significant effect on the human environment..." The first four years of operations under the 2008 Operating Agreement has shown this to be a false statement. Reclamation's unilateral release of New Mexico's and Colorado's Rio Grande Compact accrued credit water in 2011 to satisfy its remaining project and international delivery obligations after exhausting the Usable Water is one counter example to this statement. The granting of carry-over credits for water that supposedly had been conserved in storage, but in fact had been released and unaccounted under the 2008 Operating Agreement and therefore required dedication of months of reservoir inflows to refill, is another.

## REQUIREMENT TO ANALYZE THE OUTCOME OF THE VICIOUS CYCLE THAT THE 2008 OPERATING AGREEMENT HAS PUT IN PLACE

Changed operations pursuant to the 2008 Operating Agreement have created a cycle with potentially major adverse environmental consequences. The changes have caused a major interstate redistribution of the surface water supply of the Rio Grande Project, which is a surface water storage and distribution project. Significant amounts of surface water have been reallocated water from the Elephant Butte Irrigation District (EBID) to the El Paso County Water Improvement District No. 1(EP#1) (see the NMISC April 25, 2012 letter and attachments).

The ultimate result of the reallocation of surface water is an unsustainable vicious cycle. Reduced surface water supply causes reduced groundwater system recharge and increased groundwater pumping by EBID farmers. More pumping and less recharge causes reduced groundwater table elevations. The decline in groundwater table elevations then can further reduce river delivery efficiency. Reduced delivery efficiency

under the 2008 Operating Agreement causes Reclamation to increase the transfer of surface water from EBID to EP#1, thereby further reducing EBID farmers' surface water supplies. Unless a very wet climate cycle returns, the vicious cycle reinforces itself through less aquifer recharge and more groundwater pumping.

The environmental impacts of this vicious cycle are cumulative and should be evaluated in the current NEPA. They include, but are not limited to, reduction of aquifer sustainability due to the mass balance impacts of increased groundwater pumping with reduced groundwater discharge, increase cost of production due to the need to pump groundwater, and increased groundwater salinity. The increased groundwater salinity may be caused by lowering the elevation of the groundwater table below the drains which stops the salt flux the drains normally remove; reducing recharge which reduces dilution of salinity; and increasing pumping which can cause intrusion of poor quality water that salinates groundwater that otherwise would be potable.

Endangered species, wildlife, and riparian habitat may also suffer adverse impacts under the 2008 Operating Agreement operations. Before the 2008 Operating Agreement, certain areas such as Selden Canyon maintained year-round flow, supporting these water uses and users. Last year, that was not the case. The reduced water table elevation may cause the river and drains to dry up for extended periods of time and may take the groundwater to elevations below the reach of riparian vegetation.

Please do not hesitate to contact me at rolf.schmidt@state.nm.us if you have questions regarding the NMISC's scoping comments. As indicated in your letter, please make sure that this response to your request for scoping is made publicly available.

Sincerely yours,

Rolf Schmidt-Petersen

Rolf Schmidt-Petersen
Rio Grande Basin Manager
New Mexico Interstate Stream Commission

Attachment

Attachment to NMISC April 30, 2012 NEPA Scoping Comments

**List of Outstanding New Mexico Issues with Operations under the 2008 Rio Grande project Operating Agreement and Manual**

In March 2010, John D'Antonio sent a letter to Commissioner Connor outlining New Mexico's concerns and issues with the 2008 Rio Grande Project Operating Agreement and Operations Manual. The majority of concerns and issues raised in the letter remain and we re-iterate that the updated Manual(s) do not adequately address the following:

1) Texas Groundwater Pumping
    a. Texas needs to pay for all of its pumping effects to the Rio Grande Project (be they in the Mesilla Bolson or Hueco Aquifer system) –
2) Diversion Ratio Calculations
    a. Revise how the Diversion Ratio is applied at the end of each irrigation season –Basically, true it up and modify allocations based upon the actual conditions that occurred.
    b. Revise the allocation method from the D2 line, specifically evaluating and revising the line for changes in reported data (entities, methods, etc) starting in about 1992.
3) Texas Diversions of Project Surface Water
    a. Carryover accounts should be eliminated. In no instance, should water that has been released from the reservoirs be credited as if it was "conserved" in a carryover account.
    b. Caps should be placed on EBID and EP1 total diversions when reservoir usable supply is less than 700,000 acre-feet
    c. The American Canal extension credit should be eliminated.
    d. Reclamation should set, track, and manage deliveries to the Hudspeth County Water Improvement District (for normal operations) so they do not exceed twenty-five percent of the water diverted into the American Canal.
4) Documentation and Transparency Issues
    a. In the future, a neutral third party should conduct and report diversions and river flows at the major gaging locations (as near real time as is possible).
    b. The procedures, roles and responsibilities, and products of the monthly meetings should be documented and reported.
    c. The 2008 Operating Agreement and Operating Manual(s) need to be more fully documented.

Once the general parameters of revisions to the 2008 Operating Agreement and Operating Manual have been agreed to, the operations of the Project need to be evaluated technically to provide assurances the new operations will achieve the agreed upon outcomes, and refined as needed.

**Attachment**
**E**

# NEW MEXICO INTERSTATE STREAM COMMISSION

**COMMISSION MEMBERS**

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Transmittal: Via email jwilber@usbr.gov and US Postal Service

June 6, 2013

Mr. Jim Wilber
Bureau of Reclamation, Albuquerque Area Office
555 Broadway NE, Suite 100
Albuquerque, NM 87102

**Re: United States Bureau of Reclamation Draft Supplemental Environmental Assessment – Implementation of Rio Grande Project Operating Procedures, New Mexico and Texas [May 8, 2013]**

Dear Mr. Wilber:

The New Mexico Interstate Stream Commission (NMISC) submits the following comments concerning the U.S. Bureau of Reclamation (Reclamation) May 8, 2013 Draft Supplemental Environmental Assessment, Rio Grande Project Operating Procedures (Draft EA).

At the outset, the NMISC reiterates its concern that the review and comment deadline imposed by Reclamation has stifled meaningful public review and comment upon the complex technical issues addressed in the Draft EA. The limited comment period provided does not allow a reasonable opportunity for input. *See* Reclamation Manual ENV P03, Establish policy for implementation of the National Environmental Policy Act § 1.B(1) ("Reclamation will provide all reasonable opportunity for input and involvement from the public and other Federal, State, Tribal, and local agencies on environmental issues.") On May 15, 2013, NMISC requested a four-week extension of the comment period to obtain supporting technical information, hold a public meeting, and review, analyze, and comment on the Draft EA and supporting technical information. Reclamation denied the full requested extension on May 21, 2013, allowing instead a two-week extension (until June 6, 2013), and, on that same date, provided the NMISC with large (although incomplete) technical data files (data, spreadsheets and calculation scripts). Reclamation conceded in its data submittal communication that its technical report was not complete:

> The details provided here will be addressed in a technical appendix to the final Supplemental EA. The technical appendix is currently being developed and is not yet available. It should be noted that a number of data values, calculations and assumptions have been revised since the release of the Draft Supplemental EA.... Where discrepancies occur, the data, methods,

assumptions and calculations detailed in this response and the accompanying files supersede those in the Draft Supplemental EA.

In light of the fact that Reclamation has not yet completed its Technical Appendix, it is premature for NMISC to provide final and complete comments on technical conclusions. NMISC requests a 30-day review period following the receipt of a revised Draft Supplemental EA and complete Technical Appendix, along with all "final" versions of data, methods, assumptions and calculation scripts. Notwithstanding this request, in the meantime the NMISC has made reasonable efforts to conduct a preliminary review and provides preliminary comments herein on Reclamation's preliminary analyses. The NMISC's general comments are included below and more specific comments are included in Attachment 1. Attachment 2 contains a summary of NMISC correspondence to Reclamation regarding the Draft EA process.

**General Comments**

As you know, NEPA is the fundamental federal law to ensure that federal agencies make informed decisions and provide for timely public notice and participation in environmental analyses and decision-making. The Council on Environmental Quality (CEQ) regulations are binding on all federal agencies, and each federal agency has its own NEPA guidance consistent with the statute and CEQ guidelines. Reclamation's Draft EA violates NEPA, including the CEQ regulations and Reclamation's own NEPA handbook.

Since 2007 Reclamation has repeatedly violated NEPA regarding Rio Grande Project operations by undertaking a major federal action significantly affecting the environment without preparing the required Environmental Impact Statement (EIS). Reclamation cannot continue issuing interim EAs while ignoring the significant, cumulative and long-term effects of the 2008 Operating Agreement for the Rio Grande Project (2008 OA). In the 2007 EA, Reclamation claimed to examine the effects of the operating agreement over a five-year period, and promised that in 2012 it would issue a study of the 50-year life of the agreement. Now, in 2013, Reclamation instead issued another draft 3-year study, this time promising to analyze the environmental effects of the 50-year period of the 2008 OA in a later EIS, which Reclamation estimates it will prepare in 2016. Neither the original 2007 EA nor the current Draft EA address the actual fifty-year 2008 OA federal action. Reclamation's continued failure to analyze impacts over the 50-year period avoids analysis of the cumulative and long-term impacts to New Mexico's Project water supply, economic impacts to farmers and communities in New Mexico, and ongoing harm to the aquifer. Reclamation's actions are akin to the prohibited practice of segmenting a large project into many small projects in order to avoid NEPA analysis. Rather than continuing to "segment" its analysis to avoid revealing the cumulative and long-term impacts, in order to comply with NEPA and applicable regulations, Reclamation must withdraw the Draft EA, revert to its pre-2007 operating practices, and complete an EIS that adequately examines the impacts over the life of the 2008 OA.

The Draft EA also violates NEPA because it fails to consider all impacts that are reasonably related to the 2008 OA, including without limitation the impacts related to other federal laws, including the Endangered Species Act and the Rio Grande Compact. Specifically, the Draft EA fails to analyze impacts to critical habitat upstream of Elephant Butte Dam, and fails to describe how Project Operations, including carry-over storage, can be implemented in a manner that is consistent with the requirements of the Rio Grande Compact.

Reclamation has also violated NEPA's prohibition against predetermined outcomes because it irretrievably committed Reclamation to a course of action before engaging in a valid NEPA process. Reclamation signed the 2008 OA on March 10, 2008 and only now, five years later, concedes that it will prepare an EIS on that federal action, but nevertheless proposes to continue implementing the 2008 OA in the interim. By agreeing that an EIS is necessary, Reclamation admits the 2008 OA is a major federal action significantly impacting the human environment. And Reclamation's ongoing operations under the 2008 OA are an express violation of NEPA because an EIS must *precede* implementation of the major federal actions significantly affecting the human environment. Reclamation's NEPA compliance handbook, states at section 11.5, "Doing NEPA on Decisions Already Made--NEPA compliance is required **before any discretionary** Federal action with potentially significant environmental impacts is initiated. Decisions should not be made without full compliance with NEPA. **To do this is illegal and a violation of NEPA**. The one exception to this requirement is in emergency situations." Bureau of Reclamation, Reclamation's NEPA Handbook at 11-4 (2012) (emphasis added). There is no emergency here nor has Reclamation claimed there is an emergency.

In addition, the Draft EA describes the impacts of the proposed action quite differently than they were described in the initial 2007 FONSI/EA, e.g., the Draft EA indicates the 2008 OA results in increased groundwater pumping and aquifer impacts in New Mexico ( see, p. 46) whereas the initial FONSI/EA speculated the effect of the 2008 OA might be to *reduce* EBID's reliance on groundwater. (See, para. 5, p. ii). The Draft EA must explain and quantify the differences with respect to groundwater pumping and aquifer impacts in New Mexico and must provide a similar analysis for groundwater pumping and aquifer impacts in Texas.

Reclamation also has not adequately considered alternatives to the proposed action. 40 C.F.R. § 1502.14. First, and as explained in more detail below, Reclamation considered only two alternatives: a no-action alternative and the proposed alternative. Agencies are required to analyze reasonable alternatives to the proposed action. There are numerous reasonable alternatives to the proposed action, including but not necessarily limited to those previously raised by NMISC, that Reclamation did not consider, including removing carryover storage from the agreement, eliminating groundwater pumping as Project water in conformance with the State Court adjudication ruling, and accounting for groundwater pumping in Texas. Reclamation's failure to evaluate these reasonable alternatives violates NEPA.

Further, Reclamation has failed to take the requisite "hard look" at the impacts of the proposed action. The analysis in the Draft EA, as discussed in more detail below and in Attachment 1, relies on flawed, incomplete, and outdated information. It fails to utilize the best available science, fails to analyze impacts to the aquifer, contains many vague and incomplete conclusions, and fails to recognize judicial determinations by the New Mexico adjudication court regarding rights to groundwater. For all these reasons, the draft EA is inadequate to inform either Reclamation or the public of the likely impacts of the 2008 OA, let alone allow Reclamation to make an informed decision about whether an EIS is required.

**General Comments on Draft EA by Section**

*Section 1, Summary:*

Reclamation states on page1 that it attempted to conduct a technical analysis as part of the Draft EA, but concludes, in part, that:

> 1) for the period 2013-2015, differences in potential impacts between previous operations of the project under the No Action alternative and the projected operations under the OA are projected to be minimal and insignificant, and 2) based on the available data and analytical tools, we can only reasonably predict potential impacts to the human environment over a limited time frame.

However, there is no empirical evidence to support the conclusion that the short term impacts will be minimal.

The justification for not doing a full fifty-year analysis of the potential impacts of the 2008 OA in an EIS is not valid for the following reasons:

1- The results presented in tables 4.1 to 4.7 show significant changes to each district's allocations.
2- Existing groundwater models were not used to evaluate the impact on groundwater resources, riparian habitat and economic loss/gain. This indicates that the best available science was not used in developing the Draft EA.
3- The Draft EA fails to consider potential impacts from the designation of Critical Habitat for the Southwestern Willow Flycatcher by the U.S. Fish and Wildlife Service.
4- The Draft EA recognizes that the 2008 OA has resulted in significant adverse effects in New Mexico but fails to analyse any alternatives that minimize those impacts.

Even in the face of its statements in the Draft EA and its analysis that the 2008 OA has had a significant negative effect on EBID water supplies and significantly increased the supplies for EP1 (Section 4.2.2.2 Surface Water), Reclamation proposes to continue operations under the 50-year 2008 OA while an EIS is being prepared and tools further developed or refined. Reclamation must revert to the historic operating procedures used for the Rio Grande Project before the 2007 EA was completed, and immediately commence an EIS. The NMISC once again formally requests that Reclamation do so.

*Section 3, Alternatives:*

From the brief description in the Draft EA, it is not clear what operations the No Action Alternative entails. The No Action alternative appears to be a modification of the 2008 OA; not the operation conducted by Reclamation prior to 2007. Reclamation must describe whether the no action alternative is the operation that occurred immediately prior to 2007 or something different. In either case, Reclamation must describe the No Action Alternative in more detail.

In regard to the "proposed action," the Draft EA is unclear as to what operations the proposed action entails. Is it the operations that were used for the 2007 Operating Procedures (OP), the 2008 OA in the first year, or the

2008 OA as operated today? NMISC is aware that the Reclamation's Allocation Committee has made a number of changes to operations since 2008, some of which may be significant. But, to the best of our knowledge, no technical descriptions of their changes have been provided to interested public stakeholders, nor has any NEPA analysis been conducted on them. Reclamation must document all changes that have been made to Rio Grande Project operations subsequent to the 2007 OP, describe their effects, and then fully describe what the "proposed" action entails relative to changes made since 2007.

As mentioned above, other alternatives are and have been available for review. They include, but are not limited to, removing carryover, modifying carryover to be a wet water operation that reflects a real decrease in consumption in EP1, and modifying the D3 procedure so that EP1's allocation is appropriately reduced, and EBID not charged, for pumping in Texas, for actual EP1 deliveries as opposed to charged deliveries, and for credits. Reclamation must also work with its cooperating agencies in Texas to meter all Texas groundwater pumping so that the effects of the pumping would be appropriately accounted against EP1's allocations. Reclamation's failure to collect such data means that it cannot and has not adequately analyzed the effects of the proposed action, or analyze other alternatives.

Further, rather than presenting an analysis of the environmental impacts of the 2007 OP and 2008 OA, much of the Draft EA focuses on the United States' and EP1's previous litigation positions concerning the Rio Grande Project, some of which have been rejected by the courts or are currently being litigated. In Stream System Issue 104 of the New Mexico Lower Rio Grande Adjudication, to which Reclamation is a party and EP1 is Amicus, Judge Wechsler rejected Reclamation's claim to groundwater as a source of water for the Project. And, in Stream System Issue 101 the farm delivery and crop irrigation requirements of individual farmers were adjudicated and are now binding on all farmers. Therefore, the descriptive assumptions about groundwater use in the Draft EA are now out of date and inaccurate. Reclamation must revise its analysis and description of alternatives in accordance with the Court's decision and New Mexico state law.

It also appears the Project area of the Draft EA is different than that of both the 2007 EA and the 2008 OA. The 2007 EA and its operations as well as those in the 2008 OA relate to Rio Grande Project operations in their entirety from Caballo Dam to the El Paso-Hudspeth County line in Texas. But the Draft EA analysis focuses solely on operations in New Mexico. This is a structural flaw in the Draft EA that results in a failure to fully address the cumulative and long-term impacts of the proposed action. Reclamation must revise its analysis to include Project operations in their entirety from Caballo Dam to the El Paso-Hudspeth County line in Texas.

Please do not hesitate to contact me at 505-827-6160 or at rolf.schmidt@state.nm.us if you have questions.

Sincerely,

Rolf Schmidt-Petersen

Rolf Schmidt-Petersen
Rio Grande Basin Manager
NM Interstate Stream Commission

Attachment 1 – Additional NMISC Comments by Draft EA Section
Attachment 2 - Summary of NMISC Correspondence to Reclamation Prior to Release of the Draft EA

cc: Ken Rice, Reclamation
Stephen Farris, NMAGO

**ATTACHMENT F**

Rio Grande Operations Manual – Revisions through May 8, 2012

| Section | Year of Revision | Revisions |
|---|---|---|
| 3.1 | 2010 | The U.S. Bureau of Reclamation (Reclamation) shall, prior to the 2nd Tuesday of each month of the year, allocate Rio Grande Project water in accordance to the Operating Agreement to EBID, EPCWID, and the United States for delivery to Mexico. The final allocation for the year shall include storage and allocation accounting data through the month of October of such year. |
| 3.3 | 2010 | *Several paragraphs concerning the communications protocol with Mexico were deleted.* |
| 4.1 | 2010 | … The amount of flow ordered for delivery to Mexico shall be specified by USIBWC ~~and normally shall equal the amount in Mexico's delivery schedule specified for the given date~~. … |
| 4.5.1 | 2010 | … ~~The mean daily flows in the Rio Grande downstream of American Dam are determined by USIBWC for determining deliveries to Mexico. US-IBWC shall report computed monthly delivery volumes to Reclamation by the 25th of the month. Preliminary delivery volume estimates shall be provided to Reclamation, EBID and EPCWID by the 2nd Tuesday of each month~~. … |
| 4.6 | 2010 | **Water Order by Only One District**<br>4.6.1 At the start of the Primary Irrigation Season and when one District orders water for diversion prior to the other, allocation charges to that District shall start on the date and time that water arrives to the delivery point and shall equal the greater of the amount of water ordered for diversion or the amount of water released from Caballo Dam. Any charges based on the amount of water released from Caballo Dam shall be discontinued upon the other district or Mexico ordering water for delivery.<br>4.6.2 During years with less than a full allocation and diversion have [sic] been discontinued for only one district because of insufficient diversion allocation balance and during the time prior to the termination of release of water from Caballo Dam at the end of the Primary Irrigation Season (when only one District orders water for diversion), the allocation charges shall equal the greater of the amount of diversion charges made in accordance with Appendices A, B, and C of this manual or the amount of water released from Caballo Dam. |
| 4.7 | 2010 | Except when Section 4.6.2 is in effect and ~~A~~after the gates at Caballo Dam have been closed, allocated water will be charged to the Districts until such time as the stored water is no longer available at their respective headings or the estimated travel times listed in Section 4.2 above have elapsed, whichever is less. If Section 4.6.2 is in effect, allocation charges for either district shall end at the date and time the gates at Caballo Dam are closed. |
| 4.9 | 2010 | *New section added:*<br>**Accounting Mistakes Regarding Mexico's Allocation**<br>During an extraordinary drought or serious accident to the irrigation system in the United States, Mexico's delivery allocation (that has been diminished in the same proportion as the water delivered to lands in the irrigation districts in the United States) shall not be decreased during the calendar year except in the situation where an accounting or measurement mistake has been made resulting in an allocation to Mexico in an amount greater than would have been made if such error had not been made. In November of each year, if under any situation Mexico's allocation is greater than the same proportion as the water delivered to lands in the irrigation districts in the United States, then the difference in the amount greater than the proportion as the water delivered to lands in the irrigation districts in the United States shall be charged against the delivery allocation of the irrigation districts in amounts proportional to their respective irrigable acres. |
| 4.10 | 2012 | *New Section added:*<br>**Correction of D2- Linear Regression Equation During Multi-Year Extreme Drought**<br>The D2 Linear Regression Equation fails to accurately predict the measured amount of water that was diverted from the Rio Grande during consecutive calendar years when the total |

| Section | Year of Revision | Revisions |
|---|---|---|
| | | amount of water released from Caballo Reservoir is less than 400,000 acre-feet. For example during the years 1954 through 1957 the amount of water released from Caballo Reservoir was less than 400,000 acre-feet, and the amount of measured diversions was 88%, 78%, and 75% of the amount predicted by the D2 Linear Regression Equation for the years 1955, 1956, and 1957, respectively. During the 2nd consecutive year when the amount of water released from Caballo Reservoir is less than 400,000 acres [sic] feet the "Corrected D2 Linear Regression Equation" shall equal the value predicted by the D2 Linear Regression Equation multiplied by 0.88.<br>During the 3rd consecutive year when the amount of water released from Caballo Reservoir is less than 400,000 acres [sic] feet the "Corrected D2 Linear Regression Equation" shall equal the value predicted by the D2 Linear Regression Equation multiplied by 0.78.<br>During the 4th and all following consecutive years when the amount of water released from Caballo Reservoir is less than 400,000 acre feet the "Corrected D2 Linear Regression Equation" shall equal the value predicted by the D2 Linear Regression Equation multiplied by 0.75.<br>If the measured diversion ratio for a consecutive drought year in which the correction to the D2 Linear Regression Equation is applied, is higher than the diversion ratio predicted by the Corrected D2 Linear Regression Equation defined in this section, the measured diversion ratio shall be used for allocation purposes. |
| 5.2 | 2010 | A current roster of contact numbers for ~~each district~~ EBID, EPCWID, US-IBWC and Reclamation shall be distributed by each ~~party~~ of the above to EBID, EPCWID, IBWC, and Reclamation. The roster shall be updated as necessary. |
| 5.3 | 2010 | ~~The US-IBWC shall provide to~~ Reclamation shall obtain the following from US-IBWC: … |
| 6. | 2010 | EBID, EPCWID and Reclamation (including representation from US-IBWC under the auspice of Reclamation) will meet once a year in January, or more frequently if requested by one of the three parties, to review this operating manual. The Parties may modify any provisions of this manual upon having reached unanimous consent. No unilateral departure from this manual is allowed. Proposals for updates shall be submitted to all parties by January 1st of each year for review during the January meeting. The proposal shall consist of a detailed description of the proposed update with a justification for the update. Adoption of the update shall be by unanimous consent for the start of the irrigation season agreed to by the parties. At any time during the year any party may submit proposal for updating this manual. The proposal shall consist of a detailed description of the proposed update with a justification for the update. Adoption of the update shall be by unanimous consent on the date agreed to by the parties. Consent of adoption of the update shall communicated by letter to each party. The Bureau of Reclamation shall make the updated manual available to the general public upon implementation. No unilateral departure from this manual is allowed. |

Attachment
G

# NEW MEXICO INTERSTATE STREAM COMMISSION

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**VIA EMAIL: rgraham@usbr.gov and First Class Mail**

March 31, 2016

Ms. Rhea Graham
Bureau of Reclamation, Albuquerque Area Office
555 Broadway Boulevard NE., Suite 100
ALB-103
Albuquerque, NM 87102

Dear Ms. Graham:

The New Mexico Interstate Stream Commission (NMISC) is undertaking review of the Draft Environmental Impact Statement for Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project (Draft EIS), released March 18, 2016. We understand that the deadline for comment is May 9, 2016. In preparing to comment, we respectfully request the following.

First, there is a large amount of supporting data and information referenced in the Draft EIS but not included in the document nor available on the Bureau of Reclamation (Reclamation) website. Without this information the NMISC is unable to conduct a meaningful review of the Draft EIS. Accordingly, the NMISC requests the following supporting information:

- The Biological Opinion issued by the U.S. Fish and Wildlife Service and supporting data from which the analysis in the Biological Opinion was developed. (The Notice of Availability published March 18, 2016 states that the Biological Opinion is available at http://www.fws.gov/southwest/es/NewMexico/ES_bio_op.cfm, however, the document was not located on the link.)
- The IMPLAN model utilized to analyze the socioeconomic environmental consequences of the five alternatives, including all input and output files.
- All digital appendix files listed in Appendix A of the Hydrology Technical Memo, which is attached to the Draft EIS as Appendix C: Formatted Model Results for Selected Operational and Hydrologic Parameters (ALLOCATION.xlsx, etc.).
- All digital appendix files listed in Appendix B of the Hydrology Technical Memo, which is attached to the Draft EIS as Appendix C: Model Files and Unformatted Model Output (EIS.Alt1.ScenarioP25.zip, etc.).

- Several references that do not include web addresses and ISC is unable to locate, including:

  - Hanson, R. T., S. E. Boyce, W. Schmid, J. Knight, and T. Maddock, III. 2013. Integrated Hydrologic Modeling of a Transboundary Aquifer System – Lower Rio Grande. MODFLOW and More 2013: Integrated Hydrologic Modeling, Golden, Colorado, June 5-8, 2011.
  - IBWC (U.S. International Boundary and Water Commission). 2014a. Flood Control Improvements to the Rio Grande Canalization Project in Vado, New Mexico, United States Section, International Boundary and Water Commission, El Paso, Texas.
  - Reclamation (U.S. Department of the Interior, Bureau of Reclamation). 2002. Elephant Butte and Caballo Reservoirs Resource Management Plan and Final Environmental Impact Statement. U.S. Department of the Interior, Bureau of Reclamation, Albuquerque Area Office, Albuquerque, New Mexico.
  - Reclamation (U.S. Department of the Interior, Bureau of Reclamation). 2003a. Browsing Analysis of Riparian Vegetation: Elephant Butte Project Lands. U.S. Department of the Interior, Bureau of Reclamation, Denver Technical Service Center, Denver, Colorado.
  - Reclamation (U.S. Department of the Interior, Bureau of Reclamation). 2003b. Elephant Butte and Caballo Reservoirs Resource Management Plan. U.S. Department of the Interior, Bureau of Reclamation, Albuquerque Area Office, Albuquerque, New Mexico.
  - Congressional Research Service, 2015. U. S. – Mexico Water Sharing: Background and Recent Developments, Congressional Research Service document 7-5700, January 23, 2015.

Please provide all the requested information in electronic format, if available, to Kim Bannerman at kim.bannerman@state.nm.us. If you do not have the information electronically, please send a hard copy to her at the address listed above.

Second, the NMISC requests a ninety (90) day extension of time for submitting comments, from May 9, 2016 to August 7, 2016. Reclamation has provided a very limited amount of time to comment on the Draft EIS, especially in light of the large amount of supporting material not made available in conjunction with the Draft EIS. As you are aware, the Draft EIS is a nearly 400 page document, not including all the various model files and references that need review, as well as the U.S. Fish and Wildlife Service Biological Opinion drafted in consultation with Reclamation under Section 7 of the Endangered Species Act. To provide the public meaningful opportunity to participate in the Draft EIS process, we believe this extension is warranted.

The NMISC would appreciate Reclamation make a determination on this extension request well in advance of the current May 9, 2016 comment deadline to allow us and other stakeholders the opportunity to adequately prepare comments for Reclamation.

Thank you for the opportunity to comment on this Draft EIS and for your careful consideration of this request.

Sincerely,

Deborah K. Dixon

Deborah K. Dixon, P.E.
Director
New Mexico Interstate Stream Commission

DKD/kmb

**Attachment H**

**From:** Bannerman, Kim, OSE
**To:** "Graham, Rhea"; ADMIN RECORD
**Cc:** Doremus, Dale, OSE; Schmidt, Rolf L., OSE
**Subject:** Draft EIS Information Request
**Date:** Wednesday, April 13, 2016 5:17:00 PM
**Attachments:** Comments Submitted at Public Hearing 040716.doc

---

Rhea,

I just finished speaking with Dale Doremus who I understand you spoke with last night at the public hearing. It sounds like you have not adequately reviewed the information request we made last week.

My statements last week at the public hearing, as well as the written comments I submitted, are abundantly clear that we need more information than what you have already provided us. My comments specifically stated that we were thankful for what you had already provided, but we need additional information in order to do an adequate review.

The comments are attached. Please provide the additional information we have requested in a timely fashion.

Please also notify me of the date the Biological Opinion will be available on the website you listed in the Notice of Availability.

Best,

Kim Bannerman
Attorney
New Mexico Interstate Stream Commission
PO Box 25102
Santa Fe, NM 87504-5102
Phone: (505) 827-4004
Fax No. (505) 476-0399
Email: kim.bannerman@state.nm.us

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**From:** Bannerman, Kim, OSE
**To:** "Graham, Rhea"; ADMIN RECORD
**Cc:** "Jay F. Stein"; Dixon, Deborah, OSE; Doremus, Dale, OSE; Haas, Amy, OSE; Jennifer Faler; Schmidt, Rolf I., OSE
**Subject:** Extension Request Follow Up
**Date:** Wednesday, April 20, 2016 11:45:00 AM

---

Ms. Graham,

I am again following up on the ISC's request for an extension to the May 9th deadline for comments on the Rio Grande Operating Agreement Draft EIS. We submitted our request for an extension nearly three weeks ago.

Please get back to me on the status of our request.

Kim Bannerman
Attorney
New Mexico Interstate Stream Commission
PO Box 25102
Santa Fe, NM 87504-5102
Phone: (505) 827-4004
Fax No. (505) 476-0399
Email: kim.bannerman@state.nm.us

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**From:** Bannerman, Kim, OSE
**Sent:** Monday, April 18, 2016 12:06 PM
**To:** 'Graham, Rhea'; ADMIN RECORD
**Cc:** Dixon, Deborah, OSE; Haas, Amy, OSE; 'Jay F. Stein'; Doremus, Dale, OSE; Jennifer Faler; Schmidt, Rolf I., OSE
**Subject:** Rio Grande DEIS Extension Request

Ms. Graham,

Will you please update us on the status of our request for an extension of the May 9th deadline for comments. As you will recall, we asked for a 90 day extension to August 7th.

Also, at the April 7th public hearing the NMISC requested additional information, both in writing and through oral comments. I followed up on that request with an email to you on Wednesday, April 13th. To date we have not received any of the additional items requested. As I have already made clear, the NMISC cannot conduct a meaningful review of the Draft EIS without this information. The fact the comment deadline is so soon and Reclamation has not provided us with the information necessary to review the document is further support for granting the comment extension.

Please update me as soon as possible on these items.

Kim Bannerman
Attorney
New Mexico Interstate Stream Commission
PO Box 25102
Santa Fe, NM 87504-5102
Phone: (505) 827-4004
Fax No. (505) 476-0399
Email: kim.bannerman@state.nm.us

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**From:** Bannerman, Kim, OSE
**To:** Nancy Coulam
**Cc:** ADMIN RECORD; Jay F. Stein; Dixon, Deborah, OSE; Doremus, Dale, OSE; Haas, Amy, OSE; Jennifer Faler; Schmidt, Rolf I., OSE; "Graham, Rhea"
**Subject:** RE: Extension Request Follow Up
**Date:** Thursday, May 05, 2016 9:32:00 AM
**Attachments:** Comments Submitted at Public Hearing 040716.doc

---

Nancy,

Thank you for the email. I saw this in the Federal Register this morning.

We have still not received any response to our request for additional information made nearly a month ago, on April 7th. I followed up on that request April 13th and again on April 18th. Without this requested information we cannot conduct a meaningful review of the Draft EIS. I've attached our request again here.

With only a 30 day extension it is imperative that we receive this information within the next week to allow us time to review.

Kim Bannerman
Attorney
New Mexico Interstate Stream Commission
PO Box 25102
Santa Fe, NM 87504-5102
Phone: (505) 827-4004
Fax No. (505) 476-0399
Email: kim.bannerman@state.nm.us

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**From:** Graham, Rhea [mailto:rgraham@usbr.gov]
**Sent:** Thursday, May 05, 2016 9:18 AM
**To:** Bannerman, Kim, OSE; Nancy Coulam
**Cc:** ADMIN RECORD; Jay F. Stein; Dixon, Deborah, OSE; Doremus, Dale, OSE; Haas, Amy, OSE; Jennifer Faler; Schmidt, Rolf I., OSE
**Subject:** Re: Extension Request Follow Up

Kim,
In response to your request(s), attached are the press release and Federal Register notice regarding extension of the comment period and change of contact person.
Rhea & Nancy

Rhea Graham, Special Project Officer

Bureau of Reclamation Albuquerque Area Office

555 Broadway N.E., Suite 100, Mail Stop ALB-103

Albuquerque, NM 87102

(505) 462-3560 (Office) (505) 221-0470 (Mobile) (505) 462-3793 (Fax)

http://www.usbr.gov/uc/albuq/rm/RGP/

On Wed, Apr 20, 2016 at 11:45 AM, Bannerman, Kim, OSE
<Kim.Bannerman@state.nm.us> wrote:
Ms. Graham,

I am again following up on the ISC's request for an extension to the May 9th deadline for comments on the Rio Grande Operating Agreement Draft EIS. We submitted our request for an extension nearly three weeks ago.

Please get back to me on the status of our request.

Kim Bannerman
Attorney
New Mexico Interstate Stream Commission
PO Box 25102
Santa Fe, NM 87504-5102
Phone: (505) 827-4004
Fax No. (505) 476-0399
Email: kim.bannerman@state.nm.us

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---

**From:** Bannerman, Kim, OSE
**Sent:** Monday, April 18, 2016 12:06 PM
**To:** 'Graham, Rhea'; ADMIN RECORD
**Cc:** Dixon, Deborah, OSE; Haas, Amy, OSE; 'Jay F. Stein'; Doremus, Dale, OSE; Jennifer Faler; Schmidt, Rolf I., OSE
**Subject:** Rio Grande DEIS Extension Request

Ms. Graham,

Will you please update us on the status of our request for an extension of the May 9th

th

deadline for comments. As you will recall, we asked for a 90 day extension to August 7 .

Also, at the April 7th public hearing the NMISC requested additional information, both in writing and through oral comments. I followed up on that request with an email to you on Wednesday, April 13th. To date we have not received any of the additional items requested. As I have already made clear, the NMISC cannot conduct a meaningful review of the Draft EIS without this information. The fact the comment deadline is so soon and Reclamation has not provided us with the information necessary to review the document is further support for granting the comment extension.

Please update me as soon as possible on these items.

Kim Bannerman
Attorney
New Mexico Interstate Stream Commission
PO Box 25102
Santa Fe, NM 87504-5102
Phone: (505) 827-4004
Fax No. (505) 476-0399
Email: kim.bannerman@state.nm.us

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# ATTACHMENT I
# LITERATURE CITED


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Hatch, M.D. 2010. *RiverEyes Observations for 2010.* Report prepared for U.S. Department of the Interior, Bureau of Reclamation, Albuquerque Area Office, New Mexico. Albuquerque: SWCA Environmental Consultants.

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———. 2006. *Rio Grande Silvery Minnow Rescue and Salvage – Fiscal Year 2005*. Interagency Agreement 02-AA-40-8190. Albuquerque: U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office.

**Attachment**
**J**

**From:** Graham, Rhea
**To:** Bannerman, Kim, OSE; Varela, Gloria, OSE
**Cc:** Haas, Amy, OSE; Dixon, Deborah, OSE; ADMIN RECORD
**Subject:** Re: DEIS Request for Information and Extension Letter
**Date:** Wednesday, April 06, 2016 10:27:29 AM
**Attachments:** NMISC_ltr_recd_20160404.pdf

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Good Morning,

We received the hard copy of the letter attached to this Email message on Monday, April 4, 2016. We are responding to Ms. Bannerman with status of documentation requested:

The digital appendix files listed below exceed our limitations for Email attachments. We are mailing several DVDs containing:

- All digital appendix files listed in Appendix A of the Hydrology Technical Memo, which is attached to the Draft EIS as Appendix C: Formatted Model Results for Selected Operational and Hydrologic Parameters (ALLOCATION.xlsx, etc.).
- All digital appendix files listed in Appendix B of the Hydrology Technical Memo, which is attached to the Draft EIS as Appendix C: Model Files and Unformatted Model Output (EIS.Altl.ScenarioP25.zip, etc.).

Regarding documents you were unable to locate, we have provided URLs where available, with hard copies included on the DVD containing Appendix A.

- Hanson, R. T., S. E. Boyce, W. Schmid, J. Knight, and T. Maddock, Ill. 2013. Integrated Hydrologic Modeling of a Transboundary Aquifer System - Lower Rio Grande. MODFLOW and More 2013: Integrated Hydrologic Modeling, Golden, Colorado, June 5-8, 2011. Available at: https://publications.csiro.au/rpr/download?pid=csiro:EP133417&dsid=DS7
- IBWC (U.S. International Boundary and Water Commission). 2014a. Flood Control Improvements to the Rio Grande Canalization Project in Vado, New Mexico, United States Section, International Boundary and Water Commission, El Paso, Texas. Available at: http://www.ibwc.state.gov/Files/Final_SEA_RGC%20Levee%20Raising_Vado_080414.pdf
- Reclamation (U.S. Department of the Interior, Bureau of Reclamation). 2002. Elephant Butte and Caballo Reservoirs Resource Management Plan and Final Environmental Impact Statement. U.S. Department of the Interior, Bureau of Reclamation, Albuquerque Area Office, Albuquerque, New Mexico. This document is not available electronically and has been provided on the DVD with Appendix A.
- Reclamation (U.S. Department of the Interior, Bureau of Reclamation). 2003a.

Browsing Analysis of Riparian Vegetation: Elephant Butte Project Lands. U.S. Department of the Interior, Bureau of Reclamation, Denver Technical Service Center, Denver, Colorado. This document is not available electronically and is included on the DVD containing Appendix A.

- Reclamation (U.S. Department of the Interior, Bureau of Reclamation). 2003b.

Elephant Butte and Caballo Reservoirs Resource Management Plan. U.S.

Department of the Interior, Bureau of Reclamation, Albuquerque Area Office,

Albuquerque, New Mexico. This document is not available electronically and is included on the DVD containing Appendix A.

- Congressional Research Service, 2015. U. S. - Mexico Water Sharing:

Background and Recent Developments, Congressional Research Service

document 7-5700, January 23, 2015. Available at: https://www.fas.org/sgp/crs/row/R43312.pdf

Regarding your request for the IMPLAN model utilized to analyze the socioeconomic environmental consequences of the five alternatives, including all input and output files: the IMPLAN model and dataset were purchased, see reference on page 7-4, lines 124-126. The purchased IMPLAN model and data are proprietary as described on www.IMPLAN.com; model input and output are described in the narrative and values are summarized on the numerous tables in Section 4.12, pages 4-70 to 4-93.

The URL provided for the Biological Opinion was to share where the document would be posted, because it will be posted on the US Fish & Wildlife Service website, not the Reclamation website for this Draft EIS. The Biological Assessment used for consultation is posted on Reclamation's website at: http://www.usbr.gov/uc/envdocs/biop.html. We will provide you Email notification once consultation is completed and the Biological Opinion is posted.

Regarding your request for an extension, I have forwarded it on for consideration. We understand your need to plan and prepare your response, and we will be able to give you a response regarding an extension within the next two weeks.

Rhea Graham, Special Project Officer

Bureau of Reclamation Albuquerque Area Office

555 Broadway N.E., Suite 100, Mail Stop ALB-103

Albuquerque, NM 87102

(505) 462-3560 (Office) (505) 221-0470 (Mobile) (505) 462-3793 (Fax)

http://www.usbr.gov/uc/albuq/rm/RGP/

On Fri, Apr 1, 2016 at 1:30 PM, Varela, Gloria, OSE <Gloria.Varela@state.nm.us> wrote:

Ms. Graham,

Please see the attached letter addressed to you from the Interstate Stream Commission. I will mail a hard copy to you today as well.

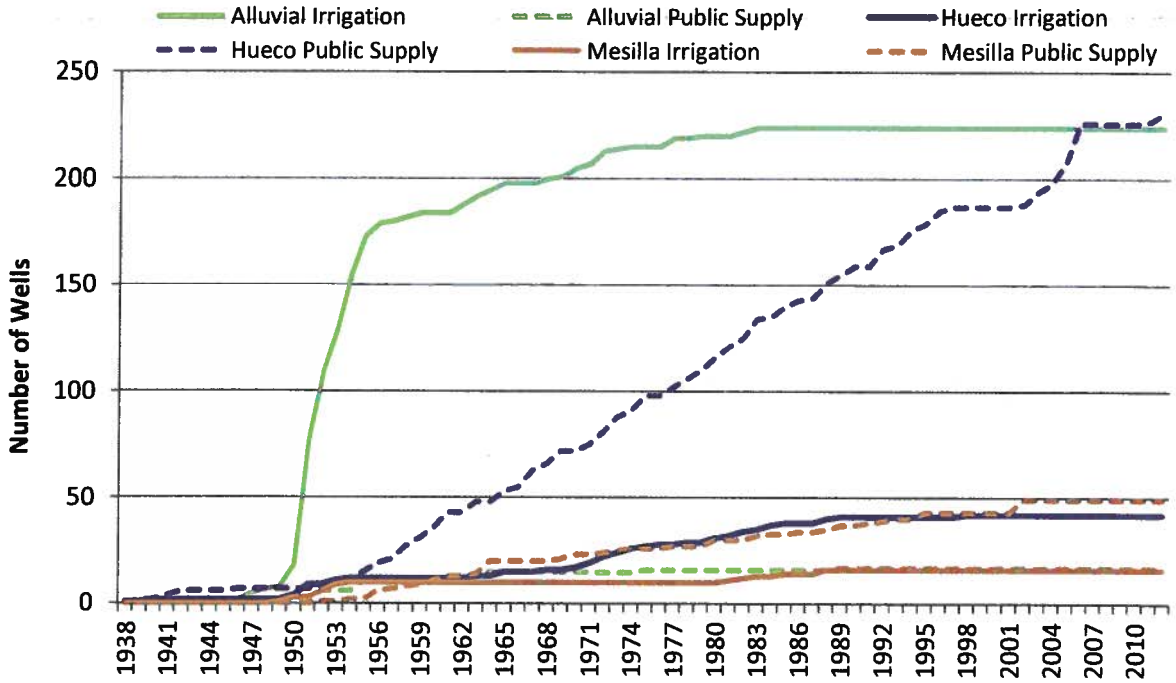
*Gloria Varela*

*Interstate Stream Commission*

*(505) 827-6103 phone*

*(505) 827-6188 fax*

**Figure 1**
**Number of Wells by Drill Date**
**El Paso County, Texas**
**1938 - 2012**




**No. of Wells with Reported Drill Date (in chart)**

| Aquifer/ Use | Irrigation | Public Supply | Other | Total |
|---|---|---|---|---|
| Alluvial | 224 | 17 | 219 | 460 |
| Hueco | 42 | 231 | 503 | 776 |
| Mesilla | 16 | 49 | 104 | 169 |
| Total | 282 | 297 | 826 | 1,405 |

**No. of Wells with No Reported Drill Date**

| Irrigation | Public Supply | Other | Total |
|---|---|---|---|
| 273 | 0 | 128 | 401 |
| 6 | 4 | 45 | 55 |
| 3 | 3 | 15 | 21 |
| 282 | 7 | 188 | 477 |

**Total Number of Wells by Reported Use**

| Aquifer/ Use | Irrigation | Public Supply | Other M&I | Domestic & Stock | Unused | Unknown | Total |
|---|---|---|---|---|---|---|---|
| Alluvial | 497 | 17 | 8 | 49 | 277 | 13 | 861 |
| Hueco | 48 | 235 | 59 | 54 | 397 | 38 | 831 |
| Mesilla | 19 | 52 | 24 | 18 | 76 | 1 | 190 |
| Total | 564 | 304 | 91 | 121 | 750 | 52 | 1,882 |

**Notes:**

Well data from Texas Water Development Board database last updated April 11, 2016 (www.twdb.texas.gov/groundwater/data/gwdbrpt.asp).

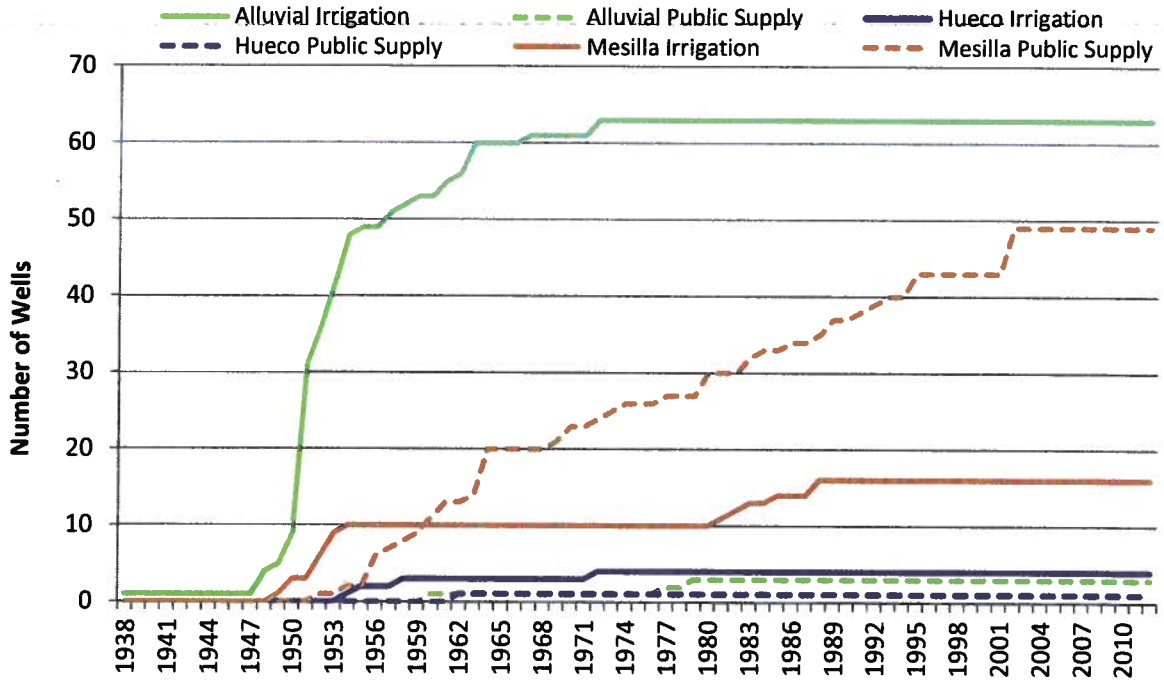
Alluvial wells are in the Rio Grande alluvium (TWDB database code aquifer source = 111RGRD).

Hueco wells are in the Hueco Bolson aquifer (TWDB database code aquifer source = 112HCBL).

Mesilla wells are in Mesilla Bolson aquifer (TWDB database code aquifer source = 112MCBL).

Other M&I includes industrial, commercial, etc.

**Figure 1**
**Number of Wells by Drill Date**
**Hudspeth County, Texas**
**1938 - 2012**




**No. of Wells with Reported Drill Date (in chart)**

| Aquifer/ Use | Irrigation | Public Supply | Other | Total |
|---|---|---|---|---|
| Alluvial | 63 | 3 | 82 | 148 |
| Hueco | 4 | 1 | 13 | 18 |
| Total | 67 | 4 | 95 | 166 |

**No. of Wells with No Reported Drill Date**

| Irrigation | Public Supply | Other | Total |
|---|---|---|---|
| 56 | 0 | 15 | 71 |
| 0 | 0 | 7 | 7 |
| 56 | 0 | 22 | 78 |

**Total Number of Wells by Reported Use**

| Aquifer/ Use | Irrigation | Public Supply | Other M&I | Domestic & Stock | Unused | Unknown | Total |
|---|---|---|---|---|---|---|---|
| Alluvial | 119 | 3 | 1 | 6 | 89 | 1 | 219 |
| Hueco | 4 | 1 | 1 | 5 | 12 | 2 | 25 |
| Total | 123 | 4 | 2 | 11 | 101 | 3 | 244 |

**Notes:**

Well data from Texas Water Development Board database last updated April 11, 2016 (www.twdb.texas.gov/groundwater/data/gwdbrpt.asp).

Alluvial wells are in the Rio Grande alluvium (TWDB database code aquifer source = 111RGRD).

Hueco wells are in the Hueco Bolson aquifer (TWDB database code aquifer source = 112HCBL).

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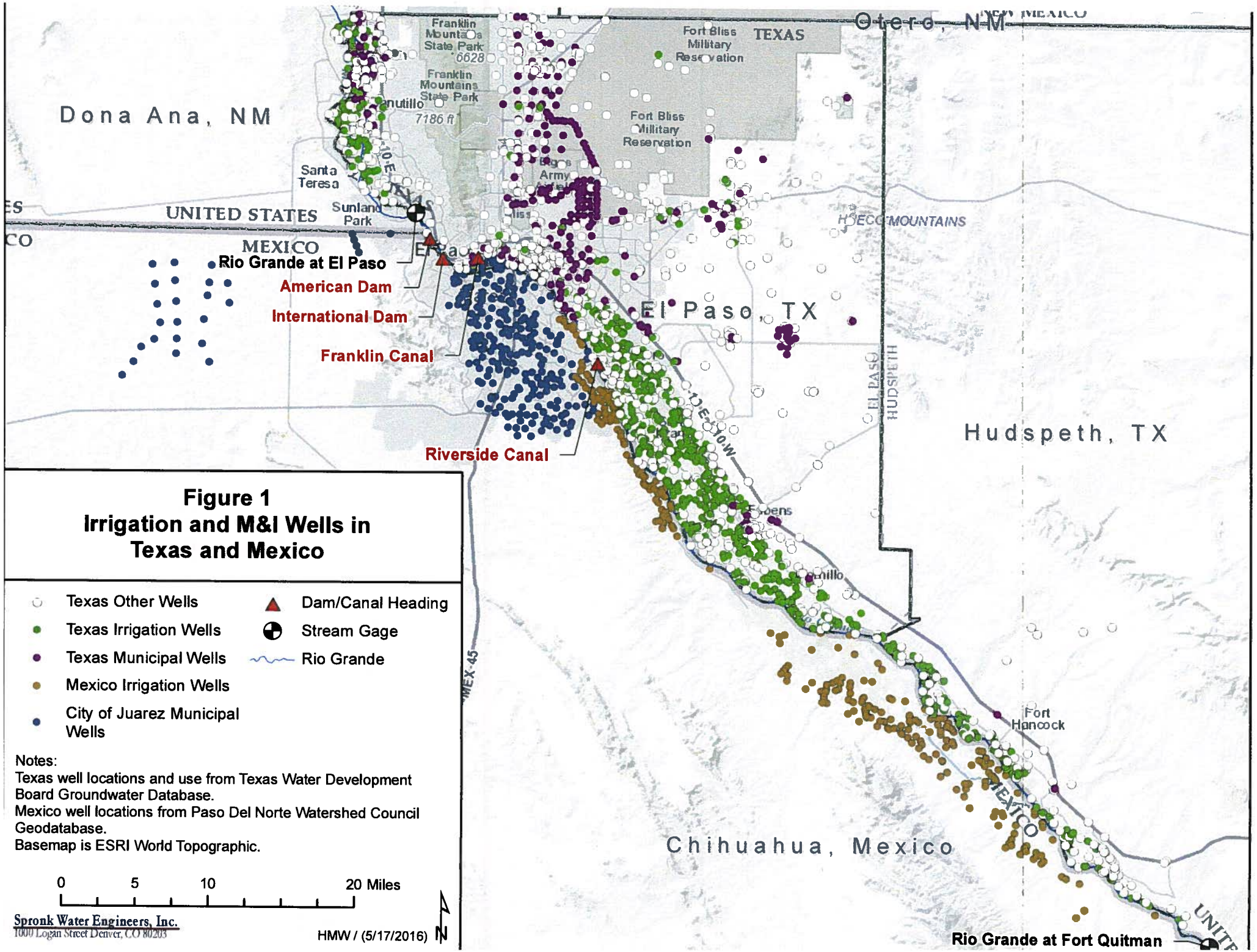


**Figure 1**
**Irrigation and M&I Wells in Texas and Mexico**

Notes:
Texas well locations and use from Texas Water Development Board Groundwater Database.
Mexico well locations from Paso Del Norte Watershed Council Geodatabase.
Basemap is ESRI World Topographic.

Spronk Water Engineers, Inc.
1000 Logan Street Denver, CO 80203

HMW / (5/17/2016)

# Major Rio Grande Basin Reservoirs

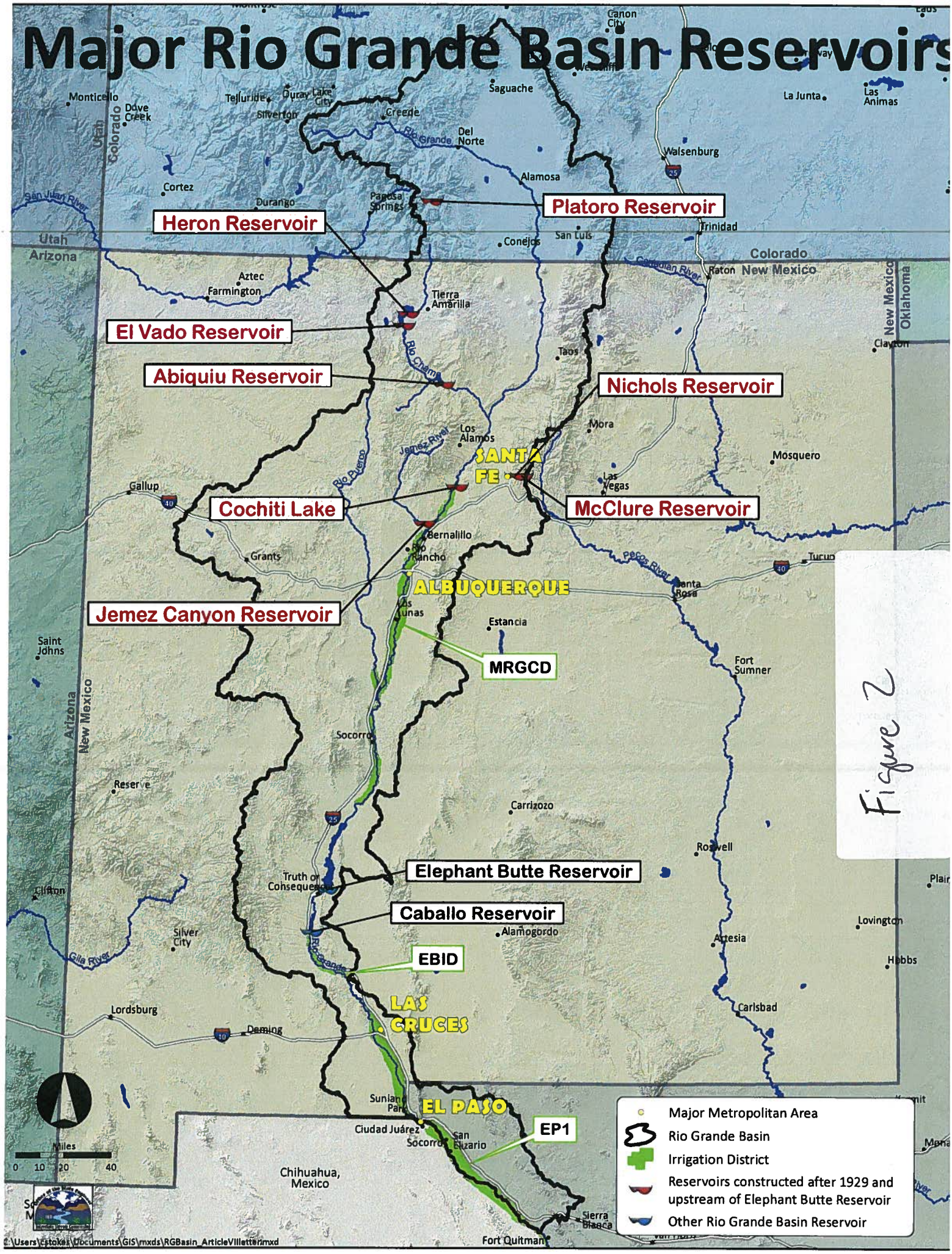


Figure 2

**Table 1**

**Summary of Project Supply and Economic Value**
**Alternative 1 (2008 OA) vs. Alternative 5 (Ad Hoc D1/D2)**
**EBID**

**Average Annual Project Water Supply**
(1,000 AF/y)

| EBID Diversions and Pumping - Alternative 1 | P25 | P50 | P75 |
|---|---|---|---|
| Project Diversions | 150.3 | 176.5 | 219.2 |
| Ground Water Pumping | 252.0 | 227.2 | 211.1 |

*P50 value is listed incorrectly a 221,170 on page 4-37.*

| EBID Diversions and Pumping - Alternative 5 | P25 | P50 | P75 |
|---|---|---|---|
| Project Diversions | 200.0 | 239.8 | 271.1 |
| Ground Water Pumping | 219.3 | 185.1 | 169.7 |

*P25 and P50 values are listed incorrectly as 217.6 and 184.3 on page 4-88.*

| | Difference (Alt 5 minus Alt 1) | P25 | P50 | P75 |
|---|---|---|---|---|
| (1) | Project Diversions | 49.7 | 63.3 | 51.9 |
| (2) | Ground Water Pumping | -32.7 | -42.1 | -41.4 |
| | Total | | | |

**Average Annual Economic Value**
($ million)

| EBID Pumping Cost - Alternative 1 | P25 | P50 | P75 |
|---|---|---|---|
| Rincon Valley | 1.4 | 1.2 | 1.1 |
| Mesilla Valley | 4.9 | 4.4 | 4.0 |
| Total | 6.3 | 5.6 | 5.1 |

| EBID Pumping Cost - Alternative 5 | P25 | P50 | P75 |
|---|---|---|---|
| Rincon Valley | 1.1 | 0.9 | 0.9 |
| Mesilla Valley | 4.2 | 3.4 | 3.1 |
| Total | 5.3 | 4.3 | 4.0 |

| | Difference (Alt 5 minus Alt 1) | P25 | P50 | P75 |
|---|---|---|---|---|
| | Rincon Valley | -0.3 | -0.3 | -0.2 |
| | Mesilla Valley | -0.7 | -1.0 | -0.9 |
| (3) | Total | -1.0 | -1.3 | -1.1 |
| | **Value of Water In EBID ($/AF Diversion) (3)/(1)** | **-$20.12** | **-$20.54** | **-$21.19** |
| | **Value of Water In EBID ($/AF Pumping) (3)/(2)** | **$30.58** | **$30.88** | **$26.57** |

Note:
The values shown in this table were obtained from Section 4 of the Draft EIS.

**Table 2**

**Summary of Project Supply and Economic Value**
**Alternative 1 (2008 OA) vs. Alternative 5 (Ad Hoc D1/D2)**
**EPCWID**

**Average Annual Project Water Supply**
(1,000 AF/y)

| | EPCWID Project Diversions - Alternative 1 | P25 | P50 | P75 |
|---|---|---|---|---|
| 84.1% | Diversions to Agricultural Use | 189.6 | 217.4 | 240.0 |
| 15.9% | Diversions to Urban Use | 35.8 | 41.1 | 45.4 |
| | Total | 225.4 | 258.5 | 285.4 |

| | EPCWID Project Diversions - Alternative 5 | P25 | P50 | P75 |
|---|---|---|---|---|
| 84.1% | Diversions to Agricultural Use | 168.2 | 190.2 | 218.3 |
| 15.9% | Diversions to Urban Use | 31.8 | 36.0 | 41.3 |
| | Total | 200.0 | 226.2 | 259.6 |

| | Difference (Alt 5 minus Alt 1) | P25 | P50 | P75 |
|---|---|---|---|---|
| | Diversions to Agricultural Use | -21.4 | -27.2 | -21.7 |
| | Diversions to Urban Use | -4.0 | -5.1 | -4.1 |
| (1) | Total | -25.4 | -32.3 | -25.8 |

**Average Annual Economic Value**
($ million)

| | Economic Benefits - Alternative 1 | P25 | P50 | P75 |
|---|---|---|---|---|
| | Diversions to Agricultural Use | 20.9 | 23.5 | 26.7 |
| | Diversions to Urban Use | 20.3 | 23.1 | 26.7 |
| | Total | 41.2 | 46.6 | 53.4 |

| | Economic Benefits - Alternative 5 | P25 | P50 | P75 |
|---|---|---|---|---|
| | Diversions to Agricultural Use | 19.5 | 21.7 | 25.2 |
| | Diversions to Urban Use | 18.3 | 20.7 | 23.7 |
| | Total | 37.8 | 42.4 | 48.9 |

| | Difference (Alt 5 minus Alt 1) | P25 | P50 | P75 |
|---|---|---|---|---|
| | Diversions to Agricultural Use | -1.4 | -1.8 | -1.5 |
| | Diversions to Urban Use | -2.0 | -2.4 | -3.0 |
| (2) | Total | -3.4 | -4.2 | -4.5 |
| | **Value of Water In EP#1 ($/AF Diversion) (2) / (1)** | **$133.86** | **$130.03** | **$174.42** |

Note:
The values shown in this table were obtained from Section 4 of the Draft EIS.

# APPENDIX A
# ADDITIONAL COMMENTS ON BA

**Document Title:** Biological Assessment Rio Grande Project Operating Agreement
**Report Date:** August 15, 2015
**Reviewed By:** SWCA Environmental Consultants
**Agency Name:** New Mexico Interstate Stream Commission

| Item | Chapter, Section, Page, Table, Figure Or Drawing | Comment |
|---|---|---|
| 1 | Section 2.2, Page 2-2; Paragraph 3 | The P25, P50, and P75 scenarios are not adequately described to evaluate how appropriate they are for model estimations for dry, average, or wet future climate predictions that will affect special status species.<br><br>The BA lacks necessary information documenting the three climate scenarios. What climate prediction data were used to parameterize the model relative to predicted climate change for the region? There should be more emphasis on the effects of a warmer and dryer climate for the region, since that is the scenario for most climate trend predictions. The BA lacks a description of predicted climate change for the region (e.g., Llewellyn and Vaddey 2013, which is not referenced) and fails to clearly state the context of the P25, P50, and P75 scenarios relative to overall climate change predictions and relative to effects of climate change on water management, given that there will likely be much less input to the Rio Grande from Colorado and New Mexico. |
| 2 | Section 2.2, Page 2-2; Paragraph 3 | There is no specific information or information source citation for the Rincon and Mesilla Basins Hydrological Model in order to evaluate the adequacy of the model to predict the Rio Grande Operating Agreement (RGOA) effects on Endangered Species Act species: "Assuming these scenarios provide a reasonable representation of likely future climatic/hydrological conditions in the Rincon and Mesilla basins through the year 2050, the model results give an estimate of the expected frequency and duration of EBR at particular water surface elevations. From these elevations, we can extrapolate to the effects on listed species."<br><br>The model was built for the Rincon and Mesilla hydrologic basins, which are downstream from EBR; how well does the model predict inflow to EBR from the Upper Rio Grande watershed upstream from those basins? Attempts were made (numerous times and ways) to obtain "Reclamation (U.S. Bureau of Reclamation). 2015b. Simulation of Rio Grande Project Operations in the Rincon and Mesilla Basins: Summary of Model Configuration and Results. Technical Memorandum No. 86-68210–2015-05. U.S. Department of the Interior, Bureau of Reclamation. Technical Service Center, Denver, Colorado," but the report was not available on the Reclamation website. Access to this report is critical in order to understand the adequacy and appropriateness of using the model in predicting RGOA effects. This is all the more important given the lack of information provided about the model in the BA. |
| 3 | Section 2, Page 2-5; Figure 2-4 | Only the P75 scenario is presented in the figure; the text says all three are presented.<br><br>The text above says that all three climate scenarios are presented in Figure 2-4, but only the P75 (wetter than average) is presented, because prolonged high water may have the greatest impacts on species. Why not instead emphasize P25, the most likely scenario based on climate prediction models? |
| 4 | Section 2, Pages 2-1 to | Inadequate information is presented in order for one to evaluate the validity of the modeling. |

| Item | Chapter, Section, Page, Table, Figure Or Drawing | Comment |
|---|---|---|
| | 2-6 | Section 2 describes the anticipated EBR water levels that may affect species. This section is critical to evaluating potential impacts to species, yet the information presented is not adequate to provide an understanding of projected climate and EBR water levels. See comment above. The document overall does not adequately address the predicted impacts of climate change as incorporated in the model and beyond the Rincon and Mesilla Basins Hydrological Model. |
| 5 | Section 3.3, Page 3-4; Paragraph 1 | Climate change and resulting potential loss of riparian wetland habitat from reduced Rio Grande flow and increased evapotranspiration, increased ambient temperatures, and increased growing season should be recognized as a potential threat to the New Mexico meadow jumping mouse (*Zapus hudsonius*), as it was for the flycatcher and cuckoo. Does the Rincon and Mesilla Basins Hydrological Model account for all aspects of potential climate change effects on species? |
| 6 | Section 3.4, Page 3-4, | More recent publications than U.S. Fish and Wildlife Service (USFWS) (2003) offer expanded and greatly refined perspectives on factors with demonstrated effects on the silvery minnow, including those that can alter rates of population growth. For instance, Cowley et al. (2009) report that survival of silvery minnow eggs declined sharply at salinities greater than 3.0 practical salinity units (PSU) and egg survival was only 5% at a salinity of 8.0 PSU. This represents a significant finding and accounts for the historic absence of the silvery minnow from the Pecos River downstream of the approximate vicinity of Brantley Reservoir in Eddy County, New Mexico, to the confluence with the Rio Grande in Texas (Sublette et al. 1990; Miller 2005). Likewise, Buhl (2002, 2006) offers a vastly refined account of the physiologic tolerances of life stages beyond the embryo stage. These above studies and their findings need to be addressed for the silvery minnow. |
| 7 | Page 4-1; Paragraph 2, between lists of citations | Need citation for "preliminary model" used that concluded "no effect" on listed species.<br><br>The BA fails to state and cite what model was used and the predictions for each species. This information may be in the citations presented, but there is no way to know which, if any, contain that information. |
| 8 | Section 4.1, Page 4-2 to 4-4 | Again, climate change needs to be addressed beyond the Rincon and Mesilla Basins Hydrological Model output. Climate is probably the main physical environmental factor that will affect the listed species. |
| 9 | Pages 4-12 to 4-14; flycatcher habitat classes | There is inadequate inclusion of soil moisture conditions.<br><br>The flycatcher habitat classes and discussions focus on vegetation structure, which is important. Soil moisture or saturation also is a key component of flycatcher habitat and should have been addressed more in the BA. Suitable habitat characteristics and classifications should include soil moisture conditions during the flycatcher breeding season. Understanding and predicting riparian groundwater dynamics is important here and should have been addressed. |

| Item | Chapter, Section, Page, Table, Figure Or Drawing | Comment |
|---|---|---|
| 10 | Section 4.2.4, Page 4-18 | This paragraph on *Diorhabda* does not provide adequate information or analysis to consider the beetle's potential impact on saltcedar (and flycatcher and cuckoo breeding habitats).<br><br>There are two different species of *Diorhabda* converging on the EBR area: the northern tamarisk beetle, *D. carinulata* from the north, and the subtropical tamarisk leaf beetle, *D. sublineata* from the south (J. Tracy, Texas A&M, personal communication, 2014), and both had nearly converged in 2015 in the EB area (Tamarisk Coalition 2016). We do not know what will happen when the two species meet in the EBR area in 2016. The two species are known to hybridize, but with <40% F2 egg viability and also reduced F2 female survival (Bean et al. 2013). At EBR in 2016 and beyond, hybridization is a possibility, competitive exclusion or coexistence are other possibilities; the effects of each of those scenarios on saltcedar of the area are unknown. *Tamarix* species hybridized in North America, but not in Asia where they and *Diorhabda* are native, and the *Tamarix* in the EBR region are hybrids between *T. chinensis* and *T. ramosissima* (Gaskin and Schall 2002). *Diorhabda* may also hybridize in the EBR area, with unforeseen ecological consequences. Since we do not know how the two different beetle species and/or hybrids may affect saltcedar around EBR at this time, predicting the impacts to saltcedar are difficult. Moore (2007) had reported that native trees are more important to the flycatcher in the San Marcial Reach and EBR delta, but recently noted that native vegetation had died back due to the recent drought, and that flycatcher breeding pairs were starting to utilize saltcedar more in the EBR delta region. Therefore, *Diorhabda* sp. will likely have an effect on the flycatcher in that area. Decline of saltcedar because of the beetles may benefit native willow and cottonwood (*Populus* sp.). However, climate change appears to be dampening any increases in native trees in areas where saltcedar may decline due to the beetle. All of this information needs to be addressed. |
| 11 | Section 4.2.4, Page 4-18 | The effects of the tamarisk beetle on flycatcher occupancy and productivity must be analyzed. Although the majority of flycatcher territories to date are in stands dominated by native vegetation, flycatchers are increasingly moving into saltcedar as reservoir elevation drops and the native vegetation dies. This has been documented in the action as late as 2015. Therefore, the combined effects of lower reservoir elevations during dry periods, die-off of native vegetation, flycatchers moving into saltcedar-dominated habitat, and colonization of the beetle must be analyzed. Flycatcher nest desertion, abandonment, and subsequent reduced productivity has been shown along the Virgin River in Nevada (McLeod and Pellegrini 2014) and Utah (Dobbs et al. 2012).<br><br>Flycatcher nest substrate (saltcedar, willow, etc.) for each nesting attempt should be provided annually to provide the degree to which flycatchers have moved across dominant vegetation types (native versus exotic). |
| 12 | Section 4.3.2, Page 4-20; Paragraph 1, first sentence | "MRG Study Area" is not defined and mapped. |
| 13 | Section 4.3.2, Page 4-21; Paragraph 2, first sentence | The Bureau of Reclamation study area is not defined and mapped as related to and described in the context of the Action Area. For example, the first six sites listed in Table 4-6 are outside the Action Area. |
| 14 | Section 4.3.2, Page 4-23; Paragraph 3, second sentence | Methods used to define cuckoo territories should have been included or referenced. |

| Item | Chapter, Section, Page, Table, Figure Or Drawing | Comment |
|---|---|---|
| 15 | Section 4.3.2, Page 4-24; Paragraph 4, last sentence | The section is addressing habitat, but the sentence is about the flycatcher.<br><br>Is the reference to the flycatcher intentional or should the reference be to the cuckoo? Also, the wording and meaning of the entire sentence is not clear. Why would flood tolerance of Goodding's willow (*Salix gooddingii*) (or the flycatcher?) have a major influence on the impacts of a rising pool? |
| 16 | Section 4.4.1, Page 4-29; Paragraphs 2 and 3 | No mention of elevation limits to the geographic distribution of the New Mexico meadow jumping mouse.<br><br>The mouse is an upland species, not known to occur below 4,500 feet of elevation; EBR is below 4,500 feet. This is an important consideration relative to habitat not present at EBR. |
| 17 | Section 4.4.3, Page 4-31; Paragraph 1 | There is no mention of predicted climate change beyond the model scenarios.<br><br>As with the other species, climate change through 2050 is likely to be the main factor reducing the probability of jumping mouse presence and potential jumping mouse habitat in the project area. |
| 18 | Section 4.5.1, Page 4-31 | The critical habitat designation specifies four primary elements of critical habitat for the silvery minnow (USFWS 2003):<br><br>1. A hydrologic regime that provides sufficient flowing water with low to moderate currents capable of forming and maintaining a diversity of aquatic habitats, including backwaters, shallow side channels, pools, eddies, and runs.<br>2. The presence of eddies, pools, or backwater, or other refuge habitat with unimpounded stretches of flowing water of sufficient length to provide a variation of habitats with a wide range of depth and velocities.<br>3. Substrate of predominately sand and silt.<br>4. Water of sufficient quality to maintain natural daily and seasonally variable water temperatures in the approximate range of greater than 1°C (35°F) and less than 30°C (85°F) and reduced degraded conditions.<br><br>Section 4.5.1 of the BA asserts that "no primary constituent elements of habitat exist in the inflow area to EBR," yet Section 4.5.2 declares that surveys for fish were conducted during 2010–2013 in suitable habitat (shorelines, backwaters, and pools), and Section 4.5.3 declares that "starting near RM 62, extending south to the active pool (approximately RM 37 in 2015), recent and ongoing construction and maintenance of the delta channel helps to maintain a riverine habitat suitable for minnows, including slackwater, backwaters, shoals, and pools, in an area that previously lacked any habitat." These apparent contradictions are unresolved in the BA. |

| Item | Chapter, Section, Page, Table, Figure Or Drawing | Comment |
|---|---|---|
| 19 | Section 4.5.2, Page 4-31 | If the silvery minnow is not expected to be found past the inflow to the active pool of Elephant Butte Reservoir, as asserted without proof in Section 4.5.2, then the pool can be regarded demographically as a population sink (i.e., where death exceeds birth). Logically, this effect will vary with the degree to which silvery minnow egg and larval stages drift into the reservoir pool. The degree to which incubating silvery minnow embryos and larvae enter the drift or are retained in upstream habitats varies with discharge and river morphology, notably including factors conducive to river-floodplain coupling. Although silvery minnow embryos are known to drift considerable distances when flow is confined to the active channel (Dudley and Platania 2007), there is evidence of reduced downstream drift as flow steadily increases sufficiently to inundate adjacent floodplain terraces (Hatch and Gonzales 2009). Multi-modal hydrographs, even if sufficient to escape the active river channel, will often result in heightened downstream drift of incubating silvery minnow embryos with repeated spikes in discharge. Reduction of distance in egg and larvae drift from points of natal origin serves to reduce impacts of habitat fragmentation that would otherwise restrict movement between subpopulations and source-sink exchanges. Reduction in egg and larvae drift would also reduce the rate of silvery minnow losses to population sinks, such as EBR. Likewise, gradual reductions in flow (e.g., 100–200 cubic feet per second/day) following periods of high discharge will reduce impacts of stranding fish.<br><br>An assessment of the impact of drifting silvery minnow eggs and larvae into EBR will require demographic modeling that accounts for rates of immigration and emigration. This problem will defy attempts at assessment reliant on mechanical explanations of population growth, i.e., methods that focus on the physical link between purported causal factors and population growth rate.<br><br>There are several problems with the assessment of silvery minnow abundance as indicated by an index of catch per effort (CPE; erroneously referenced in the BA as "density"). The BA reports no statistical difference in site and time-specific estimates of silvery minnow CPE in delta channel surveys conducted during 2010–2013. Perhaps as an oversight, the standard error of the estimates were not included in the tabulated data (Table 4-10), nor were the site-specific statistical tests and associated p-values included in the text. The absence of these elements in the BA renders it incomplete and difficult to independently assess. |
| 20 | Section 4.5.3, Page 4-32 | The BA asserts that purported evidence of a decline in silvery minnow density (= CPE) from 2010 to 2014 follows a similar pattern for the species throughout the MRG due to drought and decreased spring runoff. In this instance, a presumption is made that the concern about drought is over the extent of mortality-causing river drying. However, the amount of river drying in the MRG actually declined from 2012 to 2014 (see Hatch 2009, 2010; Hatch and Gonzales 2009; Hatch and Dodge 2013; Hatch and Pargas 2014; Hatch et al. 2016) refuting the assertion of declining CPE due to the hydrograph. Furthermore, aside from a 1-mile segment of river (between RM 63.5 and 64.5) that dried briefly in July 2009, the river downstream of the South Boundary Bosque del Apache (RM 73.7) has not dried since 2005 (Smith and Basham 2003; USFWS 2005, 2006; Hatch et al. 2016). In fact, beginning in 2006, the Bureau Reclamation has pumped water from the Low Flow Conveyance Channel to irrigate the river and maintain, generally successfully, running water conditions downstream of the South Boundary Bosque del Apache (RM 73.7). |

| Item | Chapter, Section, Page, Table, Figure Or Drawing | Comment |
|---|---|---|
| 21 | Section 4.5.3, Page 4-33; Figure 4-11 | Figure 4.11 is not referenced or explained adequately in the text. The caption and lack of text make the figure misleading. Figure 4-11 shows a strong decline in silvery minnow densities over time, yet Figure 4-12 (which also is not referenced) shows that the data come from different sampling locations each year. Figure 4-11 lacks text that explains this. Figure 4-11 as presented assumes all sampling is the same each year; it was not. This figure (even if misleading) shows the effects of drought on the silvery minnow; climate change is expected to result in more drought and reduced Rio Grande flow, and this is not adequately discussed. Again, there is no mention of anticipated climate change effects to the silvery minnow beyond the ambiguous climate model predictions. |
| 22 | Section 5, Page 5-1; Paragraph 1, last sentence | The sentence does not make sense and is misleading.<br><br>How would dynamic fluctuating EBR pool levels create long-term, established vegetation patches composed of tall woody species that both the flycatcher and cuckoo need for breeding habitat? Those fluctuations are more likely to create spatially and temporally short-term early successional vegetation communities dominated by herbaceous species (largely exotic) that are adapted to continually changing shorelines, not long-term established communities of woody plant species (willows, cottonwood) that both bird species prefer. The logic and ecological mechanism of that statement is not explained. Figure 2-3 shows considerable temporal fluctuations in EBR levels for all three climate scenarios. The spatial and temporal dynamics of EBR pool level variability overall is very important but not addressed in this BA. For example, see Hill et al. (1998). |
| 23 | Section 5.1, Page 5-1; Paragraph 2, first sentence | The sentence is uninformative and misleading.<br><br>Both bird species prefer established, long-term large patches of vegetation dominated by native woody trees. Furthermore, the flycatcher requires saturated soils during the breeding season in such vegetation patches. The sentence oversimplifies the habitat requirements of these species. |
| 24 | Section 5.1, Page 5-1; Paragraph 2, last sentence | The sentence is misleading.<br><br>Woody vegetation patches take many years to become established. Once inundated, tree mortality is likely; then, following inundation, it takes years to recover if the shoreline remains stable. This scenario should result in loss of later seral woody vegetation patches (which the birds need for habitat) and the establishment of short-term, dynamic herbaceous vegetation patches (which do not provide suitable habitat for the birds). |
| 25 | Section 5.1, Page 5-1; Paragraph 2 | This paragraph does address the potential loss of woody vegetation due to fluctuating water levels, but the potential extent of vegetation loss/change, especially for flycatcher and cuckoo habitat, is not adequately addressed. The extent and duration of inundation has effects on all plant species. The model output in Figure 2-3 shows 100-foot changes every few years, with inundation periods lasting many months. The discussion presented in this paragraph does not adequately address how such frequency, extent, and duration of flooding (i.e., dynamics as mentioned above) will affect long-lived woody tree species, which are key components of both bird species' habitats. |
| 26 | Section 5.1, Page 5-4; Paragraph 1 | This summary statement does not incorporate likely water level dynamics over time.<br><br>The last sentence states that climate variability is unrelated to the RGOA: "Such environmental conditions, while fundamentally a result of natural climatic conditions, unrelated to the RGOA, could potentially produce multi-year periods of negative impact to flycatcher and their habitat." |

| Item | Chapter, Section, Page, Table, Figure Or Drawing | Comment |
|---|---|---|
| | | The BA does not address how dynamic water level fluctuation over many years (up to 2050) will likely create much more variability for the establishment and persistence of riparian vegetation.<br><br>The statement that climate variability is unrelated to the RGOA is misleading. How can Rio Grande water management not be related to the availability of water to the Rio Grande and ultimately EBR? Again, see Llewellyn and Vaddey (2013). Predicted climate change is probably the most important environmental factor that will affect the impacts of the RGOA to listed species and is not adequately addressed in this BA beyond the groundwater model output. |
| 27 | Section 5.1, Page 5-5; Paragraph 2 | The text discusses short- and long-term inundation scenarios.<br><br>High variability in water levels over time is most likely, not just short and long-term scenarios. The BA fails to adequately address the effects of water level spatial and temporal dynamics on the species and their habitats. |
| 28 | Section 5.2, Page 5-5 | The New Mexico meadow jumping mouse is not known to occur south of Bosque del Apache and is not likely to occur in the immediate project area. |
| 29 | Section 5.3, Page 5-5; Paragraph 6 | In Section 5.3, a statement is made that "It is anticipated that any minnows in the delta reach of EBR would have the ability to move upstream along the lotic ecosystem of the temporary delta channel, continuing upstream of RM62 into the main river channel, during periods of reservoir filling, and thus avoid the lentic ecosystem of a rising reservoir." However, lacking confirming evidence, this assertion is questionable, especially for times of reservoir filling that coincide with runoff events from mid-April to mid-July, when egg and larval silvery minnow are a prominent component of the drift. For these life stages of silvery minnow, upstream movement by way of swimming or other transport processes seems doubtful. |
| 30 | Section 5.3, Page 5-6; Paragraph 1 | The "high-energy, steep-gradient channel" (quoting from the first paragraph on page 5-6) environment upstream of RM 62 is surely the consequence of cumulative effects of sediment deposition that results from water storage in EBR, reduced river channel flow as a consequence of water conveyance through the Low Flow Conveyance Channel, river channel excavation and channel straightening (e.g., removal of the Tiffany sediment plug that formed with runoff during 2005), and levee containment of high runoff. The cumulative effects of these actions are not adequately addressed in the BA. The consequences of the cumulative effects of these actions cannot be dismissed as having no direct effects. Further, actions can be taken to mitigate for these cumulative effects, including levee removal, rerouting all water to the river downstream of the South Boundary of the Bosque del Apache Refuge, and regulation of channel incision with gradient reduction structures. |
| 31 | Section 6.1, Page 6-2; Paragraph 2 | There is no explanation of why P50 is assumed to be the most likely climate scenario, given that most climate models predict a warmer and drier climate for the region. Why is P25 not the most likely scenario? Again, there is no information about the model in the BA. |

## ADDITIONAL DEIS COMMENTS RELATED TO COMPLIANCE WITH THE ESA

**Document Title:** **Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project, Draft Environmental Impact Statement**
**Report Date:** **March 2016**
**Reviewed By:** **SWCA Environmental Consultants**
**Agency Name:** **New Mexico Interstate Stream Commission**

**LEGEND** ***(for ACTION column below)***

A-APPROVED D-DISAPPROVED C-CONCUR E-EXCEPTION

| Item No. | Chapter, Section, Page, Table, Figure Or Drawing | Comment | Action |
|---|---|---|---|
| 1 | Global comment | The Draft EIS does not specify the possible implications for upstream flow regimes, including those attributable to Albuquerque Bernalillo County Water Utility Authority (ABCWUA) storage of water in EBR. Because of this, the Draft EIS is incomplete. As such, it is impossible to reasonably assess all material impacts. | |
| 2 | Page 3-21; Line 636 | "may facilitate hybridization" with what other species? This does not state which other *Helianthus* species. *H. paradoxus* may hybridize within disturbed areas (*H. annuus*?); *H. annuus* in very common in the region and colonizes disturbed sandy soils; and other *Helianthus* species (e.g., *ciliaris*) also occur in the region but have more restricted habitats and distributions. | |
| 3 | Page 3-21, 3-22 | No mention of federal and state ranks. The *H. paradoxus* is federally listed as threatened and state listed as endangered. State that *C. wrightii* is a federal candidate species and a state endangered species. | |
| 4 | Section 3.8, pages 3-14 to 3-22 | The Chapter 3 vegetation section addresses vegetation communities and special status species. But only federally listed species are considered. | |
| 5 | Page 3-27; first paragraph | The BA states that "cuckoos are nest parasites of other birds....including flycatchers." "In the arid west, 'cuckoos' [implying the western yellow-billed cuckoo] are usually found in cottonwood-willow riparian associations..." This statement implies that the cuckoo is a common nest parasite of the flycatcher, which may rarely happen but is not a common event. The cuckoo rarely lays eggs in other birds' nests, relative to other cuckoo species. These sentences are misleading, indicating that the cuckoo is a threat to the flycatcher.<br><br>Also, at the end of the paragraph, a statement is made that katydid eggs are laid in the soil and drown when inundated. The common katydids (Phaneropterinae; *Microcentrum, Scudderia, Insara*) that occur on riparian trees that the cuckoo is likely to eat lay their eggs on vegetation generally high above the ground. Meadow katydids (Conocephalinae; *Conocephalus, Neoconoephalus*) and shield-backed katydids (Tettigoniinae; *Eremopedes*) live on low vegetation near the ground and do lay eggs in soil, but are not as likely to be a significant food source for the cuckoo as the phaneropterine katydids in the trees. | |
| 6 | Section 4.7.1, pages 4-49 to 4-50 | The impact indicators in this analysis are recession and rising of reservoir water levels alone. This does not address the impacts of dynamic fluctuations. Dynamic fluctuations of water levels will result in variable shoreline disturbance dynamic conditions and will not allow woody vegetation communities to become established at particular pool levels for extended periods of time. Dynamics will favor colonizer plant species to dynamic shoreline environments, and many of those species are exotic invasives. The effects of dynamic water level fluctuations on vegetation communities are not adequately considered. Vegetation of dam reservoirs with hypovariable or hypervariable hydrologic regimes are known to be less diverse, contain more exotic species, and have | |

| Item No. | Chapter, Section, Page, Table, Figure Or Drawing | Comment | Action |
|---|---|---|---|
| | | less rare native species than natural hydrological regimes (e.g., Hill et al. 1998). This is only suggested but not adequately evaluated in Lines 1428 to 1430. Prolonged low or high water levels are less problematic than variable water levels, which are forecast for EBR and Caballo Reservoir. Figures 4-9, 4-10, and 4-11 all show considerable fluctuations over time. | |
| 7 | Page 4-51; Lines 1475–1476 | Reservoir level dynamics effects are eluded to here, but not elaborated. As with the comment above, water level temporal dynamics effects on vegetation must be considered, not just high and low levels for extended periods. | |
| 8 | Page 4-51; Lines 1487 and 1588 | No information is given on plans to control exotic weeds. There is no description of any such plans and success assumptions for controlling the spread of invasive exotic weed species on the dynamic reservoir shorelines. Will or can this even be achieved? How will you control exotic plants without negatively impacting native plants? Are there differences in control methods for herbs vs. woody plant species? What are the spatial extent and temporal frequency of treatments? | |
| 9 | Section 4 | The tamarisk beetle must be included in impact analyses. Beetles are present at Caballo and within the San Marcial Reach, with the beetle undoubtedly to reach EBR in 2016. As flycatchers readily use and successfully nest in saltcedar-dominated habitats, impact analysis must include impacts from the beetle. This does not. | |
| 10 | Page 4-57; Lines 1704–1705 | Throughout the BA impact analysis, implicit is that "habitat upstream and next to the reservoir pool would ultimately mature through natural succession past a point of suitability for the flycatcher and cuckoo." However, although habitat can "mature," there is no analysis that includes die-off of suitable habitat/vegetation, which is the more likely scenario due to prolonged receding reservoir levels. | |
| 11 | Page 4-69; Lines 2150–2151 | The conclusion that "The potential for impacts on cultural resources that may be within the reservoir pools would be unchanged from historical operations, and no new impacts on cultural resources are anticipated to result from reservoir fluctuations" is not well supported. Resources within the pool have not been inventoried or modeled, so we have no idea of what is present. It appears that significant differences may exist between the various alternatives as to 1) the mean water level and 2) the magnitude and frequency of water level fluctuations. There is the potential that the alternatives will have different effects on cultural resources (mainly archaeological sites) due to shoreline erosion and exposure. These potentially different effects have not been analyzed. | |

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June 8, 2016

**BY ELECTRONIC MAIL AND FIRST CLASS MAIL**

Nancy Coulam
Bureau of Reclamation
125 South State Street, Room 8100
Salt Lake City, Utah 84138-1147

ncoulam@usbr.gov

***Re: City Las Cruces' Comments on Draft Environmental Impact Statement: "Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project, New Mexico and Texas", referred to below as the "Operating Agreement EIS"***

Dear Ms. Coulam:

1 The City of Las Cruces finds that the Operating Agreement EIS referenced above clearly fails to comply with the National Environmental Policy Act. Rather than standing as an objective input to decision-making in advance of taking an action, the draft EIS is a *post hoc* justification of a decision made in 2008. As such it is an overt violation of NEPA which can only be cured if the Bureau of Reclamation (Bureau) returns to its pre-2008 operational practices and a meaningful evaluation of potential new practices is adequately evaluated.

2 Moreover, the methodology used by the Bureau to model the hydrologic effects of the Operating Agreement has been hidden from public review and without doubt results in countless erroneous predictions. Even so, many fundamental assumptions and conclusions reached by the Bureau are clearly incorrect, and invalidate the document as a proper NEPA analysis. Absent a return to the pre-2008 conditions, the Bureau must withdraw this document and redo its analysis, this time in a manner consistent with the requirements of the law.

Our detailed comments which support our conclusions are set out below. In addition, the City also endorses the comments provided by the State of New Mexico.

3 1. Disregard for municipal water demands. At p. 30 of Appendix C to the draft EIS, the Bureau indicates that projections of future water use through 2050 for the City of Las Cruces (along with El Paso and other communities) assume that "any population and economic growth during the simulation period will be accompanied by reductions in per capita water demand such that total non-irrigation demands remain constant at average 1995-2004 levels". This assumption is manifestly absurd.

- First, the assumption requires that the future per capita demands in Las Cruces must fall to near-subsistence levels if the Operating Agreement is to have the small impact projected by the EIS. The Bureau has no authority to compel this condition and no rational basis to assume it.
- Second, there is no assessment of the enormous harm to the City that would result from such a severely restricted municipal water supply, or even acknowledgement that the Bureau admits that their analysis implies harm.

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- Third, the Bureau has failed to assess the real-world future in which the growth in urban populations and economic activity will result in increased water requirements, despite substantial conservation programs. This is one of many reasons why the hydrologic predictions made by the Bureau have no basis in reality.

5 2. Disregard for municipal water supply needs. The EIS gives no consideration to the plans and investments the City of Las Cruces had made to meet its growing water needs through development of a sustainable surface water supply, which would have allowed reductions in groundwater pumping and a more sustainable underground supply. The Operating Agreement has been a primary factor in causing the City to abandon its plans to divert and treat surface water, thus devaluing the City's large investment in acquiring the surface water rights that were acquired to implement this plan.

6 3. Reliance on undocumented methods. The critical predictions in the EIS are based on a groundwater model which has not been made available for public or peer review. Therefore, all predictions of the hydrologic effects of the Operating Agreement are unsupported and must be considered speculative. Based on what the Bureau has revealed about the model results, it is our expectation that if and when the model is made available, it will be found to have fundamental

flaws. In particular, the model results are presented as indicating that there is no adverse long-term change to the hydrology of the region, and especially no long-term consequences to groundwater. These conclusions are clearly invalid given how profoundly the Operating Agreement has already altered the water budgets in the Mesilla Valley.

4. Analyses that are incomplete or invalid. The EIS essentially ignores many obvious impacts to the City and region.

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- The worst-case analysis in the EIS, *i.e.*, for the driest scenario, falls short of predicting the actual drought impacts of the Operating Agreement which have already been observed. Refer to comments by the State of New Mexico which reveal excessive and continuing water level declines in the Mesilla Valley since the Operating Agreement was implemented, declines far in excess of what the EIS portrays as worst-case. Even though the model demonstrably under predicts future harm, it shows that under dry conditions that are less severe than can reasonably be expected, water levels in the Las Cruces area will experience a large and steady decline.
- The EIS offers no analysis whatsoever of the implications of this water level decline, *e.g.*, increased pumping costs for the City, the potential for and consequences of increased salinity in the municipal and irrigation supply, the community impacts of having many miles of irrigation drains permanently dry and, in time, exhaustion of what historically has been a sustainable aquifer. More fundamentally, the EIS fails to acknowledge that the Operating Agreement has changed the water budget of the Mesilla Valley from one that was sustainable for more than a century, to one that is now markedly unsustainable.

8

- Projections of future Rio Grande Operations appear to substantially overstate the amount of water to which Texas is entitled while still greatly underestimating impacts in New Mexico, and never presenting a coherent analysis of the changed water budget.

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- The EIS also does not effectively assess the implications of the decline in the regional irrigation economy given that there will no longer be a reliable, sustainable water supply, but there will be increased pumping costs, and increased salinity of pumped water.

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5. Cumulative effects. The EIS contains no discussion of the numerous water management initiatives and water litigation actions now taking place in this region and provides no meaningful assessment of cumulative impacts resulting from the interaction of the Operating Agreement with these initiatives and actions. As just one example, there is no discussion of how the Operating Agreement will negatively impact Compact relinquishment credits that would otherwise benefit upstream communities.

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Far from taking a hard look at the impacts of the Operating Agreement, the Bureau has taken as soft a look as one can imagine. The EIS is so flawed as to have no value in evaluating the Operating Agreement. The Operating Agreement continues to cause great harm to New Mexico, which makes it imperative that the Bureau expeditiously initiate a meaningful NEPA process.

Sincerely,

JAY F. STEIN

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WILDEARTH GUARDIANS
A FORCE FOR NATURE

June 8, 2016

*Via Email*
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RE: Comments of WildEarth Guardians on the Draft Environmental Impact Statement for the Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project, New Mexico and Texas dated March 2016

Dear Ms. Coulam:

This letter is submitted by WildEarth Guardians ("Guardians") to provide the U.S. Bureau of Reclamation ("Reclamation") with comments on the *Draft Environmental Impact Statement for the Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project, New Mexico and Texas* dated March 2016 ("DEIS"). In addition to evaluating implementation of the 2008 Operating Agreement, Reclamation evaluates the environmental effects of a multi-year San Juan-Chama Project water storage contract for storage in Elephant Butte Reservoir.

WildEarth Guardians is a non-profit public interest environmental advocacy organization working to protect and restore the wildlife, wild places, wild rivers, and health of the American West. For more than two decades, Guardians has worked to secure flows for the iconic Rio Grande to protect and restore the fish, wildlife, and plants that depend on the river and its riparian ecosystems for their survival.

## I. Background

This year marks the 100-year anniversary of the completion of Elephant Butte Reservoir in 1916. For the past century, the Rio Grande Project—including Elephant Butte and Caballo dams and reservoirs[1], six diversion dams, 139 miles of canals, 457 miles of laterals, 465 miles of drains and a hydroelectric power plant—has shaped the development of agriculture and human communities in the region as well as significantly altered the historic flow regime of the Rio Grande and disrupted the natural riparian environment in the Rio Grande Basin in New Mexico and Texas. DEIS at 3-4. This now highly controlled and regulated river system has lost its dynamic nature and lacks the

[1] Elephant Butte Dam was one of the first dams located on the main stem of the Rio Grande.

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inherent characteristics of a fully functioning river ecosystem including sediment deposition, scouring flows, inundation, base flows, and channel and river realignment. 2003 BO at 62.

This is no more evident than below Elephant Butte and Caballo dams where "portions of the Rio Grande . . . are dry during the non-irrigation season because no surface water is being released." DEIS at 3-9 and 3-15. The DEIS at 3-24 admits that the quality of wildlife habitat from Caballo Reservoir to El Paso is considered "poor." As the construction of Elephant Butte Reservoir and operation of the Rio Grande Project stressed the lower Rio Grande river ecosystem, the taming and development of the Middle Rio Grande segment of the river (175 miles upstream of Elephant Butte Reservoir) added further strain on the river in the 20th century. The construction of Cochiti Dam (a flood control reservoir on the main stem of the Rio Grande) in 1975 put the final nail in the coffin of the dynamic and wild river in the Rio Grande valley in central and southern New Mexico.

In the arid Southwest, "[r]iparian areas constitute less than 1 percent of the land area" and "yet provide habitat to a greater number of wildlife species than any other ecological community in the region." DEIS at 3-23. In addition, these riverside areas provide "critical corridors for migratory species," especially birds. DEIS at 2-32. It should be no surprise then that the degraded river system can no longer support the full suite of plants, fish, and wildlife that once thrived in the Basin. The DEIS reports that 13 state and federally listed plant species occur in the counties in the OA study area. DEIS at 3-21. The growing list of imperiled species—including the Rio Grande silvery minnow, Southwestern willow flycatcher, yellow-billed cuckoo, New Mexico meadow jumping mouse, Pecos sunflower—is a clear indication that the health of the Rio Grande is failing and its important riparian corridor is disappearing.

Naturally, the fish and wildlife that still inhabit the region are forced to find the last best habitat available for them to thrive given the extreme changes to the natural environment. An example of this is the Southwestern willow flycatcher's use of the upper elevations of Elephant Butte and Caballo Reservoirs for nesting as the water recedes. DEIS at 3-24. The DEIS provides that "[o]ver time, as the lake at Elephant Butte has declined, there has been an increase of willows and other tress in the delta of EBR, and also an increase in flycatcher territories within the reservoir pool and north of the reservoir pool where the habitat is supported by the low-flow conveyance channel." DEIS at 3-25. It appears that the artificial infrastructure (e.g. the low-flow conveyance channel) and fluctuations in the water level of these reservoirs are providing alternate habitats for the flycatcher to inhabit; however, the danger is that this habitat is subject to the whim of water managers as well as the impacts of climate change going forward. DEIS at 3-25.

1 The DEIS evaluates and essentially rubber stamps two proposed actions—the continuation of the OA for the Rio Grande Project and a multi-year contract for storage of San Juan-Chama Project water in Elephant Butte Reservoir—that will continue the status quo on a river that is struggling to survive. Maintaining the existing water management policies of storing and distributing water from Elephant Butte Reservoir (a reservoir that has nearly 50 percent the evaporation of Abiquiu Reservoir, and likely the other 2 upstream reservoirs, located upstream on the Rio Chama) is a missed opportunity. The purpose and need for the two proposed actions could be carried out in a way that opens the door to a new water management regime for the next century and NEPA was designed as and is exactly the tool needed to evaluate those options and find a path forward that not only meets the need of the agency, but also maintains and even enhances the health of both the human and natural environment.

1 cont.

Storing water from the Rio Grande in a low elevation reservoir, like Elephant Butte Reservoir, that evaporates 250,000 acre-feet per year is irresponsible, especially given the predicted flow reductions of 35-50% for the Rio Grande in New Mexico and Texas based on climate change.[2] Four reservoirs exist in the Middle Rio Grande (and on the Rio Chama) that if reauthorized (in some cases) and/or reoperated could not only conserve water that would otherwise evaporate from EBR, but also provide a mechanism for providing significant environmental flow benefits to the Rio Chama and the 175-mile segment of the Middle Rio Grande between Cochiti Dam and Elephant Butte. If we want to retain the quality of life of the people and the ecosystems along the iconic Rio Grande from Colorado to Texas, we need to rethink how our rivers are managed and seize opportunities—like the one presented here—to evaluate a more sustainable path forward.

A. Implementation of the 2008 Operating Agreement

In June 2007, the original environmental review of implementation of the 2008 Operating Agreement was made in the *Environmental Assessment and Finding of No Significant Impact for the Bureau of Reclamation Federal Rio Grande Project New Mexico-Texas Operating Procedures, Dona Ana, Sierra, and Socorro Counties, New Mexico and El Paso County, Texas* ("2007 EA"). The 2007 EA analyzed the operating procedures that are now included in the 2008 Operating Agreement ("OA"). The term of the 2007 EA was 2007-2012.

In the twelve-page 2007 EA/FONSI, Reclamation determined that based on the information and data available in 2007, none of the environmental impacts were anticipated to reach a level of significance as defined in 40 C.F.R. § 1508.27. Reclamation reasoned in the 2007 EA that the proposed action "is essentially a water delivery accounting change which will not cause deviation from historic parameters of water in storage or in the Rio Grande" and "would not have any significant effect on the human environment." Furthermore, the 2007 EA committed Reclamation to collect data during the first five years of implementation of the new operating procedures in order to use it in support of a future environmental analysis of the affected environment.

On May 8, 2013, Reclamation released a *Supplemental Environmental Assessment for the Implementation of Rio Grande Project Operating Procedures, New Mexico and Texas* ("2013 Supplemental EA"). The 2013 Supplemental EA analyzed the environmental effects of continuing to operate under the 2008 OA for the three-year period from 2013-2015. On June 7, 2013, Guardians submitted comments on the Supplemental EA strongly recommending Reclamation prepare an environmental impact statement analyzing the direct, indirect, and cumulative effects of the proposed action for the full term of the OA through 2050, properly consider the impacts of climate change, and analyze a reasonable range of alternatives to the proposed action. Guardians May 8, 2013 comments are incorporated herein by this reference and are attached as Exhibit A.

On June 26, 2013, Reclamation sent a response to Guardians' comments on the 2013 Supplemental EA indicating its plan to "voluntarily commence and actively pursue … the development and refinement of modeling tools to thoroughly analyze the implementation of the OA

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[2] Theodore W. Sammis, Develop a Remote Sensing Tool to Estimate Evaporative Loss from Reservoirs, New Mexico State University at Las Cruces, http://gcconsortium.com/Final_SCERP_ReportSammisTed8-27-08a.html.

over its remaining life (through 2050) through an Environmental Impact Statement." While 8 years after the fact, this DEIS attempts to take a "hard look" at the environmental impacts of the implementation of the OA for the Rio Grande Project, but mostly appears to use this process as a justification for operations that are already under way.

B. San Juan-Chama Project Water Storage Contract

In January 2010, Reclamation issued a *Final Environmental Assessment and Finding of No Significant Impact for the Albuquerque Bernalillo County Water Utility Authority Contract for Storage of San Juan-Chama Water in Elephant Butte Reservoir* ("2010 SJC EA/FONSI") to renew a 40-year storage agreement for storage of 50,000 acre-feet of San Juan-Chama Project water in Elephant Butte Reservoir. This agreement would have replaced the original 1983 agreement allowing the storage of 50,000 acre feet of San Juan-Chama Project water in Elephant Butte Reservoir. Reclamation found "no significant adverse impacts" to the environment and that the proposed action would not have any significant adverse cumulative effects on any resource. However, the contract was never implemented. In the interim period, Reclamation found that due to "new information" the 2010 EA/FONSI were rendered obsolete and decided to rescind the FONSI. In order to allow storage of San Juan-Chama Project water in Elephant Butte Reservoir since 2010, Reclamation has executed annual contracts with the Albuquerque Bernalillo County Water Utility Authority. No environmental analysis was conducted of this action based on a categorical exclusion under the National Environmental Policy Act ("NEPA").

## II. Comments on Draft Environmental Impact Statement

The National Environmental Policy Act ("NEPA") aims to "encourage productive and enjoyable harmony between man and his environment" and promote government efforts "which will prevent or eliminate damage to the environment." 42 U.S.C. § 4321. As Council on Environmental Quality ("CEQ") regulations implementing NEPA explain, the law "is our basic national charter for protection of the environment." 40 C.F.R. § 1500.1(a).

Section 102(2)(C) of NEPA establishes an "action-forcing" mechanism to ensure "that environmental concerns will be integrated into the very process of agency decisionmaking." *Andrus v. Sierra Club*, 442 U.S. 347, 350 (1979). Pursuant to that statutory provision, "all agencies of the Federal Government shall ... include in every recommendation or report on … major Federal actions significantly affecting the quality of the human environment, a detailed statement" known as an environmental impact statement ("EIS") addressing "the environmental impact of the proposed action, any adverse environmental impacts which cannot be avoided ..., alternatives to the proposed action," and other environmental issues. 42 U.S.C. § 4332. What NEPA requires is that federal agencies take a "hard look at [the] environmental consequences" of their proposed actions. *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 350 (1989) (internal quotation omitted).

These comments seek to improve upon Reclamation's DEIS by detailing the ways in which it fails to comply with NEPA and how it can be augmented to encompass the spirit of NEPA and environmental stewardship. Specifically, we'll address inadequacies in the DEIS' purpose and need, range of alternatives, assessment of direct, indirect, and cumulative effects, lack of mitigation measures, and its baseline on which its analysis is based. In general, we've separated these issues out between the action involving the operating agreement and that of the storage of San Juan-Chama Project water.

A. Purpose and Need.

The environmental impact statement must "briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the purposed action." 40 C.F.R. § 1502.13. The agency, however, cannot "define the project so narrowly" that it forecloses a reasonable consideration of alternatives to the proposed action. *Davis v. Mineta*, 302 F.3d 1104, 1119 (10th Cir. 2002); *City of Carmel by the Sea v. DOT*, 123 F.3d 1142 (9th Cir. 1997); *Simmons v. U.S. Army Corps of Eng'rs*, 120 F.3d 664, 666 (7th Cir. 1997).

1. *Continued Implementation of the Operating Agreement*

2

The DEIS states that the purpose of the action is "to meet contractual obligations to [Elephant Butte Irrigation District] and [El Paso County Water Irrigation District] and comply with applicable law governing water allocation, delivery, and accounting." DEIS ES-5; 1-12. This purpose is broad enough to bring about a reasonable range of alternatives, provided Reclamation is willing to consider alternatives that involve storing carryover water in upstream reservoirs rather than solely in Elephant Butte Reservoir. As it stands, Reclamation's purpose for continuing the operating agreement is inherently defined as fulfilling those contractual obligations through storage in Elephant Butte. Many more solutions exist, however. Upstream reservoirs have lower evaporation rates and could offer benefits to the riparian and riverine habitats between the upstream and downstream reservoirs. The purpose and need as described does not appear to limit meeting the contractual obligations of EBID and or EPCWID by storing carryover water in upstream reservoirs, but to the extent it does it should be expanded.

2. *San Juan-Chama Project Water Storage Contract*

3

The DEIS describes the purpose and need for the San Juan-Chama Project water storage contract as necessary "to respond to a request to allow for a multi-year storage contract of San Juan-Chama Project water in [Elephant Butte Reservoir] in accordance with the Act of December 29, 1981, Public Law 97-140." DEIS at ES-5; 1-12. However, this is a very narrow statement that does not provide an opportunity for exploration of a range of alternatives. The only alternative that would meet this purpose and need is granting the storage contract for some term whether a multi-year or single year.

However, Reclamation previously described in the 2010 SJC EA that the purpose and need for requesting a storage contract for SJCP water in Elephant Butte was:

> (1) Additional storage for ABCWUA due to full reservoirs upstream. (2) Offset ground water effects that occur between November and March/April every year. This occurs by the Office of State Engineers (OSE) stating the amount of water (letter water) that would need to be moved from the ABCWUA San Juan-Chama pool into the native Rio Grande pool. This is an accounting procedure that allows for easy payment to the State and approved by Interstate Stream Commission (ISC). (3) Water could be used for third parties. (4) Water could be moved from Elephant Butte Reservoir via accounting to Abiquiu.

2010 SJC EA/FONSI at 8-9. This broader purpose and need statement lends itself to being evaluated in a way that allows for the evaluation of a range of alternatives beyond the action proposed.

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Reclamation should amend the purpose and need for the SJCP water storage contract to include the real underlying purposes of the need for storage, not simply acknowledging and responding to a request by a water utility. If the purpose and need for storage in EBR is to ensure that unused SJCP water allocations do not go unused, then the solution does not necessary require the storage to be in EBR. We suggest Reclamation more broadly define the problem that needs to be solved to allow for a full suite of alternatives to be explored, as required by NEPA.

B. Scope of Alternatives.

The "heart" of the NEPA process is an agency's duty to consider "alternatives to the proposed action" and to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." 42 U.S.C. §§ 4332(2)(C)(iii), 4332(2)(E); 40 C.F.R. § 1502.14(a). An agency must "[r]igorously explore and objectively evaluate all reasonable alternatives" and specifically "[i]nclude the alternative of no action." 40 C.F.R. §§ 1502.14(a), (d). Operating in concert with NEPA's mandate to address environmental impacts, an agency's fidelity to alternatives analysis allows agencies to "sharply defin[e] the issues and provid[e] a clear basis for choice among options by the decision maker and the public." 40 C.F.R. § 1502.14. NEPA's implementing regulations emphasize the importance of fully informed and well-considered conservation decisions that "foster excellent action" and "protect, restore, and enhance the environment." 40 C.F.R. § 1500.1(c); *see also* 40 C.F.R. § 1500.2(e).

Detailed consideration of reasonable alternatives provides all interested parties with an informed basis to question initial predispositions and "to rethink the wisdom of the action." *Nat. Resources Def. Council v. Hodel*, 865 F.2d 288, 296 (D.C. Cir. 1988); *see also Citizens Against Burlington, Inc. v. Busey IV*, 938 F.2d 190, 196 (D.C. Cir. 1991) ("the rule of reason does not give agencies license to fulfill their own prophecies, whatever the parochial impulses that drive them). Accordingly, "[t]he existence of reasonable but unexamined alternatives renders a [NEPA analysis] inadequate." *Friends of Southeast's Future v. Morrison*, 153 F.3d 1059, 1065 (9th Cir. 1998) (citation omitted).

Reclamation failed to offer a range of reasonable alternatives in the DEIS. The purpose of NEPA is to find alternative ways of carrying out federal action in a more environmentally sound manner. Reclamation offers no choice to stakeholders when it proposes to continue its current course of action for the next several decades. If it is proposing to continue what it considers the "status quo," the action has already been taken without public input. We are concerned the public hasn't been given adequate choices to consider in the DEIS. Following are assessments of the alternatives included in the DEIS for both the operating agreement and the San Juan-Chama water storage as well as additional suggestions as to the type of additional alternatives that should be included in the final EIS.

1. *Reclamation conflates the proposed action and the no action alternative prejudging the decision to be made and making the exercise of analyzing alternatives futile.*

5 The DEIS provides that "the agency determined that, under NEPA, the No Action Alternative should reflect current operating procedures under the OA." DEIS at 2-2. Further, Reclamation decided that it "would continue implementing the procedures defined in the OA from 2016 to 2050, while allowing storage, on request of up to 50,000 acre-feet per year (AFY) of San Juan-Chama Project water in EBR, if space is available." DEIS at 2-2. This clearly goes against the purpose and spirit of NEPA as a mechanism to ensure "that environmental concerns will be integrated **into the very process of agency decisionmaking**." *Andrus v. Sierra Club*, 442 U.S. 347, 350 (1979) (emphasis added).

Reclamation is evaluating the impacts of its proposed action—continuing to implement the OA through 2050—as the no action alternative. However, that is not the no action alternative. Continued implementation of the OA through 2050 is the *proposed* action. The true no action alternative would be not continuing to implement the OA and returning to pre-OA operating conditions (as described in Alternative 5). If Reclamation decided to implement the no action alternative, Reclamation would allocate water for the RGP in the same way it did prior to the 2008 operating agreement being signed. Reclamation cannot skirt its duties under NEPA just because it has conducted less comprehensive environmental analysis in the past 8 years that have allowed for the temporary operation under the 2008 OA. It is likely that had Reclamation not completed this DEIS that it would have been sued for its piecemeal and inadequate NEPA analysis in 2007 and 2013. Even though operations have already commenced, the DEIS is really evaluating whether to continue to operate under 2008 OA or not.

Reclamation admits "Alternative 5 is the best possible representation of prior operating practices in a modeling context."[3] Alternative 5 would be the closest alternative to the real status quo—the scenario prior to the adoption of the operating agreement, which is when Reclamation took the action it is proposing to continue now. Alternative 5, which proposes to rescind the carryover and diversion adjustment provisions of the operating agreement, should be the DEIS' no action alternative since it represents the state of the RGP *before* Reclamation took the action of implementing the OA. For this alternative to be a true no action alternative for both the OA and SJCP, it should also presume no multi-year SJCP water storage contract and instead presume no storage or storage under an annual contract as was the case prior to the implementation of the OA. 6

Further, Reclamation appears to claim in response to Guardians' 2013 SEA comments that it is conducting an EIS voluntarily, and that its previous EA completed in 2008 was sufficient to comply with NEPA requirements. The SEA, however, is not adequate to fulfill NEPA requirements when the action at issue is a multi-decade plan. Reclamation's claim that the SEA was sufficient for its previous 5-year plan cannot be subsequently applied to a nearly 35-year plan. 7

Finally, it is apparent from the U.S. Fish and Wildlife Service's biological opinion on the proposed action that its analysis is based on comparing the effects of the proposed action to the baseline conditions—Alternative 5, absent the SJCP storage. 2016 Biological Opinion at 31-34. To compare the effects of Reclamation's proposed action—what it refers to as the no action alternative—the Service considered how species would fare under Reclamation's proposed action as 8

[3] Reclamation asserts that Alternative 5 is not exactly representative of historical operations, presumably because it includes storage of San Juan-Chama Project water, which did not take place until after the operating agreement was adopted.

6 cont. compared to what would take place if the Rio Grande Project operated under conditions that do not include those in the operating agreement. This further confirms the need for Reclamation to separate the proposed action (implementing the OA through 2050) from the no action alternative (not continuing to implement the OA).

2. *The proposed range of alternatives do not provide any meaningful choice regarding meeting the purpose and need of meeting the contractual obligation of the RGP stakeholders or for providing additional storage for SJCP water in the Rio Grande Basin.*

1 cont.

The proposed range of alternatives does not provide any meaningful choices for stakeholders in regards to meeting the contractual obligations of the Rio Grande Project stakeholders. Reclamation needs to offer alternatives that reflect its commitment and responsibility to environmentally sound practices by including in the DEIS alternatives to storing carryover water in Elephant Butte Reservoir. Elephant Butte loses one-third of its water every year to evaporation, amounting to 250,000 acre-feet per year.[4] Therefore, Reclamation should include an alternative that considers storage in upstream reservoirs, which due to temperature and geography, have significantly lower evaporation rates and could provide water supply as well as environmental benefits to Rio Grande Project contractors as well as the river itself.

Further, the proposed range of alternatives does not provide any meaningful choices for stakeholders in regards to the storage of San Juan-Chama Project water. The only alternative that provides any room for choice is Alternative 2, which is identical to the no action alternative without the San Juan-Chama storage provision. Reclamation should include alternatives that evaluate additional scenarios regarding the storage of this water, such as continuing under the current 1-year contracts as opposed to extending them to 2050 or finding or making available additional storage upstream of Elephant Butte Reservoir. The current range of alternatives offers no choice but to either store San Juan-Chama water in Elephant Butte or not. This violates NEPA's requirement of offering for public comment and consideration "all reasonable alternatives."

We would like to see Reclamation include in its final EIS the additional alternatives discussed above that reflect a broader purpose and need for San Juan-Chama Project water storage and an expanded definition of the RGP's carryover provision, all of which would provide stakeholders and Reclamation with meaningful alternatives that comply with NEPA requirements.

C. Environmental Baseline/Affected Region.

1. *The "affected region" is defined too narrowly to allow "hard look" of environmental effects of the storage of San Juan-Chama Project water in Elephant Butte.*

9

The "affected region" as described in the DEIS—from the San Marcial Railroad Bridge above Elephant Butte Reservoir in New Mexico downstream along the Rio Grande floodplain to the El Paso/Hudspeth County line—is not an adequate geographic region to analyze the direct, indirect

[4] Theodore W. Sammis, Develop a Remote Sensing Tool to Estimate Evaporative Loss from Reservoirs, New Mexico State University at Las Cruces, http://gcconsortium.com/Final_SCERP_ReportSammisTed8-27-08a.html.

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and cumulative effects of the storage of San Juan-Chama water in Elephant Butte (DEIS at 1-14, 3-1). The DEIS claims that "[t]he ongoing Federal action that is the subject of this EIS is to consider alternatives for allocating, delivering, and accounting for RGP water and a contract for storing San Juan-Chama Project water in EBR." DEIS at 1-14. The DEIS concludes at page 1-14 that the "Federal action is implemented entirely within the larger geographic context of the established RGP facilities and operations." While it may be true that the study area for evaluating the impacts of implementation of the OA may be adequate, the study area is defined too narrowly for evaluating the environmental effects of the San Juan-Chama Project water storage contract.

A contract for the storage of San Juan-Chama Project water in Elephant Butte has impacts beyond those that occur in Elephant Butte Reservoir itself. The Albuquerque Water Utility Authority described the need for the storage of San Juan-Chama Project water in Elephant Butte in its original 2010 EA/FONSI for the following reasons:

1. Additional storage for ABCWUA due to full reservoirs upstream.
2. Offset ground water effects that occur between November and March/April every year. This occurs by the Office of State Engineers (OSE) stating the amount of water (letter water) that would need to be moved from the ABCWUA San Juan-Chama pool into the native Rio Grande pool. This is an accounting procedure that allows for easy payment to the State and approved by Interstate Stream Commission (ISC).
3. Water could be used for third parties.
4. Water could be moved from Elephant Butte Reservoir via accounting to Abiquiu.

2010 SJC EA/FONSI at p. 8-9. The above activities and their attendant environmental impacts are not all limited to the geographic region between San Marcial and the El Paso/Hudspeth County line. In fact, most of the listed activities will have environmental impacts outside of Reclamation's defined the study area.

First, for example, the storage of San Juan-Chama Project water in Elephant Butte means that less water will be stored in upstream reservoirs. Notwithstanding the environmental impacts of subjecting more water to higher evaporation losses, the communities that reside in homes around Heron Reservoir also have an interest in the reservoir remaining as full as possible to support their quality of life and property values. Second, how the San Juan-Chama Project water storage in Elephant Butte is used to offset ground water impacts (e.g. impacts to Rio Grande flows from ground water pumping by the Water Utility Authority) may have environmental impacts above San Marcial based on the type of "accounting procedure" used to ensure such offsets. Finally, and most significantly, moving SJCP water from EBR upstream to Abiquiu Reservoir "via accounting" will most certainly have environmental impacts above San Marcial that Reclamation must analyze as a part of this DEIS. The exchange of San Juan-Chama Project water storage with upstream native Rio Grande water impacts river flows and endangered species all along the Rio Chama and main stem of the Rio Grande above San Marcial. The DEIS concedes that "San Juan-Chama Project water is not included in the total RGP storage but is maintained as a separate pool **until exchanged upstream**." DEIS at 1-12 (emphasis added).

While convenient to include the storage of San Juan-Chama Project water in Elephant Butte in the same environmental impact statement as the OA due to the overlapping involvement of the

EB Reservoir, the storage in EBR only exists to aide the Water Utility Authority (and other SJCP contractors) in managing their water and depletions outside and upstream from (Cochiti to San Marcial) the "affected area" as defined by Reclamation in the DEIS. In fact, SJCP water is required by statute to be used in the Middle Rio Grande. The primary tool for "moving" SJCP water upstream is by "exchange," which is in essence trading SJCP water in EBR with native Rio Grande stored in an upstream reservoir. For example, in 2014, the City of Santa Fe (a SJCP water contractor) had 11,412 acre-feet of SJCP water stored in EBR. A like amount of water was being stored in El Vado Reservoir on behalf of the six middle Rio Grande Pueblos. Instead of releasing the water stored in El Vado to EBR and in the process supporting flows in the Rio Grande, an "accounting procedure" was used to change the label on the native water to SJCP water and that water was moved to storage in Abiquiu Reservoir. The water was subsequently used by the City of Santa Fe to serve its customers in Santa Fe and the river was deprived of that 11,000 acre feet of water. Hence, storage of SJCP water in EBR and the reasonably foreseeable accounting mechanisms that will operate to allow for this water to be managed for its stakeholders have impacts far beyond the boundaries of EBR and the affected area as defined by Reclamation in the DEIS.

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2. *Reclamation must revisit its analysis of the impacts of the San Juan-Chama Project water storage contract or remove the proposed action from the DEIS.*

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In order to satisfy the requirements of NEPA, Reclamation must revisit its analysis of the impacts of SJCP storage to evaluate the effects of the exchange on the Middle Rio Grande. Another option for Reclamation would be to remove this proposed action from the DEIS or proceed with an alternative that does not include such SJCP water storage.

Based on how the DEIS "affected area" is described, many of the stakeholders in the Middle Rio Grande that may be impacted by the proposed action may not be aware that the proposed action—including the storage and exchange of SJCP water upstream—could impact their interests. Reclamation should reach out to those interested stakeholders and reopen the comment period to ensure that those interests affected by the proposed storage and exchange have the opportunity to participate in this public process.

13

3. *Reclamation needs to clarify that diversions from the Rio Grande into the low flow conveyance channel are not authorized nor legal.*

14

The DEIS at 3-5 describes the existing conditions for surface water providing that "the inflow to EBR is determined by gages at San Marcial that measure the combined flow of the river and the low flow conveyance channel (LFCC). This is an artificial channel that runs alongside the Rio Grande between San Acacia, New Mexico and EBR, **that diverts some or all of the river's flow into a narrower, deeper, and more hydraulically efficient channel**." DEIS at 3-5 (emphasis added). This statement is simply untrue based on current legal authority and policy of Reclamation and other federal and state agencies. The LFCC currently operates as a drain along the Rio Grande and while as such creates significant challenges for the river; there is not authorized "diversions" from the Rio Grande into this channel. If such "diversions" are occurring they are being made in violation of law. We ask that Reclamation clarify this statement to make is accurate based on its current legal authority and be clear that no such "diversions" are allowed or being made.

15

4. *Reclamation and the Service need to consider the recovery plan criteria for the flycatcher and cuckoo in order to evaluate and understand the importance of the Rio Grande Management Unit to the survival and recovery of the species.*

It should be noted that, on August 15, 2014, the Service released its 5-Year Review of the Southwestern willow flycatcher to evaluate the current status of the species and determine if reclassification was necessary based on the data (USFWS, 2014, p. 2). The Service based its review on the five factors described in section 4(a)(1) of the ESA. It is important to note that the Service concluded just two years ago in its 5-year review that:

> Downlisting (or delisting) criteria established in the Recovery Plan have not been met. The most current estimated number of rangewide flycatcher territories is 1,299 (Durst et al. 2008, p.12-13), which is less than the minimum 1,500 territories needed for downlisting and 1,950 for delisting (USFWS 2002, p.84-85). The 1,299 territories are also not geographically distributed appropriately to meet downlisting or delisting criteria (Table 1), and therefore, habitat-related goals have not been met, nor have all necessary accompanying conservation/ management plans been completed. (USFWS, 2014, p.11)

We incorporate the analysis and findings of the Service in 2014 here by reference. Based on current and potential threats to the flycatcher (including the impacts of climate change) and the inability of the population to rebound to the levels set in the recovery plan, the evidence strongly suggests that great care should be taken when taking actions that may result in take of the species or result in the destruction or modification of critical habitat.

D. Mitigation Measures.

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Finally, Reclamation did not consider mitigation measures in its DEIS, as required by NEPA. 40 C.F.R. 1508.25(b)(3). As Reclamation conceded in the DEIS, the region has experienced historic drought conditions in recent years and several endangered or threatened species in the area are unable to thrive due to the altered landscape, the result of anthropogenic changes to the riparian and riverine systems. Climate change has undoubtedly contributed to drought conditions, higher temperatures, and increased evaporation rates. Though Reclamation claims that the effects of future climate change will be much greater than any discretionary action the agency could possibly take, future conditions affecting the region should still be taken into account. The purpose of NEPA is to address how the environment will be affected by major federal action. If the region's environment is largely altered by future climate change and will be further adversely affected by the federal action, Reclamation should include that scenario in its baseline and considered this scenario in the EIS' section on alternatives and mitigation measures. Reclamation should consider measures it could take to mitigate any present and future adverse effects, present and future, some of which could come from proposed actions such as relocating the storage of RPG water to an upstream site.

E. Direct, Indirect and Cumulative Effects of the Proposed Actions.

1. *The DEIS fails to take a "hard look" at the potential direct, indirect and cumulative impacts on the human and natural environment from the Proposed Actions.*

17 The DEIS describes as a part of the environmental baseline issues that it then glosses over and dismisses as direct and indirect effects of the proposed action, including the continuation of the OA. The DEIS fails to take a "hard look" at how the proposed action affects the resources analyzed. For example, the DEIS fails to evaluate how the continued implementation of the OA impacts groundwater levels in the region, water quality, vegetation communities and plant species, wildlife (including listed species), and aquatic resources. An example of this is included in the section on climate change below and is highlighted in the 2016 BO.

2. *Effects of the San Juan-Chama Project are entirely absent from the DEIS.*

11, 12 cont. Reclamation fails entirely at analyzing the direct, indirect and cumulative effects of the San Juan-Chama Project water storage contract above San Marcial. *See* the section on "affected environment" above. As defined by statute, San Juan-Chama Project water must be used in the Middle Rio Grande valley and thus the impacts of not just where the water is proposed to be stored—but where the stored water will eventually be used or transported—are critical to this analysis. Even though the two projects are contemporaneous, they will have distinct and separate effects on the natural systems around them. The San Juan-Chama water that will be exchanged and stored in EBR will affect the elevation of EBR (which will cause impact to the Southwestern willow flycatcher and yellow-billed cuckoo) and the choices surrounding how that water is exchanged upstream and what release of native water will no longer be necessary as a result will impact river flows and many of the resources identified herein, but in the Middle Rio Grande valley. This is a separate effect and analysis from that resulting from the OA as it benefits EBID and EPCWID. Though the effects may be intertwined, there are direct, indirect and cumulative effects—those that taken alone may only have minor consequences but added together have much more deleterious effects—that will take place beyond the scope of the analysis in the DEIS.

3. *Reclamation fails to address the full scope of past, present, and reasonably foreseeable future actions that cumulatively are significant when added to the proposed actions.*

18 The DEIS fails to address the cumulative environmental effects of the proposed action. Cumulative impacts are those impacts that may be individually minor but when added to other past, present and reasonably foreseeable future actions are collectively significant. 40 C.F.R. § 1508.7.

The DEIS acknowledges other "past, present, and reasonably foreseeable future actions" that may impact the affected environment. DEIS at 4-3. However, the actions identified (Delta Channel Maintenance and the Rio Grande Canalization Project) are both located in the lower Rio Grande, which ignores the upstream impacts that may add to the impacts to the resources being analyzed in the EIS. For example, the status of the flycatcher and cuckoo in the Middle Rio Grande –particularly the availability of habitat and river flows in the reach between San Acacia diversion dam and the EBR delta—impacts the number of birds that will end up utilizing the margins of EBR. The DEIS does not even mention the numerous activities—including the revision to the management plan under the 2003 Biological Opinion that guides river management from Cochiti Reservoir to Elephant Butte—and instead draws a stark boundary between the lower and middle Rio Grande. Especially as populations of listed species cross these arbitrary project boundaries, the cumulative effect on a more basin-wide scope should be included. Another example is that the San Acacia Levee Project—the reengineering of 43 miles of levees from San Acacia to San Marcial that will cut the Rio Grande floodplain in half and sever the river from access to some 400 acres of

critical habitat impacting flycatchers and cuckoos should be considered in evaluating the level of impacts on these imperiled birds by inundation of territories within the reservoir.

F. Climate Change.

19 The DEIS, unlike the prior environmental assessments done for the proposed action, includes the predicted impacts of climate change in the model it developed to model effects. We appreciate this effort, but believe there are aspects of climate change that have not been incorporated into Reclamation's analysis.

On December 18, 2014, CEQ released revised draft guidance for public comment that describes how Federal departments and agencies should consider the effects of greenhouse gas emissions and climate change in their NEPA reviews. The revised draft guidance supersedes the draft greenhouse gas and climate change guidance released by CEQ in February 2010. This guidance explains that agencies should consider **both** the potential effects of a proposed action on climate change, as indicated by its estimated greenhouse gas emissions, and the **implications of climate change for the environmental effects of a proposed action.** The guidance also emphasizes that agency analyses should be commensurate with projected greenhouse gas emissions and climate impacts, and should employ appropriate quantitative or qualitative analytical methods to ensure useful information is available to inform the public and the decision-making process in distinguishing between alternatives and mitigations

1. *Flow and habitat impacts due to climate change.*

Climate change is a significant new and increasing threat to the Southwestern willow flycatcher. The National Audubon Society's climate model predicts an "84 percent loss of current summer range [for all four subspecies of flycatcher] by 2080, with a major northward movement of the range" (Audubon, 2016, available at climate.audubon.org/birds/wilfly/willow-flycatcher). As the Southwestern willow flycatcher is adapted to the southernmost edge of the species' range, it is uncertain that it will be able to adapt to this shift in its climate envelope.

In the Rio Grande Basin—where the largest population of remaining flycatchers exists—climate change is predicted to drastically reduce river flows over the coming decades. The 2013 *West-Wide Climate Risk Assessment: Upper Rio Grande Impact Assessment* concluded that "average supplies of all native sources to the Upper Rio Grande Basin would decrease on average by about one third" (Llewellyn et al., 2013, p. 118). The loss of flows coupled with the projected increase in demand (from agricultural, riparian vegetation and urban landscaping) will further stress the river system (Llewellyn et al., 2013, p. 118). Importantly, the study found that

> the reduction in water is expected to make environmental flows in the river more difficult to maintain, and reduce the shallow groundwater available for riparian vegetation. Both of these impacts could alter habitat conditions for fish and wildlife in the Upper Rio Grande Basin riverine and riparian ecosystems.

(Llewellyn et al., 2013, p. 120)

Finally, and most troublingly, the study concludes:

> Ecological and human systems within the basin already operate close to thresholds (i.e., point at which small changes could have larger-scale repercussions) related to available water supply. It is possible that some systems in the basin have already undergone regime shifts. In the future, as projected water supplies decrease and demands increase, water-availability thresholds may be crossed, and key systems may change their basin structure and function.

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(Llewellyn et al., 2013, p. 120)

Dettinger et al. (2015) details the impacts of climate change on water supplies and river flows and concludes that "the Rio Grande is facing the largest climate-change water supply deficits (relative to historical record) among the four basins considered [Klamath, Colorado, Sacramento-San Joaquin Bay-Delta, and Rio Grande]" (p. 2,084). The impacts of these changes will be amplified due to an archaic system of laws—the Rio Grande Compact—that allocates water between the states of Colorado, New Mexico and Texas. The study predicts that "by 2100, flows available for irrigation uses in Colorado's San Luis Valley could decline by 25%. Divertible flows in the Middle Rio Grande were projected to decline by 35%... Below Elephant Butte, flows could decline by 50%" (Dettinger et al. 2015, p. 2,083).

This is especially troubling considering the relatively large populations of flycatcher in the Elephant Butte Reservoir (subject to 50% decline in flows) and the area above the reservoir near San Marcial (the end of a river predicted to have 35% reduction in flows). For example, Reclamation concluded in its Draft Environmental Assessment for operations at Elephant Butte:

> During the 2014 surveys, 598 resident flycatchers were documented throughout the Middle Rio Grande Management Unit, which included resident birds forming 234 pairs and establishing 364 territories. Consistent with previous years, the San Marcial Reach was the most productive, with 307 territories and 205 pairs. The 2014 surveys showed a second consecutive year of increased territory numbers after a large drop in 2012… The San Marcial Reach was again most productive, with 255 nests and 151 flycatcher fledglings. Overall, nesting success for all of the Middle Rio Grande Management Unit was the lowest observed in the past 16 years of monitoring, with most failures due to depredation. (USBOR, 2016, p. 3-25, *internal citations omitted*)

As is demonstrated by the data, these populations fluctuate based on annual river conditions and climate change will likely make those variations more significant in the future.

Further, it is predicted that this loss of river flows will result in a sharp reduction in suitable habitat over the next century. Habitat suitability maps for the Rio Grande Basin—based on current conditions and conditions predicted in 2030, 2060 and 2090—show a considerable decrease in the amount of suitable habitat for the flycatcher (Friggens, 2015).

Drought also causes decreases in habitat quality. In the Lower Rio Grande Management Unit, territory numbers have been increasing since monitoring began in 2010; however, "drought conditions during the past two years have killed many of the willows within the area and reduced the quantity and quality of available habitat. Even with increased flows in the river during the summer of 2014, the native habitat did not visibly recover. If this decline in habitat quality is not reversed, it is

likely that territory numbers in this reach will decrease during the coming years" (Moore & Ahlers, 2015, p. 18).

2. *The 2016 Biological Opinion demonstrates that the proposed action are amplifying the effects of climate change and negatively impacting habitat of the flycatcher and cuckoo.*

The Service's *Biological Opinion on effects of action associated with the proposed continuation of the Rio Grande Project Operating Agreement and storage of San Juan-Chama Project water in Elephant Butte Reservoir, New Mexico* dated May 25, 2016 ("2016 BO") provides a detailed analysis comparing the proposed action to the baseline (alternative 5— the "real" no action alternative) including the impacts of climate change on the Southwestern willow flycatcher and the yellow-billed cuckoo. 2016 BO at 31-40. This analysis and the entire 2016 BO are incorporated herein by this reference and any issue raised therein is raised herein by this reference. From this analysis, it is clear that the proposed action amplifies the impacts of climate change on the flycatcher and cuckoo over the first 20 years of the 35-year term of the proposed action. See Tables 4 and 5 (2016 BO at 34 and 38), and reproduced below.

Table 4. Summary of flycatcher take analysis under baseline and proposed action conditions. Amount of impacted suitable or marginally suitable designated critical habitat is the same amount in both baseline and proposed action conditions.

| Year | Take of Flycatcher Territories Baseline | Take of Flycatcher Territories Proposed Action | Take of Flycatcher Nests (eggs/ nestlings) Baseline | Take of Flycatcher Nests (eggs/ nestlings) Proposed Action | Temporary Removal of Occupied Suitable or Marginally Suitable Habitat (ac) Baseline | Temporary Removal of Occupied Suitable or Marginally Suitable Habitat (ac) Proposed Action | Temporary Removal of Suitable or Marginally Suitable Designated Critical Habitat (ac) |
|---|---|---|---|---|---|---|---|
| 2023 | 69 | 77 | 50 (200) | 53 (212) | 195 | 196 | N/A |
| 2036 | 0 | 9 | 0 | 16 (64) | N/A | N/A | N/A |
| 2037 | 44 | 60 | 29 (116) | 34 (136) | 80 | 195 | N/A |
| 2046 | 24 | 24 | 16 (64) | 16 (64) | N/A | N/A | N/A |
| 2047 | 56 | 56 | 34 (136) | 34 (64) | 196 | 196 | N/A |
| 2048 | 39 | 39 | N/A | N/A | 78 | 78 | 599 |

As shown in Table 4 showing the impacts on the flycatcher, by 2023 the "take" associated with flycatcher territories increases by 8 territories considering the additional impacts of the proposed action (the proposed action analyzed by the Service includes both implementation of the OA and the SJCP storage contract). By 2036, the proposed action is responsible for taking 9 additional territories and by 2037, the proposed action is predicted to impact another 16 territories. It makes sense that the water management changes to the reservoir elevation (above the baseline) will be exacerbated by carryover storage allowed in the OA and the additional 50,000 acre feet of SJCP water storage. The Service finds that by the end of the study period (2050), 599 acres of critical habitat for the flycatcher would be destroyed by inundation for an extended period of time. A similar analysis is provided for the cuckoo in Table 5 and similarly the Service predicts the loss of 599 acres of critical habitat.

We believe that the analysis in the 2016 BO supports a conclusion that the take and destruction and modification of habitat associated with climate change combined with

21

21 cont. implementation of the proposed action warrants a jeopardy determination, and that a specific RPA should be identified and implemented to ensure the survival and recovery of the flycatcher and cuckoo. This is especially true considering the cumulative effects of other past, present and reasonably foreseeable actions in the region.

## III. Conclusion

Reclamation has failed on several fronts to comply with the letter and spirit of NEPA. The alternatives presented do not provide meaningful choices for the public to comment on and consider the various avenues that are available to Reclamation and the stakeholders of the RGP and SJCP water storage plan. The no action alternative does not truly represent a scenario in which Reclamation would be taking no action. It violates NEPA by presuming a federal action that was taken and analyzed for 5 years can be applied to a 35-year contract. Alternative 5, meanwhile, is closer to a no action alternative, though due to its inclusion of the SJCP water storage, there is no true no action alternative. The offered alternatives in general do not provide for options of water storage anywhere but Elephant Butte Reservoir—a short-sighted plan when considering the future of water needs of the region and the human and natural environments that will be impacted.

The statement's purpose and need must be expanded and include options for storage in other reservoirs. The effects—direct, indirect, and cumulative—must be more fully considered. In all, NEPA compliance requires a much closer examination of the region and how it will be impacted by Reclamation's actions.

Thank you for the opportunity to submit comments on the Draft Environmental Impact Statement.

Sincerely,

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# Western water and climate change

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*Abstract.* The western United States is a region long defined by water challenges. Climate change adds to those historical challenges, but does not, for the most part, introduce entirely new challenges; rather climate change is likely to stress water supplies and resources already in many cases stretched to, or beyond, natural limits. Projections are for continued and, likely, increased warming trends across the region, with a near certainty of continuing changes in seasonality of snowmelt and streamflows, and a strong potential for attendant increases in evaporative demands. Projections of future precipitation are less conclusive, although likely the northernmost West will see precipitation increases while the southernmost West sees declines. However, most of the region lies in a broad area where some climate models project precipitation increases while others project declines, so that only increases in precipitation uncertainties can be projected with any confidence. Changes in annual and seasonal hydrographs are likely to challenge water managers, users, and attempts to protect or restore environmental flows, even where annual volumes change little. Other impacts from climate change (e.g., floods and water-quality changes) are poorly understood and will likely be location dependent.

In this context, four iconic river basins offer glimpses into specific challenges that climate change may bring to the West. The Colorado River is a system in which overuse and growing demands are projected to be even more challenging than climate-change-induced flow reductions. The Rio Grande offers the best example of how climate-change-induced flow declines might sink a major system into permanent drought. The Klamath is currently projected to face the more benign precipitation future, but fisheries and irrigation management may face dire straits due to warming air temperatures, rising irrigation demands, and warming waters in a basin already hobbled by tensions between endangered fisheries and agricultural demands. Finally, California's Bay-Delta system is a remarkably localized and severe weakness at the heart of the region's trillion-dollar economy. It is threatened by the full range of potential climate-change impacts expected across the West, along with major vulnerabilities to increased flooding and rising sea levels.

*Key words: Centennial Paper; climate change; Colorado River; Klamath River; Rio Grande; Sacramento–San Joaquin Bay Delta; water resources; western United States.*

*If climate change is the shark, then water is its teeth.*
—Paul Dickinson, CEO of Carbon Disclosure Project

## Introduction

The western United States has always been a nexus of great opportunity and great challenge for the Nation. The region is notable for burgeoning human settlements and its "wide open spaces"; for its anthropogenic land disturbances and native landscapes; for its complex terrains and diverse climates; and for its abundant resources and its scarce ones. Water has always played a pivotal role in its development, so that, to an extent unmatched elsewhere, water has been a limiting factor in where agriculture was undertaken, in where and how large its settlements have grown, and in the character and survival of many of its natural landscapes. And now, like so much of the Earth, social and natural conditions in the western United States are changing rapidly due to a variety of influences, including its long history of recurrent and severe droughts, floods, water-quality contamination, environmental degradation and endangered species, strong competition for the often limited water supplies that exist among a diverse set of

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water users, and growing changing populations and economies.

The western United States includes hundreds of rivers and catchments but, at the largest scale, a half dozen major basins drain about 66% of the area and constitute important touchstones for thinking about the future of water in the West. These drainages include the Colorado River basin, the Sacramento-San Joaquin drainages in California, the Klamath River basin, and the Rio Grande basin, which will be discussed as examples of the challenges facing western water managers later in this review. The remaining areas comprise large numbers of drainages, some interconnected but mostly not. The region and its drainages are remarkable for their diversity, ranging from the moist and abundantly flowing Columbia River system to the much drier and more tenuous hydrology of the Lower Colorado and Rio Grande catchments, with the fragmented and lonely Great Basin drainages standing in stark contrast to the well-connected and generally more populous and developed larger rivers. Given this diversity, it is difficult to provide a single vision of the future of western water, especially in its details, but on the whole, the region and its waters are notable for the challenges they will face. Western water, whether it is in rivers, soils, or aquifers, is essentially everywhere faced with a continuation of its long history of high demands even as its supplies are negatively impacted by hydroclimatic changes and fluctuations.

All told, climate change threatens water resources in the western United States to a degree that is probably unmatched anywhere else in the country. A "water supply stress index" for the United States, based on current conditions, is mapped in Fig. 1, showing widespread stress in much of the Southwest, western Great Plains, and parts of the Northwest relative to the rest of the country. In this figure, the stress indices are ratios of annual water demands to annual surface- and groundwater water supplies for each watershed, and watersheds are considered stressed (higher index values) when water demands for agriculture, power plants, and municipalities exceed 40% of available supplies. These stresses often cause conflict for water resources among sectors. In other contexts, basins can experience critical stresses even when demands are far below this threshold (Averyt et al. 2013).

Since the onset of American settlement of the West, when John Wesley Powell wrote his *Report on the Arid Regions of the United States* (Stegner 1953) 140 years ago, it has been understood that the West is a region where water will be a crucial, limiting determinant of where, when, and how humans can survive and prosper. Thus much of the history of the West has been about dividing the waters there, managing them, and building some of the most ambitious infrastructures around to store and move waters long and short distances across the landscape to ensure that water is available when and where needed, to the extents practicable.

Now, almost a century and a half later, we are in a time of adjustment in the West and some of the established methods and arrangements for water management are in states of flux. Looking forward, the western states will be confronted with many water-management challenges and tradeoffs including many from climate change, but the good news is that few of them are likely to be totally new: The West has already grappled with most of the problems that will face it in the future, however inadequately in some cases and however transformed some will be by larger trends in the future. The task confronting the West now is to resolve problems that it has long acknowledged but left partly or completely unresolved and to prepare for changes that will surely come. Drought, contamination, floods, environmental degradation, and difficult resource competitions are all part of the history of the region and lie at the core of most of its most pressing future challenges. Unfortunately, in recent decades, society within the region and globally has initiated changes aggravating these perennial issues, while adding a few more, with climate change being an increasingly pressing and threatening source of such "aggravations."

This paper is a distillation of findings regarding western water and climate change, from the Water Resources chapter in the 2014 National Climate Assessment (Georgakakos et al. 2014), coupled with several vignettes of issues developing in iconic western rivers to add specificity to those findings and to illustrate the diversity of conditions facing the region.

## Climate-Change Impacts on the Western Water

In this section, observed changes and projections of future changes in the western water cycle are summarized. However, notably, natural climate variations occur on essentially all time scales from days to millennia, and the water cycle reflects these variations. Observations of recent changes in the water cycle in the West thus inevitably include natural hydroclimatic variations as well as local human influences (like dam building or land-use changes) in combination with whatever global climate changes are underway. Recent studies have begun to rigorously attribute a limited number of specific long-term and temperature-driven changes in the western water cycle to human-induced climate change (for example, Barnett et al. 2008). Although observed changes for many of the other water-cycle variables addressed in this section are consistent with projected human-induced climate changes, research to formally attribute these responses to global causes is still needed.

### *Warming*

Much of the western United States has warmed in recent decades by about 1.5°C compared to the historical norms from 1901–1960 (e.g., Walsh et al. 2014), with greatest warming in summers and springs, and in nighttime temperatures (Hoerling et al. 2013).

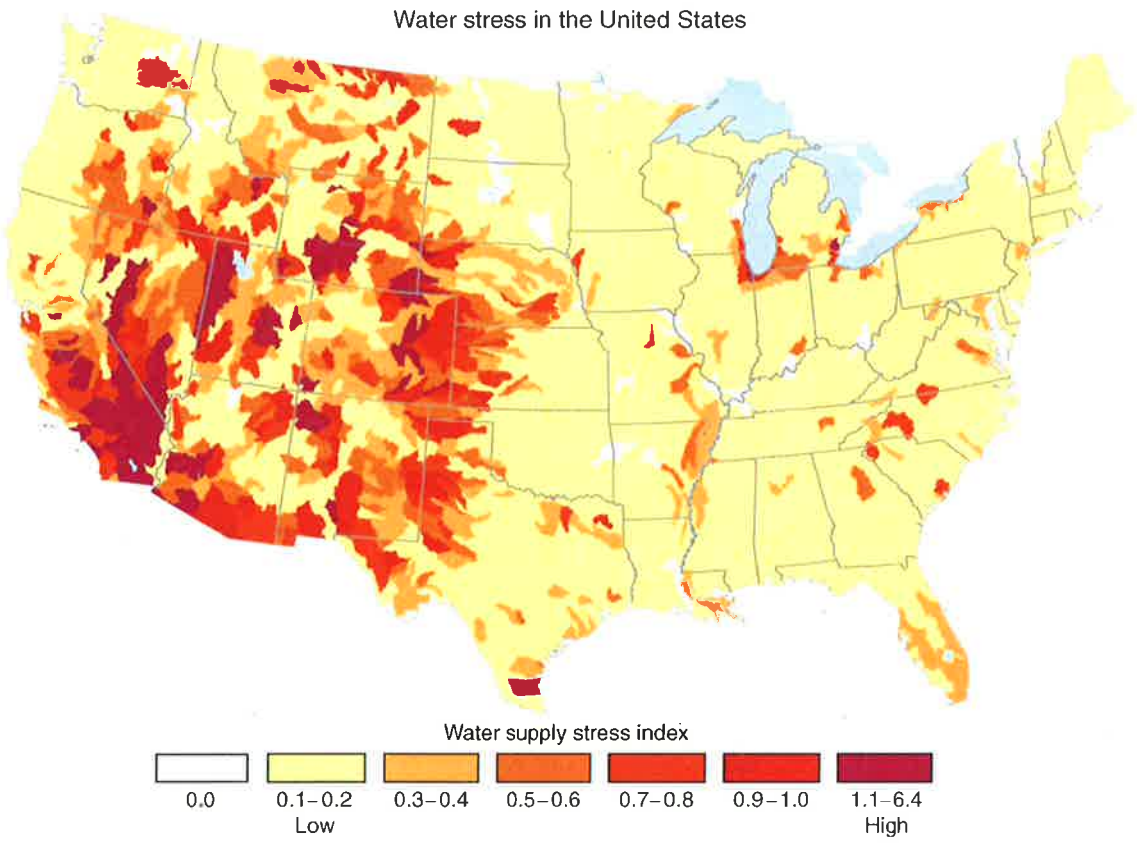


FIG. 1. Current surface-water-supply stress index of Averyt et al. (2013); see *Introduction* for definition of index.

The warming of minimum temperatures in the region has been confidently attributed to the influences of increasing greenhouse gases in the global atmosphere (Bonfils et al. 2008). Averages of many recent projections of future temperatures have the western United States warming by between about 2.5°C and 5°C by end of century (although some projections yield even warmer outcomes), depending most strongly on future rates of greenhouse-gas emissions (Walsh et al. 2014). Observed frost-free seasons have increased in length by between about 15% and 20%, a trend that is projected to continue well into the future, increasing by as much as 60–70% in many mountainous areas of the west (Walsh et al. 2014). On the whole, warming is projected to be largest in the continental interior and somewhat ameliorated as the Pacific coast is approached.

These warming trends reflect increasing greenhouse-gas concentrations in the atmosphere (Bonfils et al. 2008), and affect water in the West through a variety of processes. Warming is already directly affecting snow and ice processes (Pierce et al. 2008, Hidalgo et al. 2009), is lengthening growing seasons (Cayan et al. 2001), and thus potentially may be affecting evapotranspiration totals, and is increasing water temperatures and reducing mixing in some lakes. Warming, and its effects in the west, will continue in any event but at rates that will directly reflect future rates of greenhouse-gas emissions.

### *Rain, snow, evapotranspiration, and runoff*

In recent decades, annual average precipitation has increased across the Great Plains, California, the Pacific Northwest, and Alaska, while decreases have been observed in Hawaii and parts of the Southwest (Walsh et al. 2014). Annual average precipitation totals are projected to increase across the northern states, and decrease to the south, especially in the Southwest (Orlowsky and Seneviratne 2012, Cayan et al. 2013, Walsh et al. 2014: Figs. 2.12 and 2.13). Thus far, the correspondences between observed and projected precipitation changes are weak, suggesting that natural fluctuations are contributing significantly to the observed "changes." Furthermore, the most recent generation of climate-change projections (for the IPCC Fifth Assessments; IPCC 2013) have shown approximately the same pattern of precipitation change across the western states (growing wetter along the northern tier of states and drying along the southern tier) as previous projections, albeit with a southward shift of the transition zone between those two broad realms such that in the most recent projections, taken as an ensemble, increasing precipitation reaches farther south than in previous projections. The result is that newer

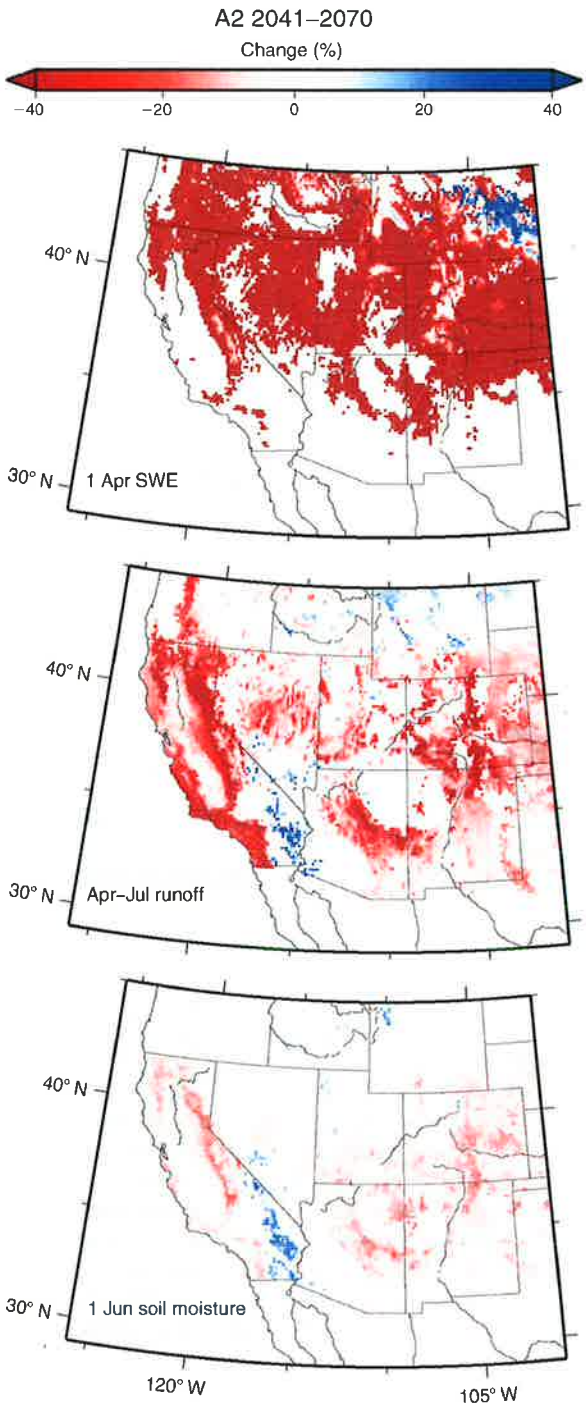


FIG. 2. Projected changes in snow (snow water equivalent, SWE), runoff, and soil moisture, as percent change in 2041–2070 from 1971–2000 conditions, under continued increases in greenhouse-gas emissions (A2 scenario; Cayan et al. 2013).

projections yield precipitation increases that extend into parts of the Upper Colorado River Basin and northern California that, in previous projections, received little change or even decreases in overall precipitation. The extent to which these differences between this generation of climate-change projections and the previous one should be interpreted as improved estimates of future precipitation remains to be determined, because the shift is rather subtle at the resolution of the climate models making the projections.

On the other hand, changes in precipitation extremes have been, and are projected to be, greater than changes in means. The number and intensity of very heavy precipitation events (defined as the heaviest 1% of all daily events from 1901 to 2012) have been increasing significantly across most of the United States. The amount of precipitation accumulated from those heaviest daily events has also increased in most areas of the United States (Georgakakos et al. 2014). Very heavy precipitation events are projected to increase everywhere in the western United States (Kharin et al. 2013, Polade et al. 2014, Walsh et al. 2014). Heavy precipitation events that historically occurred once in 20 years are projected to occur as frequently as every 12 years by late this century in the Southwest and every 15 years in the Northwest (Wang and Zhang 2008). Dry spells are also projected to lengthen in most regions, especially across the southern and northwestern parts of the contiguous United States (Walsh et al. 2014), with the most consistently projected increases being for the numbers of dry days in the southwest and up the west coast (Polade et al. 2014). Thus, although projected changes in total average annual precipitation are generally small in many areas, both wet and dry extremes are projected to increase substantially almost everywhere.

Snowpacks and snowmelt-fed rivers in much of the western United States have trended toward earlier melts and flows since the middle of the last century, including the past decade (Hamlet et al. 2005, Fritze et al. 2011, Hoerling et al. 2013, Walsh et al. 2014). These trends are related to declines in spring snowpack, earlier snowmelt, and larger percentages of precipitation falling as rain instead of snow. These changes have taken place in the midst of considerable year-to-year variability and long-term natural fluctuations of the western U.S. climate, as well as other influences, such as the effects of tree deaths from warming-liberated pest infestations (Pugh and Small 2012) and from dust and soot on snowpacks, as well as differences between the trends in the colder interior mountain catchments and the warmer maritime mountains of the Pacific Coast states (Hamlet et al. 2005, Stewart et al. 2005, Hodgkins 2009, Painter et al. 2010, Stoelinga et al. 2010, Fritze et al. 2011, Creamean et al. 2013). There are thus both natural and human influences on the observed trends (Barnett et al. 2008, Bonfils et al. 2008, Pierce et al. 2008, Das et al. 2009, Hidalgo et al. 2009), but studies specifically designed to differentiate between natural and human-induced causes have shown that up to 60% of these changes are attributable to human-induced climate warming (Barnett et al. 2008). Notably, not all snowpack variables have changed detectably, or should be expected to have changed yet (Pierce and Cayan 2013).

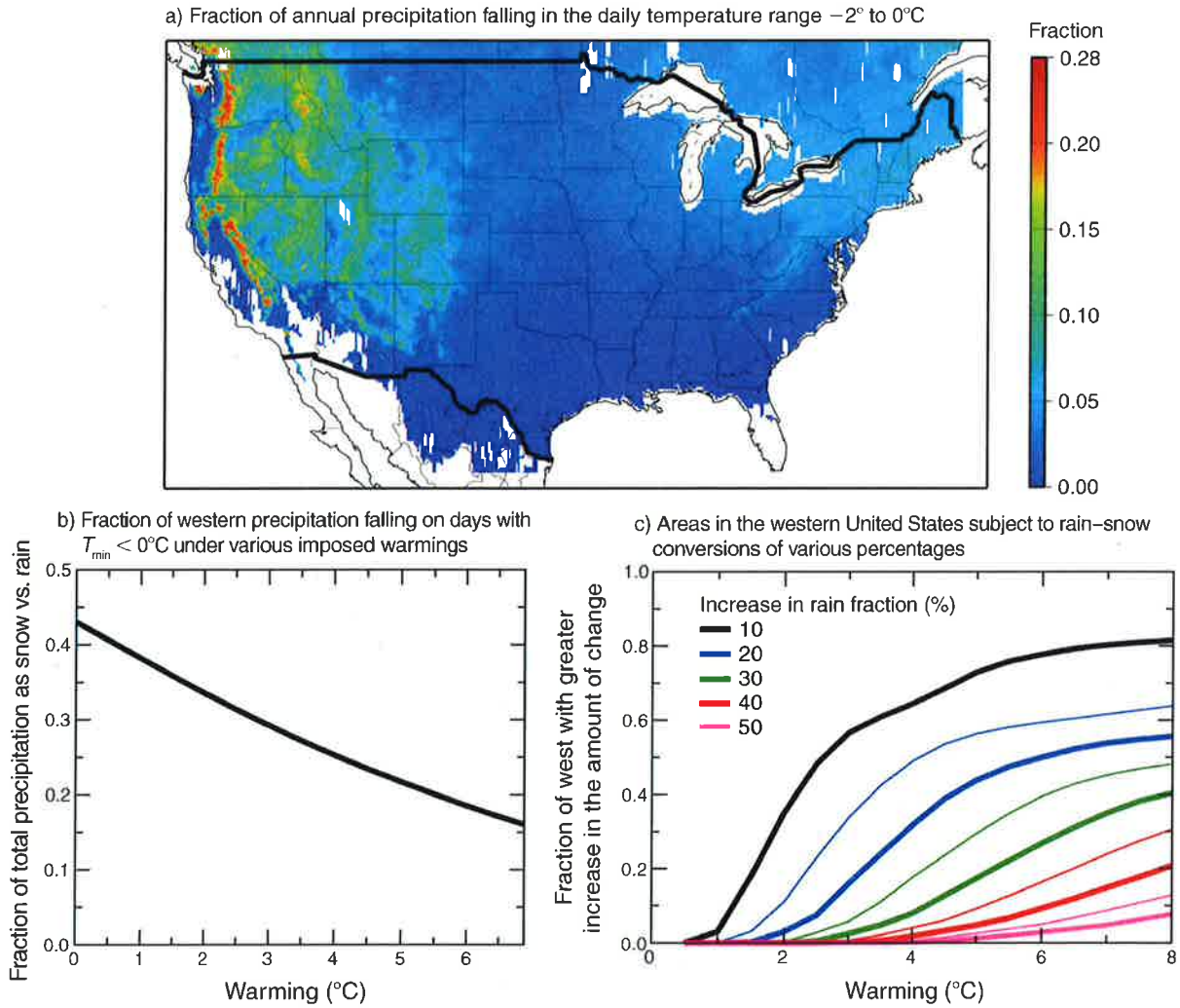


FIG. 3. (a) Influences of hypothetical +2°C warming (imposed uniformly on gridded daily temperature and precipitation, 1950–1999 (Maurer et al. 2002) on snow vs. rain fractions of total precipitation, as the historical fraction of precipitation that fell on days in the temperature range −2°C to 0°C; (b) fractions of overall precipitation, west of 100° W, falling historically on days with minimum temperature ($T_{min}$) less than freezing under various imposed warmings; and (c) fractions of the area of the western United States that would experience various degrees of snow–rain transition under various degrees of warming.

Snowpack and snow fed hydrologic conditions in the West are projected to continue to change, with major losses in the 1 April water content of the snowpack that feeds western rivers (snow water equivalent, or SWE; Fig. 2a); significant reductions in April to July runoff in California, Arizona, and the central Rocky Mountains (Fig. 2b); and reductions in warm-season soil moisture (Fig. 2c). A simple analysis of the historical record of daily precipitation and temperatures since 1948 helps to put the projected snow-system changes in the West into a national context: Fig. 3a illustrates the percentages of precipitation that have historically fallen on days in the temperature range between −2°C and freezing (Dettinger and Culberson 2008), as a proxy for the fraction of precipitation that might change from snowfall to rainfall under a modest +2°C warming. This simple consideration suggests that snowpacks are most vulnerable in the western United States (Klos et al. 2014), and indeed the western United States is where the largest changes have already been witnessed (Knowles et al. 2006, Feng and Hu 2007).

The possible rain–snow changes suggested in Fig. 2a are summarized for the western United States as a whole across a wider range of temperature changes in Fig. 3b and c. Fig. 3b shows a steady decline in the fraction of the regional-total precipitation that might transition from subzero to above-zero temperatures, indicating that about 4% more of the total precipitation would convert from snow to rain per °C warming, all other things being equal. This way of aggregating the snow-to-rain fractions gives, at the regional scale, a sense of the vulnerability of the overall water supply. However, only a fraction of the western land area is actually directly contact with water in lakes and streams, with about 10%

of the area of Colorado River Basin (as a proxy for western conditions more generally) lying within 60 m of open water, lakes, or streams (Batker et al. 2014). Across the broader dry-land areas of the West, changes from snow-dominated conditions to rain-dominated conditions are likely to impact winter and spring snow cover, length of snow seasons, soil freezing, and ultimately a variety of vegetation and ecosystem functions and services (such as potable water, flood risk reduction, water filtration, wildlife habitat, soil-erosion reduction, soil formation, raw materials, food, recreation, air quality, and aesthetic value; Batker et al. 2014). Ultimately these impacts may also result in changes in water supply yields (e.g., Goulden and Bales 2014, Painter et al. 2010) and carbon sequestration (e.g., Arnold et al. 2014). Fig. 3c, in contrast to Fig. 3b, summarizes areas (rather than precipitation totals) that might be making various levels of snow–rain transition as a function of warming. This metric has a somewhat less linear response to warming than that in Fig. 3b. Thus, for landscape managers, the snow–rain transition may entail an even more nuanced evaluation of impacts than for water managers.

Evapotranspiration (ET) is the second largest component of the western water cycle after precipitation and marks the divide between "green water" (that nourishes plants and landscapes and is quantified by ET) vs. "blue water" (that runs off or recharges groundwater, and is thus more often the subject of diversion and management for water supplies; Falkenmark and Rockstrom 2004). In snowy settings, sublimation of snow and ice can increase these returns of water to the atmosphere, sometimes in significant amounts (Strasser et al. 2008, Reba et al. 2012). Globally, land ET rates increased between 1982 and 1997 but then stopped increasing, or have decreased, since about 1998 (Jung et al. 2010), reflecting the so-called "hiatus" in atmospheric warming in this latter period (e.g., Trenberth and Fasullo 2013). The same ET decline has been witnessed in many areas of the western United States. Factors contributing to the land ET rate changes may include declining winds (Vautard et al. 2010, McVicar et al. 2012), declining solar insolation (Roderick and Farquhar 2002), increasing humidity (McVicar et al. 2012), and declining soil moisture (Jung et al. 2010).

Projections of actual ET rates vary by region (Hay et al. 2011, Wehner et al. 2011, Dai 2012, Hoerling 2012, Sheffield et al. 2012), but the atmospheric potential for ET is expected to increase globally and across the entire western United States region with warming. In the West, actual ET rates and totals will likely be affected by local soil moisture changes and by changing lengths of snow-covered and growing seasons. Changing vegetation and land uses in response to land developments and climate change also are likely to affect ET totals (Pugh and Gordon 2012, Goulden and Bales 2014). Much more research is needed to confidently understand the historical trends and to make confident projections of future ET rates and totals (Milly and Dunne 2011).

Runoff and streamflow at regional scales declined during the last half-century in the Northwest (Luce and Holden 2009), with no clear trends in much of the rest of the western United States (McCabe and Wolock 2011), although a declining trend may be emerging in annual runoff in the Colorado River Basin (USBR 2011). Historical fluctuations of streamflow have been dominated more by fluctuations in precipitation than by temperature (Karl and Riebsame 1989). Nevertheless, as warming proceeds and impacts ET and soil moisture, the amount of runoff generated by a given amount of precipitation is generally expected to decline (McCabe and Wolock 2011). Broadly speaking, in response to the combination of projected precipitation and temperature changes, annual streamflow is projected to decline in the Southwest (Milly et al. 2008, USBR 2011), and to increase in Alaska and the Northwest (Solomon et al. 2007, Milly et al. 2008, Elsner et al. 2010, USBR 2011, Markstrom et al. 2012), mirroring projected precipitation patterns (Strzepek et al. 2010). Annual and seasonal projected changes in runoff for eight basins in the Northwest, northern Great Plains, and Southwest are illustrated in Fig. 4 (USBR 2011, Georgakakos et al. 2014). Basins in the southwestern United States and southern Rockies are projected to experience gradual annual runoff declines, with basins in the Northwest to northcentral United States projected to experience little annual change through the midcentury, and increases by late century. Even though annual changes may be minimal, projected seasonal changes are greater in many areas, with cool season runoff increasing over the west coast basins from California to Washington and over the northcentral United States. Basins in the southwestern United States and southern Rockies are projected to see little change to slight decreases in the winter months (USBR 2011). Warm season runoff is projected to decline substantially over a region spanning southern Oregon, the southwestern United States, and southern Rockies, and change little or increase slightly north of this region (USBR 2011).

Changes in annual hydrographs are likely to challenge water managers and users, even where annual volumes do not change. Higher flows in early spring will favor what have been junior and infrequently used storage rights, and senior rights may find less flow on the descending limb of the hydrograph through the summer and fall. In fact, the changing hydrograph will mean that some diversions thought in the 20th century to have reliable senior water rights may be without water during the hottest and driest periods of summer. The economic value of these once-prized rights would be vastly reduced (Stratus Consulting 2009). Environmental water will also be in short supply in this season, adding to overall stress.

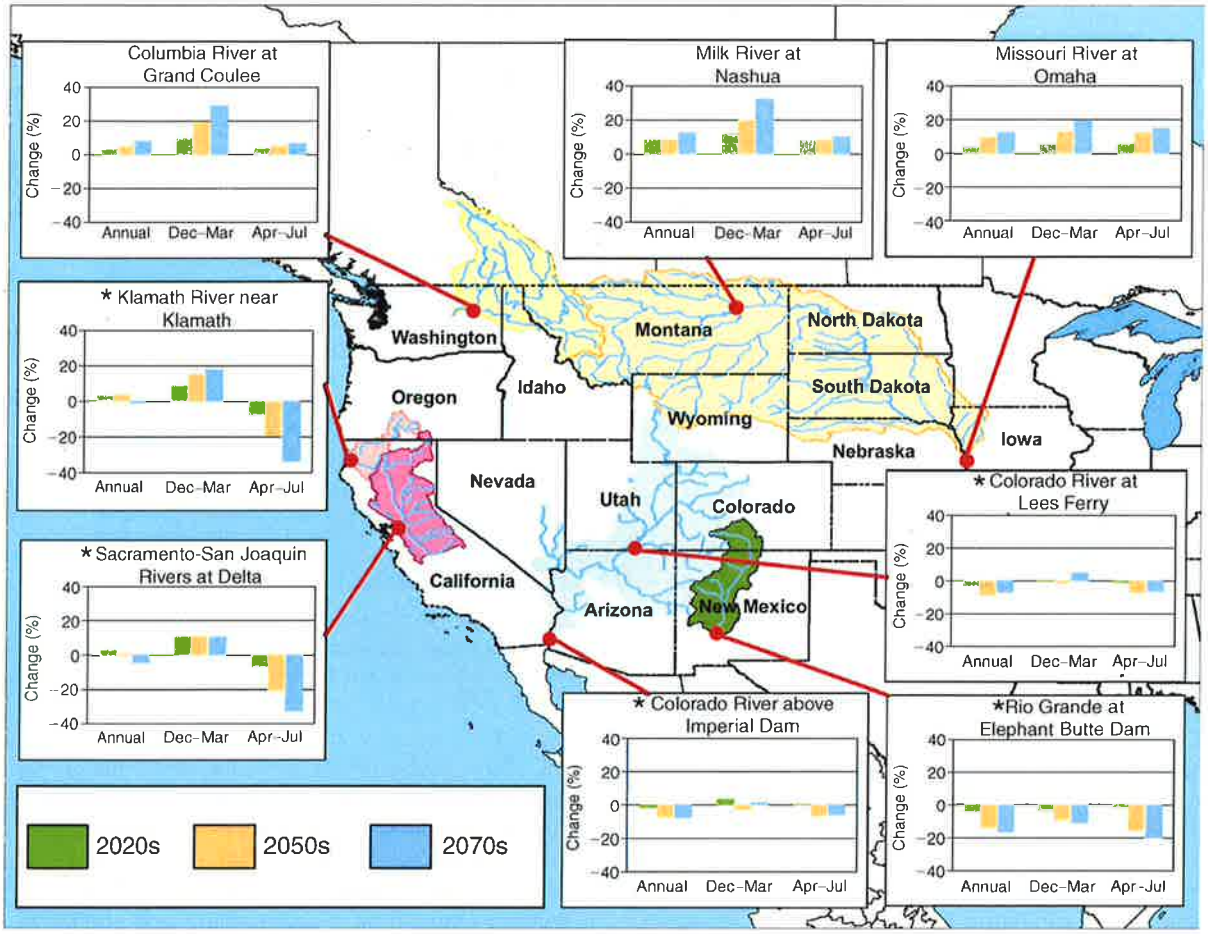


FIG. 4. Streamflow projections based on combinations of scenarios with substantial global-emissions reductions, some reductions from current emission trends toward the end of this century, and continuations of current rising emissions trends, for eight river basins in the western United States (USBR 2011), as percent change in average runoff for three future decades (2020s, 2050s, and 2070s) relative to the 1990s. Stars indicate four major river basins that are discussed in detail in this paper (the Colorado River basin is shown as Upper and Lower Colorado).

### *Drought*

Droughts occur on time scales ranging from season-to-season to multiple years and even multiple decades. There has been no universal trend in the overall extent of drought across the continental United States since 1900. However, in the Southwest, widespread drought in the past decade has reflected both precipitation deficits and higher temperatures (Hoerling et al. 2013), in ways that resemble projected changes (Cayan et al. 2010). Except in the few areas where increases in summer precipitation compensate, summer droughts (Walsh et al. 2014) are expected to intensify almost everywhere in the continental U.S. (Trenberth et al. 2004) due to longer periods of dry weather and more extreme heat, leading to more moisture loss from plants and earlier soil moisture depletion in basins where snowmelt shifts to earlier in the year (Scibek et al. 2007, Huntington and Niswonger 2012). Basins watered by glacial melt in the Sierra Nevada, Rockies, and Alaska may experience increased summer river flow in the short term, until the amounts of glacial ice become too small to contribute significant river flow (Hall and Fagre 2003, Basagic and Fountain 2011), at which time flows may decline precipitously.

### *Flood*

Fig. 5 shows statistically significant historical trends in flood magnitudes at only about 27% nationally of long-term gauges analyzed, and that floods have been decreasing in parts of the Southwest (see also Karl and Knight 1998, Gutowski et al. 2008, Villarini et al. 2009). With heavy rainfall events projected to increase, though, the potential for flash flooding is expected to increase in many settings. Land cover, flow and water-supply management, soil moisture, and channel conditions are also important influences on flood generation (Poff et al. 2006) and must be included in projections of future flood risks. Region-specific storm mechanisms and seasonality also affect flood peaks (Villarini et al. 2009). Because of this, and our limited ability to project future very heavy

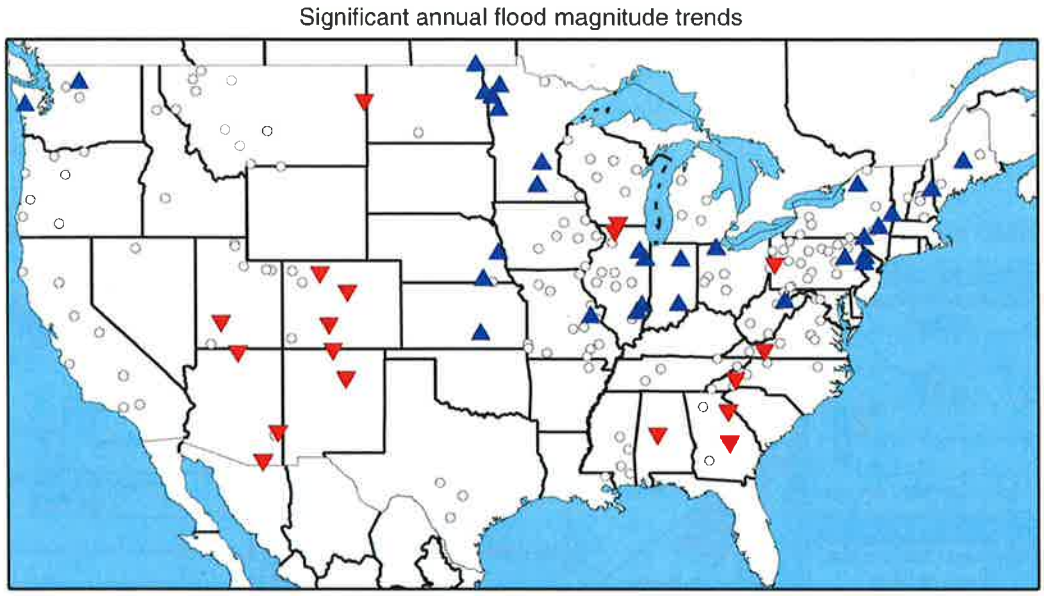


FIG. 5. Streamflow-gage locations (with >85 years of record) where the relationship between historical annual flood magnitudes and global atmospheric carbon dioxide concentrations has been statistically significant ($P < 0.05$; modified from Hirsch and Ryberg [2012]). Blue triangles indicate increasing annual flood magnitude trends, red triangles indicate decreasing trends, and white circles indicate trends that have not been statistically significant ($P > 0.05$).

events with precision, evaluations of the relative changes in various storm mechanisms may be useful (Villarini et al. 2009, Dettinger 2011). Warming is likely to directly affect flooding in mountain settings, as catchment areas receive increasingly more precipitation as rain rather than snow, and more rain on remaining snowpacks (Mote 2003, 2006, Knowles et al. 2006, McCabe et al. 2007, Nayak et al. 2012) In some such settings, flooding may increase as a result, even where precipitation and overall river flows decline (Raff et al. 2009, Das et al. 2013, Georgakakos et al. 2014).

### *Groundwater*

Groundwater is the only perennial source of fresh water in many western regions and is commonly used as a buffer against climate extremes. As such, it is essential to water supplies, food security, and ecosystems. In regions of Nevada, Utah, and the southern Great Plains, groundwater is a primary water supply. Groundwater aquifers in these areas, and even in the rest of the western United States where surface water provides large fractions of overall supplies (Fig. 6), are susceptible to the combined stresses of climate and water-use changes. For example, during the 2006–2009 California drought, when groundwater was drawn upon to augment for flagging surface-water supplies for much irrigation in California's Central Valley, groundwater storage declined dramatically (Famiglietti et al. 2011). The current California drought has sparked enough groundwater development and pumpage so that the State has undertaken significant changes in how groundwater will be managed. Even in the Colorado River basin, where surface water provides large fractions of most water supplies (Fig. 6), sustained dry conditions during the past decade have resulted in massive groundwater depletions (Castle et al. 2014).

Climate change impacts on groundwater storage are expected to vary from place to place and aquifer to aquifer. Although precise responses of groundwater storage and flow to climate change are not yet well understood nor readily generalizable, recent and ongoing studies (Earman and Dettinger 2011, Taylor et al. 2012, Crosbie et al. 2013) identify key risk factors: (1) precipitation is the key driver of aquifer recharge in the widespread water-limited environments of the West (Hidalgo et al. 2008) while ET is the key driver in energy-limited environments (like swamps or marshlands) and (2) climate change impacts on recharge depend on several factors, including basin geology, frequency and intensity of high-rainfall periods that drive recharge, seasonal timing of precipitation, and strength of groundwater–surface water interactions. In many mountainous areas of the United States, groundwater recharge is disproportionately generated from snowmelt infiltration, suggesting that the loss of snowpack to warming may affect recharge rates and patterns (Earman et al. 2006, Scibek et al. 2007, Earman and Dettinger 2011, Huntington and Niswonger 2012).

Generally, though, impacts of changing demands on groundwater systems, whether due directly to climate changes or indirectly through changes in land use or surface-water availability and management, are likely to cause more immediate changes in groundwater availability (Taylor et al. 2012, Sheng 2013). Changes in

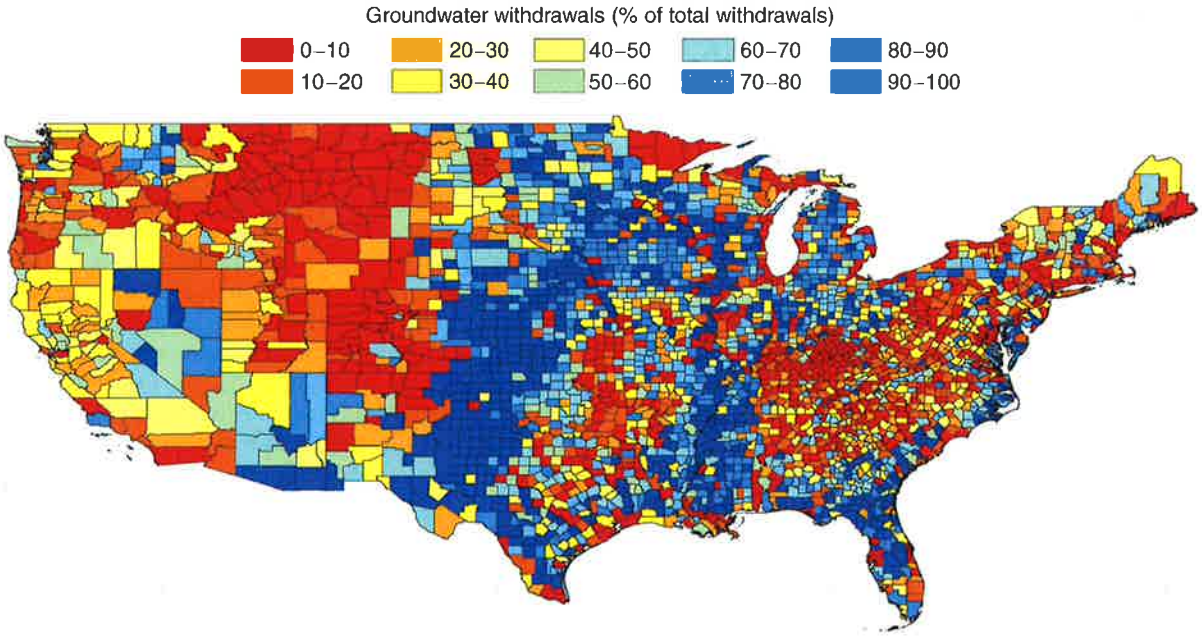


FIG. 6. Groundwater withdrawals as a percentage of total withdrawals (from all surface and groundwater sources) by county (Kenny et al. 2009, Georgakakos et al. 2014).

recharge and resulting changes in storage may be more subtle and take longer to emerge.

### *Water quality*

Projected changes in air and water temperatures, precipitation intensity, and droughts will likely affect water quality in the West's rivers and lakes. Increasing water temperatures and intensifying droughts can inhibit lake mixing, reduce oxygen in bottom waters, and increase the time pollutants remain in water bodies. More intense runoff and precipitation can increase river sediment, nitrogen, and pollutant loads. Lower flows can concentrate pollutants, increase stream temperatures, and reduce dissolved oxygen. Unfortunately, our understanding of the specific of how quality will change remains limited.

Water temperature has been increasing in many rivers globally (Kaushal et al. 2010). Changes in streamflow temperature and flow regimes can affect aquatic ecosystem structure and function (Groffman et al. 2014). Water temperature directly regulates the physiology, metabolism, and energy of individual aquatic organisms, as well as entire ecosystems. Streamflow quantity influences the extent of available aquatic habitats, and streamflow variability regulates species abundance and persistence. Flow also influences water temperature, sediment, and nutrient concentrations (Maurer et al. 2010).

Other factors being equal, the length of the season that lakes and reservoirs are thermally stratified is increasing with increased air and water temperatures (Schneider and Hook 2010, Sahoo et al. 2012) and mixing may be inhibited or even eliminated in many lakes. For example, in Lake Tahoe—one of the deepest lakes in the world—the length of the season in which differences in lake temperatures with depth cause stratification (separate density layers) has been increasing since the 1960s (Fig. 7) in response to increasing air and surface water temperatures (Coats et al. 2006). Because of its large size (relative to inflow) and long water-residence times, other influences on stratification have been largely overwhelmed and warming air and water temperatures have caused progressive declines in near-surface density, leading to longer stratification seasons (by an average of 20 days), decreasing the opportunities for deep lake mixing, reducing oxygen levels, and potentially impacting many species and numerous aspects of aquatic ecosytems (UC Davis Tahoe Environmental Research Center 2012). Increasing stratification reduces deep mixing in the lake, which in turn is projected to lead to decreasing dissolved oxygen in the deep water and bottom sediments (Sahoo et al. 2012). These conditions are expected to encourage the release of nutrients (nitrogen and phosphorous; Baron et al. 2013), heavy metals (such as mercury), and other toxins into lake waters (Schneider and Hook 2010, Sahoo et al. 2012).

### *Water withdrawals and demands*

Total U.S. freshwater withdrawals (including water that is withdrawn and consumed as well as water that returns to a source) and consumptive uses have leveled off and even declined nationally since 1980 (Maupin et al. 2014). Western water withdrawals have followed suit despite more than a 50% increase in the region's population (Fig. 8; Brown et al. 2013*b*). This leveling

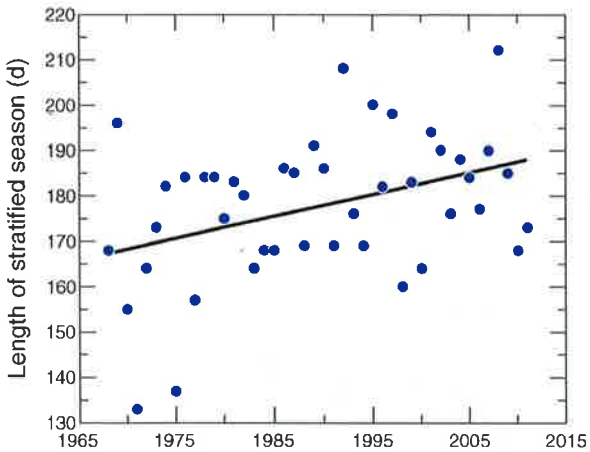


FIG. 7. Observed changes in lake-stratification season length for Lake Tahoe. The black line is a linear trend fitted to the season lengths, by linear regression ($r = 0.39$, $P < 0.01$), indicating increases in season length of about 5 days per decade since 1968.

reflects demand management, including switching from flood irrigation to more efficient methods in many parts of the western United States (Brown 2000, Foti et al. 2012), enhanced water use efficiencies in response to environmental pollution legislation (in the industrial and commercial sector); new plumbing codes, water efficient appliances, efficiency improvement programs, and pricing strategies (Groves et al. 2008, Jeffcoat et al. 2009, Rockaway et al. 2011) in the municipal sector; changes from water-intensive manufacturing and other heavy industrial activities to service-oriented businesses (David 1990); and replacement of older once-through-cooling electric power plants by plants that recycle their cooling water (in the thermoelectric sector). At the national level, irrigation and all electric power plant cooling withdrawals account for ~77% of total withdrawals but most of the power-plant usage is in the eastern states. In most of the West, though, irrigation is the dominant water use (Fig. 9d). Comparatively few of the farms thereby serviced are the small family farms of yesteryear (Fig. 9b). In the West, about 81% of the irrigation waters are consumed by evapotranspiration and plant growth.

Water demand is projected to increase as population grows, but is projected to increase substantially more as a result of climate change. In the absence of climate change but in response to a projected population increase of 80% and a 245% increase in total personal income from 2005 to 2060, simulations indicate that total water demand in the United States could increase by 3% (Brown et al. 2013*b*). Under these conditions, approximately one-half of the western United States would experience an overall decrease in water demand, while the other half would experience an increase (Fig. 10a). Recent projections of western water consumption between 2010 and 2030 suggest that, while irrigation uses may not increase much (neglecting, for the moment, climate change), increased uses for municipal and industrial sectors are expected (Tidwell et al. 2014). If, however, climate change is also factored in, the total water demand is projected to rise by an average of 26% over the same period (Fig. 10b; Brown et al. 2013*b*). When climate change is included, 90% of the country and 100% of the West is projected to experience a total demand increase, although—using a different methodology—Averyt et al. (2013) found some areas in the far Northwest and deepest Southwest escaping the increases. By 2090, total water demand is projected to increase by 42% under the A1B scenario and 82% under a higher-emissions A2 scenario. Crop irrigation and landscape watering needs are directly affected by climate change, especially by projected changes in temperature, potential ET, and soil moisture. Consequently, the projected increases in water demand are larger in the western states, where irrigation dominates total water withdrawals. Thus the impacts of projected population, socioeconomic, and climate changes may combine to amplify water demand in the West.

### *Instream water uses*

Hydropower contributes 7% of electricity generation nationwide, but provides up to 70% in the Northwest and 20% in California, and Alaska (USEIA 2013). Climate change is expected to affect hydropower directly through changes in runoff (average, extremes, and seasonality), and indirectly through increased competition with other water demands. Based on runoff projections, hydropower production is expected to decline in the Southwest (EPRI 2011), unless offset by new hydropower operations and technologies.

Changing climate is also projected to affect water and wastewater treatment and disposal in ways that depend on system-specific and interacting attributes. For example, elevated stream temperatures, combined with lower flows, may require wastewater facilities to increase treatment to meet stream water quality standards (USEPA 2011). More intense precipitation and floods, combined with escalating urbanization and associated increasing impermeable surfaces, may increase contaminated overland flows or combined sewer overflows (USEPA 2008). Moderate precipitation increases, however, could result in increased stream flows, improving capacity to absorb wastewater in some regions. Sea level rise and more frequent coastal flooding could damage wastewater utility infrastructure and reduce treatment efficiency (Flood and Cahoon 2011, Moser et al. 2014).

The projected increases in water withdrawals and uses (Fig. 10) threaten to deepen and widen ecosystem impairments, especially in the Southwest where drier conditions are projected (Groffman et al. 2014). These impairments include too much and too little sediment, hydrographs out of alignment with fish and habitat needs, water temperatures below dams too cold in summer and too warm in winter, and dams that impair

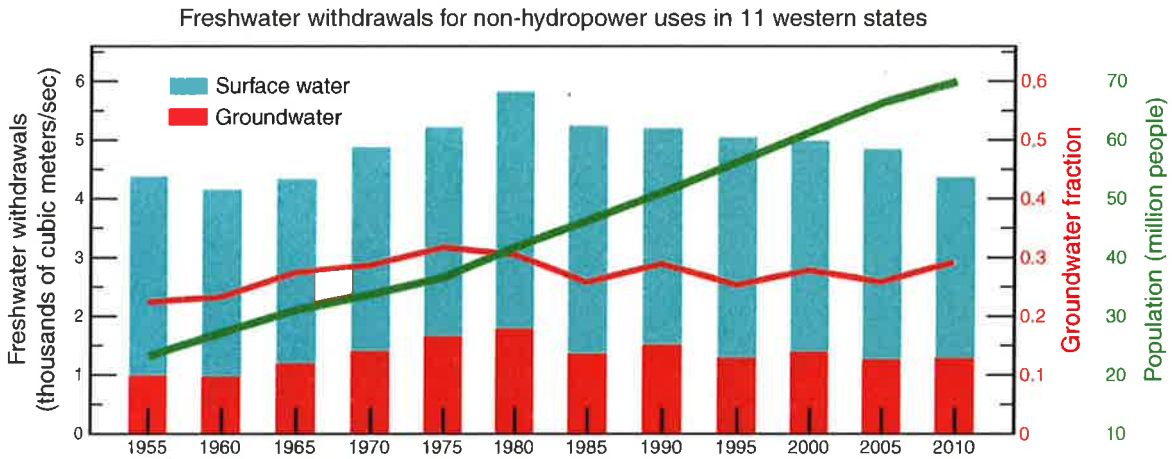


FIG. 8. Western U.S. freshwater withdrawals from groundwater and surface water sources (bars; left-hand *y*-axis), with fractions of withdrawals from groundwater (red curve; inner right-hand *y*-axis) and population trend (green curve; outer right-hand *y*-axis) overlain. States included in data are Arizona, California, Colorado, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming. Primary data are available at http://water.usgs.gov/watuse.

upstream and downstream fish movements (Poff and Mathews 2013).

## WESTERN WATER AND CLIMATE CHANGE: FOUR ICONIC RIVERS

Water strategies and solutions to meet western population growth have spanned a broad range from increasing supplies to decreasing demands. Many of these could also be used to adapt or prepare for climate change adaptation. Examples of these strategies include new dams (being considered in California and Colorado), desalination (San Diego), basin imports via pipeline (St. George, Utah and the Front Range of Colorado), municipal conservation, permanent transfers from agriculture (Colorado Springs), water markets, land fallowing (Los Angeles), canal lining (San Diego), retirement of grass lawns by purchase (Las Vegas), groundwater banking (Arizona), reuse (Orange County and Aurora, Colorado), new rate structures, consumer education, municipal conservation, indoor fixture rebates (Denver), new landscape design, water loss management from leaky mains, and aquifer storage and recovery (Arizona) (Western Resource Advocates 2005). On the whole, given the uncertainties about the precise forms that climate-change will take, it may be that solutions that engage whole portfolios of differing supply and demand options, with differing climate vulnerabilities, may be the most robust in the future. However, detailed analyses of future water-supply reliabilities in the Inland Empire area of southern California under a wide range of highly uncertain future climates (Groves et al. 2008) showed that (1) strategies in which adaptions and plans are continually revisited and rethought, as additional information emerges, are the least expensive options that agencies can pursue and (2) the next most effective and cost-efficient strategies are demand reductions. In this context, the good news is that per capita demand has declined in recent years in many Southwestern cities through active demand management programs (Gleick 2010, Cohen 2011).

Both tools and barriers confront those who intend to prepare and adapt western water systems for climate change. A quick overview of the situations in four iconic western river basins (Fig. 4) provides a sense of the challenges that confront the region.

### *The Colorado River basin*

The Colorado River drains parts of seven states and two nations in the American Southwest (Fig. 4). Its waters irrigate over 20 000 $km^2$ of land inside and outside of the basin, and serve 40 million Americans in every major southwestern city (USBR 2011). The river's waters were originally allocated under the 1922 Compact that split the river into a Lower Basin (California, Nevada, and Arizona) and an Upper Basin (Colorado, Utah, New Mexico, Wyoming). A 1944 international treaty set aside 1.85 $km^3$ annually for Mexico. Agriculture consumes over 80% of the total water use in the basin (USBR 2011, Cohen et al. 2013). Additional laws, agreements under NEPA, international treaties, and Supreme Court Decrees have added to the original agreements (Meyers 1966, Getches 1984, Verburg 2011), and constitute what is called "The Law of the River." Upper Basin agriculture is mainly alfalfa production and pasture for cattle. The Upper Basin climate, with few exceptions, does not support other crops due to the relatively short growing season. Notably, alfalfa is highly consumptive of water (Glennon 2012, Robbins 2014). Lower Basin agriculture is extremely varied and includes cotton, wheat, and many winter vegetables, in addition to large amounts of alfalfa (Cohen et al. 2013). Reflecting the aridity of the region, most of the cities served are either beyond the basin's boundaries (Los Angeles, San Diego, Denver, Salt Lake, Albuquerque)

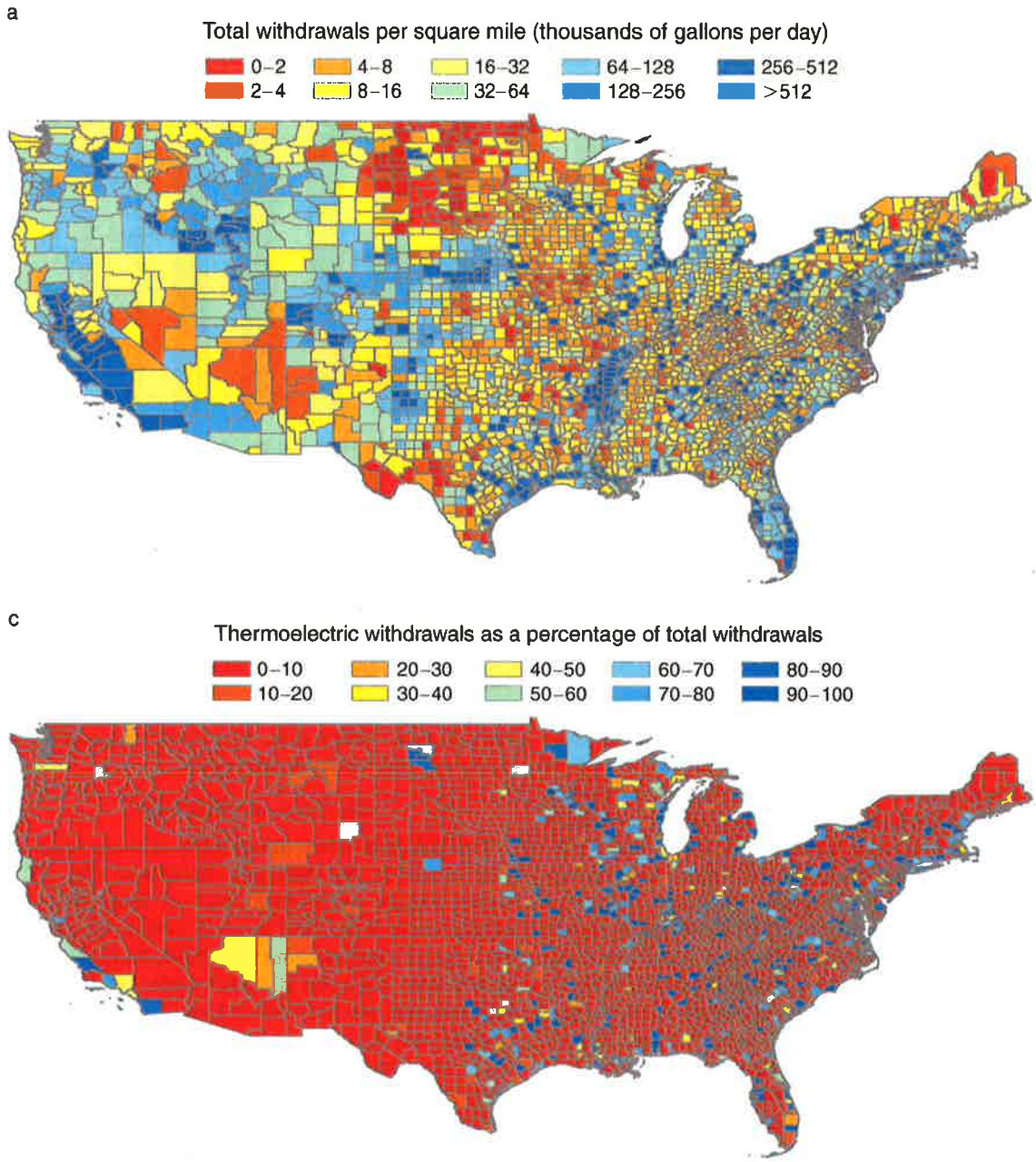


FIG. 9. Geographical distribution of 2005 U.S. water withdrawals by sector and source (Kenny et al. 2009, Georgakakos et al. 2014): (a) total withdrawals (surface and groundwater) in thousands of gallons per day per square mile (about 10 $m^3 \cdot d^{-1} \cdot km^{-2}$); (b) fraction of farms operated by family or individual, by county as a percentage of total (U.S. Department of Agriculture 2012); (c) thermoelectric plant cooling withdrawals as percentage of total withdrawals; and (d) irrigation, livestock, and aquaculture withdrawal, as percentage of total withdrawals. Ranges are inclusive at the upper end (i.e., 0–10, 10.01–20, etc.).

or significantly uphill from their supply points (Las Vegas, Phoenix, Tucson).

The river is fed primarily by winter snowpack from the Rocky Mountains, with roughly 15% of the total basin area (mostly in the Upper Basin) generating 85% of the flow. The 20th-century mean annual flow at Lees Ferry, the dividing line between Upper and Lower Basins, was approximately 18.5 $km^3$. Half of this volume was allocated to the Lower Basin and half to the Upper Basin in the original Compact. (A small but important part of the basin's runoff (1.1 $km^3$) enters the river below Lees Ferry in the Grand Canyon.) Unfortunately, the 20th century is now known to have been anomalously wet, especially at the time of the compact negotiations, and megadroughts substantially more severe than those in the 20th century have occurred many times during the

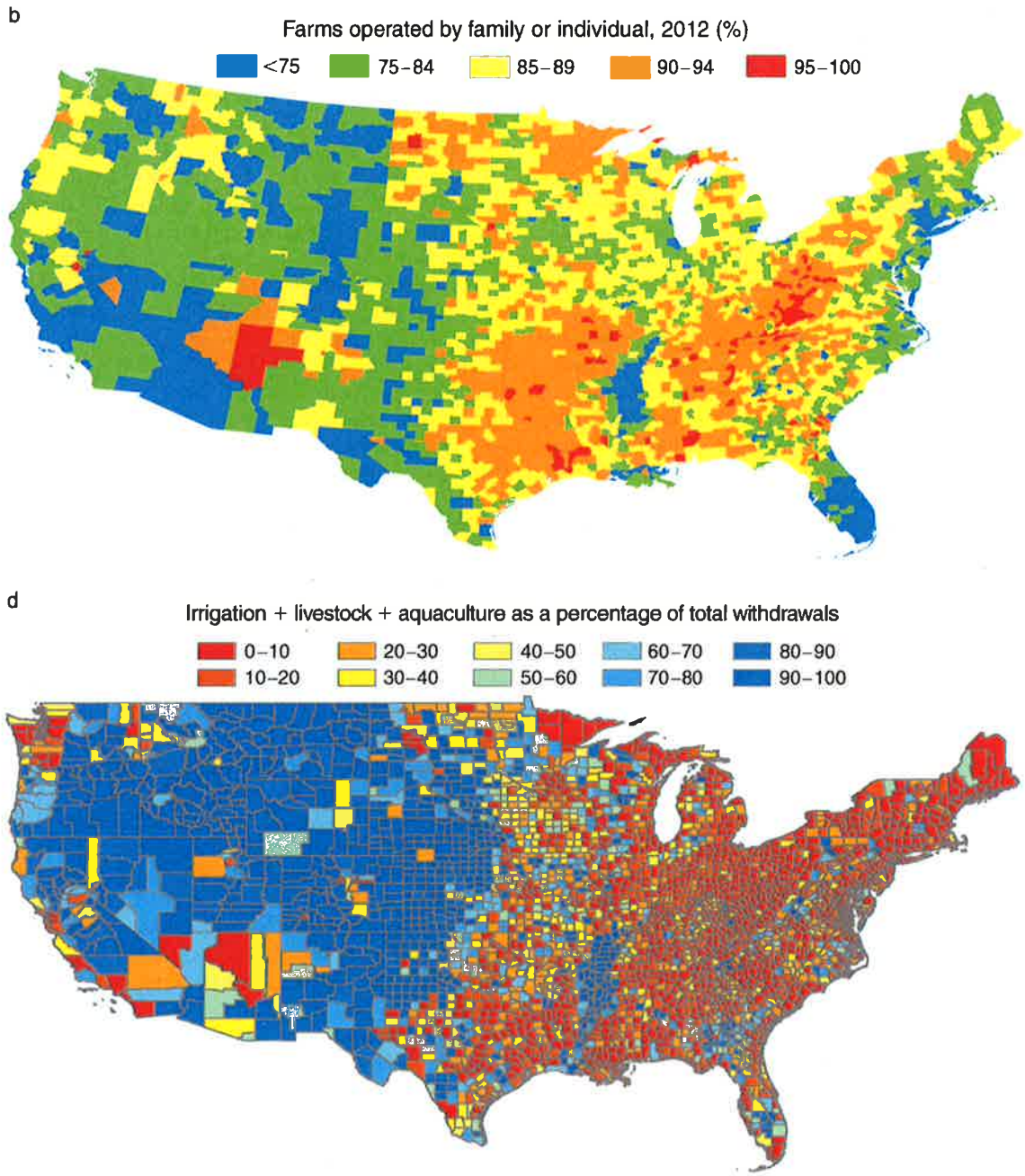


FIG. 9. Continued.

past several thousand years (Woodhouse et al. 2006, Meko et al. 2007). Climate change is now expected to exacerbate droughts and likely lower the mean flow (Ault et al. 2014).

Recent climate-change projections over the basin have consistently indicated that the southern parts of the basin are likely to face precipitation declines and enhanced droughts, in contrast to the northernmost parts of the basin that may experience smaller precipitation declines or even increases (Gao et al. 2011, Cayan et al. 2013, Polade et al. 2014, Walsh et al. 2014). Most of the basin lies in the area between these two trends, so that projected future precipitation amounts are quite climate-model dependent and uncertain. Temperatures are of course projected to warm throughout the basin, and evaporative (and transpiration) demands are thus generally expected to increase. Thus less runoff and recharge may result from any given amount of precipitation, however much precipitation does or does not change in the basin. Nonetheless, precipitation projections remain quite uncertain and variable (from place to place and model to model), so that the precise

effects of climate change on water supply in the basin as a whole remain uncertain.

Furthermore, dust on snow from the southwestern deserts has been shown to advance runoff timing by three weeks and decrease water quantity by 5% by darkening snowpack and thus absorbing more solar energy. Much of this blowing dust results from land use disturbances such as construction, grazing, and off road vehicles in the region. Under climate change, another loss of as much as 1% and a significant additional three-week timing advance might occur (Painter et al. 2010, Deems et al. 2013).

Despite this supply-side uncertainty, the Colorado River basin almost certainly faces major future water-resource shortages because it is already overallocated and demands upon the river continue to grow (see Plate 1). Under the continuous onslaught of built-in deficits and (likely) reductions in its flows relative to the allocations of its waters and, especially, continued growth of water demands on the system, even the basins abundant storage options provide only short-term respites. The river system is restricted and managed by over 100 reservoirs. Bureau of Reclamation reservoirs provide the majority of storage in the system. Hoover Dam, completed in 1935, and Glen Canyon Dam, completed in 1963, provides over 62 $km^3$ of storage in the nation's two largest reservoirs, Lakes Mead and Powell. An additional 12 $km^3$ is stored in Upper Basin reservoirs (USBR 1981). Total reservoir storage is four times the annual flow, a very large amount of storage relative to most other comparable rivers in the world. Recent studies have explored the chances that the major reservoirs will dry out under the combined influences of climate change and heavy demands; all reach the conclusion that this is a very likely outcome under current management practices sometime before 2050 and perhaps as soon as 2020 (Barnett and Pierce 2008, 2009, Rajagopalan et al. 2009).

There are two distinct but related water quantity problems in the Colorado River Basin, one in the Upper Basin, and one in the Lower Basin. In the Lower Basin, the passage of the 1968 Colorado River Basin Project Act created a long-term built-in deficit, defined as an imbalance between the water legally available to the Lower Basin and the amount used by its three states. This act authorized the construction of the Central Arizona Project (CAP), an annual 2-$km^3$ diversion from the Colorado River to Phoenix, Tucson, and agricultural areas in Arizona. Of this amount, availability of 1.5 $km^3$ per year is dependent on the Upper Basin not using their full allocation. It was known that over time this "extra" Upper Basin water would decline due to increasing population and use in the Upper Basin (Tipton and Kalmbach 1965, Johnson 1977). The only unknown was when the Upper Basin would use their full allocation, thereby depriving CAP of its supply. Also, the 1968 Act did not account for the growth of Las Vegas from approximately 275 000 residents to the current 2 million people with 90% of their supply coming from Lake Mead. Climate-change reductions in flow will only speed the day of reckoning due to these gaps and could make the built-in deficit worse, especially if flow declines were to occur to the limited but critical aforementioned inflows below Lees Ferry.

The drought of the past 15 years in the Southwest has made the built-in deficit obvious, and by 2007 the Basin states agreed to new operational rules for reservoirs and Lower Basin deliveries in times of shortage (U.S. Department of Interior 2007). Only one-half of the 1.5-$km^3$ built-in deficit was covered by the agreement, however. With continuing drought conditions, in 2010 and again in 2014, Lake Mead dropped to within 3 m of the first trigger point established in the 2007 rules. The Lower Basin states are reportedly in negotiations to solve this difficult problem, which will likely require that California share in shortages (Wines 2014*a*, *b*).

The Upper Basin faces a different, but related, problem. Under the terms of the 1922 compact, they agreed to not deplete the flows at Lees Ferry below 93 $km^3$ in any given 10-year period. This arrangement was reached as an imperfect way to limit Upper Basin consumptive use (Colorado River Commission 1922). When the compact was negotiated, it was never anticipated that this limit would be reached, because the supply was thought to greatly exceed the amount allocated. The flows, however, have proven to be less than originally thought, thus providing the Upper Basin with an allocation to an uncertain, continually varying amount of water, which makes planning for future Upper Basin development difficult. The most immediate examples of this difficulty and uncertainty is provided by the current drought, which has yielded flows that have been approximately 20% below the long-term mean and has reduced reservoir storage by 60%. If the drought continues apace for even a few more years, the Compact could require the Upper Basin to curtail its uses to meet its 93-$km^3$ obligation.

In the midst of these large-scale built-in and developing challenges, significant tribal rights need to be addressed. A number of Indian tribes inhabit the basin on federally created reservations. Under the Winters Doctrine, these tribes are entitled to reserved water rights (Royster 1994, Shurts 2000). Only some of these tribal rights have been fully quantified, with most other tribes who are still seeking to finalize rights residing in Arizona. One of the more uncomfortable aspects of this situation is that supplies for tribal rights come from the states in which they live, despite the federal nature of the obligation (Royster 1994). Arizona has by now allocated all of its most senior CAP water right for tribes, and remaining settlements will have to come from its lower priority CAP supplies, supplies that are most likely to be curtailed by the 1968 agreement (Weldon and McKnight 2007).

A number of environmental concerns also challenge the basin (Pitt et al. 2000, Pitt 2001, Adler 2007). Dams

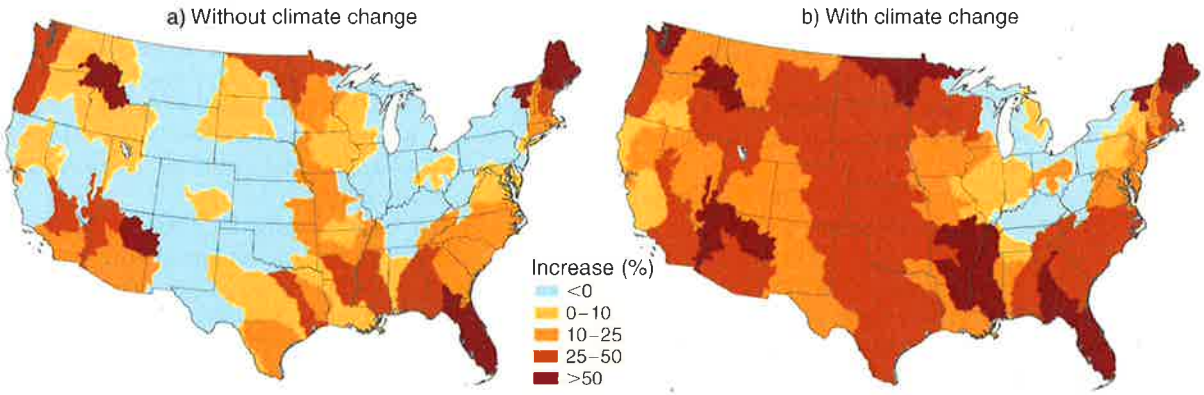


FIG. 10. Projected 2005–2060 changes in water withdrawals (Brown et al. 2013*b*) (a) incorporating projections of economic and population growth and (b) also including climate change projected by three climate models under a middle-of-the-road A1B greenhouse-gas emissions scenario (increasing emissions through the end of this century, with reductions in the rate of increase after 2070). Ranges are inclusive at the upper end (i.e., 0–10, 10.01–25, etc.).

and other infrastructure on the river have blocked fish movements, restricted sediment transport, and changed the timing and temperature of flows. In addition, introduced nonnative fishes threaten endemic fishes. In the Upper Basin, there are federally listed endangered fish in multiple tributaries including the San Juan, Gunnison, Colorado main stem and Green. There are Recovery Programs under the Endangered Species Act (ESA) in place (Adler 2007), but these programs are funded from hydropower sales that have been reduced during the drought. In the Lower Basin in 2005 a basin-wide Habitat Conservation Program was finalized, the Multi-Species Habitat Conservation Program. It provides for over US$650 million over 50 years to conserve 26 species; 6 threatened and/or endangered and 20 non-federally listed species (Adler 2007). The river also has not reliably reached its terminus in the Sea of Cortez for almost 50 years. New international agreements are in place to provide environmental flows in the lowest river reaches and, in 2014, the first of these flows was released.

### *The Rio Grande*

The Rio Grande drains a bi-national basin that flows through Colorado and New Mexico before reaching Texas at El Paso, from whence it continues south and east to form a 2000-km U.S.–Mexico international border (Hill 1974). The river's headwaters in Colorado's eastern San Juan Mountains drain a small area compared to the Colorado, and consequently those headwaters produce a comparatively small amount of flow, about 1.2 $km^3$ per year from snowpack. Flows are also highly variable from year to year (Gutzler 2011). Near these headwaters, the Rio Chama is the largest U.S. tributary to the Rio Grande, contributing another approximately 0.5 $km^3$ per year from a drainage that also drains part of Colorado's San Juan Mountains (Thomson 2011). The present discussion will only extend as far south as Fort Quitman, Texas, a bit south of El Paso and Cuidad Juarez, Mexico. (The river is often dry at Fort Quitman due to upstream extractions and only regains flow at its confluence with Mexico's Rio Conchos [Schmandt 2002].) The Rio Grande upstream from Fort Quitman (the Upper Rio Grande) comprises three distinct agricultural segments: Colorado's San Luis Valley; the Middle Rio Grande, in New Mexico, from near Cochiti Reservoir to Elephant Butte Reservoir; and the Paso del Norte region from Elephant Butte Reservoir to Fort Quitman, also mostly in New Mexico.

Water in the river is derived predominantly from snow, although New Mexico in some years has a pronounced summer monsoon that can provide significant if unpredictable water in the Middle and Paso del Norte reaches. At least two studies have investigated future flows of the Rio Grande under the influence of climate change (Hurd and Coonrod 2012, Llewellyn et al 2013). Lewellyn et al.'s 2013 study indicated that, by 2100, flows available for irrigation uses in Colorado's San Luis Valley could decline by 25%. Divertible flows in the Middle Rio Grande were projected to decline by 35%, in large part because the compact allows Colorado to use more flow at lower flow levels so that it could deliver less to New Mexico. Below Elephant Butte, flows could decline by 50%. These declines are Reclamation's worst modeled flow outcomes from climate change in the entire United States, and reflect the small size of the basin, the small size of its primary runoff-generating snow-covered areas, and its position far enough south so that it is projected (by nearly every climate model) to lie within the zone where climate change is most likely to entail significant precipitation declines.

The river is governed by a 1906 international treaty and a three-state compact signed in 1939. The compact was designed to protect senior agricultural water rights in both Colorado and near El Paso. Under the compact, the upper two sections have annual (and occasionally year-to-year) delivery requirements to river sections downstream that vary nonlinearly according to input flows The compact has been the source of much

interstate litigation between the three signatory states (Paddock 2001), and the most recent ongoing litigation involves the consequences of groundwater pumping on a large scale, something not envisioned in the compact. The 1906 treaty requires a small 0.074-$km^3$ delivery to Mexico near El Paso.

Two aspects of water management of the Rio Grande are not present elsewhere in the West. Acequias are communal water systems that share in maintenance and shortages, unlike the predominate western legal doctrine of prior appropriation. These rights are typically tied to the land and cannot be transferred to new uses. New Mexico's 12 Pueblos were established before the United States existed, and hence have unquantified but "time immemorial" water rights that predate even the Spanish Law once utilized in the region. Pueblo rights have been the subject of some of the longest-running Supreme Court cases. Both of these rights complicate and add uncertainty to water management.

Three large cities, Albuquerque, population 555 000, El Paso, population 672 000, and Ciudad Juarez, population 1.3 million, rely on the river for large fractions of their supplies, along with heavy groundwater pumping (which involved significant aquifer overdrafts in the past, that in recent years have been stabilized). However, as with other regions around the West, agriculture is a dominant water use. The Bureau of Reclamation constructed four federal projects in the basin. The Rio Grande project was approved in 1905, and its primary reservoir, the 2.5-$km^3$ Elephant Butte, was completed in 1916 to service project lands (Littlefield 2008) in the Paso del Norte region and beyond. Water from this reservoir is delivered by Elephant Butte Irrigation District and El Paso County Water Improvement District #1 to farmers in New Mexico and Texas. The Rio Grande Project services 728 $km^2$ of U.S. land and another 100 $km^2$ in Mexico (USBR 1981). Major irrigated crops are cotton, alfalfa, pecans, vegetables, and grain. The Bureau of Reclamation's Middle Rio Grande Project was approved in 1950s and involved rehabilitation of an existing regional irrigation system, the Middle Rio Grande Conservancy District. Reclamation channelized the Rio Grande in this river section creating a number of environmental problems. Approximately 400 $km^2$ are irrigated by the project. Alfalfa, barley, wheat, oats, corn, fruits, and vegetables are the principal crops grown (USBR 1981). Still farther upstream, in the San Luis Valley, agriculture and irrigation developed prior to federal involvement (USBR 1981). The Closed Basin Project there was completed in the 1970s to provide agriculture with extra supplies not subject to the compact. The fourth Bureau of Reclamation project is the San Juan–Chama built in the 1970s to move Colorado River water into the Rio Grande, thereby providing an additional 0.1 $km^3$ per year for the Rio Grande. This project provides municipal supplies for Albuquerque and Santa Fe, irrigation supplies for the Middle Rio Grande Conservancy District, and is also used for a federal reserved rights settlement with the Jicaralla Apache Tribe. In recent drought years, this water has been critical for environmental, municipal and irrigation interests. This water, however, is subject to New Mexico's Colorado River Compact allocation and could be curtailed by drought and climate change.

The river has been heavily modified by human activities, including changes in sediment loading and capture, changes in the seasonal hydrograph, increases in salinity, channelization, and on-stream reservoir construction (Llewellyn et al 2013). In 1994, the Rio Grande Silvery minnow was listed as federally endangered. The fish was found only in the reach between Cochiti and Elephant Butte dams, 5% of its historic range from the mountains to the ocean. Severe habitat loss, channelization, blockage of fish movement, too much and too little sediment, and increased salinity have all contributed (Cowley et al. 2006). A severe drought began in 1996 and that same year the diversion of the entire river brought about a large minnow kill. The Bureau of Reclamation began using stored water from up its San Juan–Chama (SJC) Project near the headwaters of the river against the protests of the SJC contractors to benefit the minnow. Beginning in 1999, a number of complicated legal disputes ensued over a proposed recovery plan, critical habitat designation, biological opinions, and the legality of the using SJC water for the minnow (Katz 2007, Kelly and McKean 2011, DuMars 2012). Proposed solutions for minnow recovery include removal of Cochiti Dam, thus providing a riverine environment that never historically dried, more water in the river, sediment control in river uplands, "naturalize" irrigation drains to mimic habitat, set levees further back to allow ecosystem services to occur, and enactment of strict water conservation (Cowley 2006).

Thus, the Rio Grande is another western basin that is using its water to the maximum, and even more so than in the Colorado, current projections of climate change suggest that the flows that are currently being disputed and wrangled in the Rio Grande are likely to be less and less available for any use as the century wears on. On the whole, the Rio Grande is facing the largest climate-change water-supply deficits (relative to historical record) among the four basins considered here.

### *The Klamath*

The Klamath River is volumetrically the third largest river on the West Coast, with approximately 480 $m^3/s$ in average discharge. The basin is smaller than the others considered here, with the river traveling about 425 km from headwaters in southern Oregon to discharge in the Pacific Ocean in California. The Klamath is an "upside down" basin: it is relatively flat in its headwaters (the Upper Basin) and its 300-km lower canyon is relatively steep and narrow (the Lower Basin). Above its discharge point, the Klamath is joined by the Trinity River in

PLATE 1. Climate change is projected to exacerbate extreme climatic events, like drought and its impacts on western water supplies. This photo shows Lake Mead and Boulder Dam, on the Colorado River (USA) in February 2015, with a stark white "bathtub ring" of dry slopes exposed below normal water levels as a result of current drought conditions over much of the Southwest United States. Photo credit: Kelly Redmond.

California. Also unusual is that the Upper Basin generates a relatively small fraction of the total flow (12%) while lower tributaries, the Salmon, Shasta, Scott, and Trinity, generate the remainder (Powers et al. 2005). The Bureau of Reclamation's Klamath Project in the Upper Basin was authorized in 1905 and water deliveries from it began in 1907 (USBR 1981, Powers 1999). The Project includes seven dams and four major natural but enlarged lakes, and many irrigation canals and pumping facilities. Upper Basin lakes are large (0.6 $km^3$) but are very shallow. These reservoirs provide negligible carry-over storage from year to year. Approximately 900 $km^2$ are irrigated in the Upper Basin producing wheat, malt barley, alfalfa, onions, and potatoes. Cattle are grazed on irrigated pasture. About 250 000 people inhabit the basin. Four private hydroelectric dams were installed in the early 20th century just below the Upper Basin. These dams block coho, chinook, and steelhead migrations into the Upper Basin, where the fish were historically present (Hamilton and Curtis 2005). The Federal Energy Regulatory Commission (FERC) license for the dams expired in 2004 and long-term relicensing has been delayed pending resolution of the basin's problems.

Under natural conditions, the Klamath River was the third most productive salmon river on the West Coast, after the Columbia and Sacramento Rivers. Barriers to fish passage, eutrophication, and warmer water temperatures now impact migrating salmon, especially during droughts. Irrigation along the upper Klamath, along with the almost-total diversion of the Trinity River, have reduced flows, impacting migrations of salmon in both spring (outward migrations) and fall (upstream migrations; Hamilton and Curtis 2005, National Research Council 2008). The Upper Basin contains six national wildlife refuges encompassing almost 800 $km^2$ of freshwater marsh, open water, croplands, meadows, and some old growth forest. Two of the refuges utilize Klamath Project water, thus competing with farmers. The refuges provide habitat for waterfowl, water birds, wintering bald eagles, and other animals. The Lost River and shortnose suckers that inhabit the upper basin were listed as endangered in 1988. Water quality conditions in the (Upper) Klamath Basin lakes have been a concern with respect to sucker mortality, with the lakes subject to warming and eutrophication with concomitant loss of dissolved oxygen (Kann and Welch 2005). Low levels of dissolved oxygen have been associated with fish mortality (Martin and Saiki 1999).

The lower Klamath River is affected by Reclamation's Shasta/Trinity River Division project, a very large transbasin diversion of up to 90% of the Trinity's flows into the Upper Sacramento River for use by the Bureau of Reclamation's Central Valley Project (McBain and Trush 1997). Low flow levels and high water temperatures in the Lower Basin are also of concern to salmon species (once present throughout the basin and now restricted to the Lower Basin), such that, in 1997, coho salmon were listed as threatened.

All told, the Klamath fisheries and flows have been much impacted by agricultural development and heavy management of its waters (including those of the Trinity), and the basin is well known as a setting for

some of the most contentious and near-violent confrontations between various water-use communities. In 2001, Reclamation issued a biological assessment of the endangered suckers. In response, biological opinions from the U.S. Fish and Wildlife Service (USFWS) for suckers and National Marine Fisheries Service (NMFS) for coho were released later that year. Both the USFWS and NMFS called for higher reservoir levels and higher mainstem flows to protect the fish. Also, in 2001, Reclamation announced that due to severe drought no water would be released to farms in order to minimize stress to the three fish species, the first time such a ruling had been made in the history of the project. Some water was ultimately released later in the year. The announcement was met with strong opposition by the community. In 2002 warm water temperatures and low flows led to a large Chinook salmon kill near the mouth of the Klamath (Levy 2003). In 2002, a National Research Council committee was convened to investigate the soundness of the governing biological opinions, and found that scientific support was lacking for requirements of higher water levels in Upper Klamath Lake and for higher minimum stream flows in the upper Klamath River proposed in the 2000 USFWS and NMFS biological opinions. The NRC Report was highly controversial (Cooperman and Markle 2003, Lewis 2003). The USFWS and NMFS subsequently released modified biological opinions in 2003, and over the next six years the NRC released two additional reports, one on the causes of the declines and strategies for recovery (National Research Council and Committee on Endangered and Threatened Fishes in the Klamath River Basin 2004), and one on hydrology, ecology, and fishes (National Research Council 2008). The USFWS and NMFS subsequently released revised opinions in 2008 and 2013, respectively. In 2011, some Klamath Basin tribes (including Klamath, Modoc, and Yahooskin tribes) finally received a quantified water right by Oregon, although not all have been federally recognized. Tribal interests are not always aligned, with lower basin tribes having different viewpoints than upper basin interests.

In 2010, 45 separate federal, state, and local entities signed to two agreements for resolution of at least some of the problems facing the basin. The Klamath Basin Restoration Agreement (KBRA) attempts to restore native fish production, establish water and power supplies to support agriculture, communities, and the refuges, and contribute to the public welfare and sustainability for all Klamath Basin communities (Stern et al. 2013). The price tag for the KBRA has been estimated at US$1 billion. The Klamath Hydroelectric Settlement Agreement (KHSA) provides for the removal of the four private hydroelectric dams, primarily to improve fish habitat. It mandates a number of studies pertaining to dam removal feasibility and impacts (some of which have been concluded), limits costs to some participants, and contains a number of implementation details including a removal schedule. The KRBA and the KHSA are cross linked, each requiring Congressional approval of the other settlement (Stern et al. 2013). The agreements failed to pass Congress in 2014 and are set to expire in 2015 if no action is taken. Some parties, notably some of the Lower Basin Tribes, some environmental groups, and some local governments, actively oppose the agreements. The tribes oppose the agreements because they do not include the Trinity River, the environmental groups believe not enough water for environmental flows will be present during drought years, and local governments oppose the dam removal.

The Trinity now has its own restoration project that has increased Trinity flows and reduced the out-of-basin diversions to the Central Valley Project, with the Bureau of Reclamation electing to use some of this water to provide additional fish flows in the Lower Klamath rather than divert the water into the Sacramento basin. This action has been opposed in federal court by irrigators in California's Central Valley, who otherwise would benefit from this water.

The Klamath basin has a small enough area and population so that, in principle, a basin-wide perspective for solutions to these many challenges is still possible, especially if discussions are expanded to include interests on the Trinity River. The basin is far enough north so that the majority of climate models project gradual increases in precipitation this century (Cayan et al. 2013, Polade et al. 2014), which, combined with rising temperatures and evaporative demand, may yield modest flow declines overall (but significant declines in summer streamflow; Fig. 2; Cayan et al. 2013). The declining flows (from climate change and increased irrigation demands) coupled with warmer air temperatures threaten the basin most directly through rising water temperatures and further water quality declines, that may place many of the agricultural and ecological interests in this contentious basin at risk in coming decades.

### *The Sacramento–San Joaquin Bay Delta*

The stabilization of the Sacramento–San Joaquin Bay-Delta is the most critical single water problem in California and arguably the most pressing water issue in the United States. The Bay-Delta is the largest estuary on the West Coast and is central to California's trillion-dollar water economy and many of its ecosystems. The 163 000-km$^2$ watershed that feeds freshwater to the Bay-Delta is bounded by the Sierra Nevada, southernmost Cascade Mountains, and California's Coastal Ranges, providing freshwater flows of the Sacramento and San Joaquin Rivers that merge in the Bay-Delta (California Department of Water Resources 1993). An average of 40% of annual runoff to the river network is produced from snowmelt (Knowles 2000) and flows into and through the Bay-Delta estuary. Pacific Ocean tides propagate through the Golden Gate to the Delta, and

the extent of salinity intrusion into northern San Francisco Bay is determined by the highly variable standoff between sea-level height and river inflows. The Delta's contributing hydrology has followed the climate-driven trends already observed across the western United States and attributed to human-induced warming (Barnett et al. 2008), including trends of increasing winter and spring air temperatures and lengthened growing seasons (Cayan et al. 2001), declining contributions of snow to annual precipitation (Knowles et al. 2006), and hastening of spring snowmelt by 5 to 30 days (Stewart et al. 2005). Mean sea level at the entrance to San Francisco Bay has increased ~2.2 cm per decade since the 1930s, and the frequency of extreme tides has increased 20-fold since 1915 (Cayan et al. 2008).

The Delta itself encompasses 3000 $km^2$ of tidal to freshwater wetlands, agricultural lands, and river/estuarine channels at the confluence of the Sacramento and San Joaquin rivers. The Bay-Delta is a critical element in the state-scale water-conveyance systems that contribute drinking water supplies for two-thirds of the state's population (22 million people) and irrigation supplies for at least US$27 billion in agricultural production (45% of the nation's produce), and are thus a primary water source for California's trillion-dollar economy (Healey et al. 2008). About 6 $km^3$ of freshwater are pumped from the Delta by the federal Central Valley Project and the State Water Project each year to supply municipal and agricultural water demands in southern and central California (Healey et al. 2008). Salinities fluctuate seasonally and from year to year within both the Bay and Delta (Peterson et al. 1996). These salinity variations are managed by upstream reservoir releases with the dual purposes of preserving uncontaminated freshwater supplies and ensuring healthy ecosystems in and around the estuary, ecosystems that historically have supported at least 750 known plant and animal species (Healey et al. 2008).

Mount et al. (2006) have identified five primary drivers of future risk and adverse change in the Delta: land subsidence, invasive species, population growth and urbanization, seismicity, and climate change with sea-level rise. Both the ecosystems and the freshwater supplies associated with the Delta are in jeopardy. Freshwater diversions have altered the water balance and water quality of the estuary in ways that threaten the ecosystems. In 1993, two fish species in the Delta were listed under the Endangered Species Act (ESA). Within the Delta, approximately 60 islands sit below or near sea level, protected by >1800 km of aging levees. The levees continually risk failure due to combined pressures from sea-level rise, island subsidence, freshwater flooding, poor levee maintenance, and earthquakes (Mount and Twiss 2005). Major failure among the Delta levees could draw a massive influx of sea water from the San Francisco Bay into the freshwater parts of the Delta, which could render it unusable as a central link in the State's major freshwater-conveyance systems. Disruption of these conveyances could cost upward of US$30 billion and require many years to fix (Benjamin and Assoc. 2005). Both the State Water Project and the federal Central Valley Project are at risk (California Department of Water Resources 2009, Lund et al. 2010). Besides its vulnerable water infrastructure, the Delta is traversed by other key infrastructure including major north-south and east-west highways, electrical power lines, gas lines, and rail lines, all of which are threatened by flooding from the two rivers and by sea-level rise (Lund et al. 2010, Suddeth et al. 2010).

The listing of two fish species in 1993 under the ESA precipitated a crisis that led to the development of the CALFED Bay-Delta Program (Morandi 1998), which has recently been replaced by the Delta Stewardship Council. The express goal of these programs has been improving both ecological health and water management in the San Francisco Bay-Delta and its watershed. The program was envisioned as a multi-decade attempt through inter-agency coordination and decision-making to improve deteriorating ecosystems (Luoma et al. 2008), stressed water supply reliability, threatened water quality, and precarious levee systems in the Bay and Delta (National Research Council 2010). Over the last 15 years, federal, state, municipal, agricultural, and environmental interests have engaged in a variety of occasionally contentious and always complex and expensive initiatives in an attempt to create solutions acceptable to all parties (Isenberg et al. 2007, 2008, Owen 2007, National Research Council 2011). Hanneman and Dyckman (2009) have argued using game theory that, with current lines of authority, all participants have little incentive to agree as long as they can await a better solution; issues in the Colorado River basin, by contrast, have been more readily resolved because of the strong authorities that the Secretary of the Interior and Water Master wield. Nonetheless, this fall, the voters of California approved a massive US$7.5 billion bond issue to, once again, try to put many different water-supply systems around California on firmer footing, including crucial elements in the Delta.

Climate change threatens the Bay-Delta in many ways (Cloern et al. 2011), but California is an exceptionally well "plumbed" state (Lund 2006) and has an economy that can support as large an array of investments to address the problems in the Delta as any other system on earth (even if one current estimate indicates that an additional 7.4 $km^3$ of storage could be used; Lund et al. 2010). The large variety of canals, diversions, markets, and reservoirs (including groundwater reservoirs) presumably offer many opportunities for responding to and ultimately reducing many of those climate-change challenges. Indeed, Harou et al. (2010) have applied a hydroeconomic model of the state's water supply systems to conclude that even a multidecade-long "megadrought" could be weathered, albeit with high costs and many losers. Water temperatures in the Delta are expected to rise, causing difficulties for fisheries there

that are already in peril (Brown et al. 2013*a*). In this overall context, among the many climate-change challenges that the state faces, some of the most pressing for the Bay-Delta will be the combined influences of sea-level rise (Cayan et al. 2008) and projected increases in flood flows and frequencies (Das et al. 2013). California has somewhat more than one year's worth of reservoir storage space at its disposal to meet dry-year water demands, and only about one-third of that space is typically available for flood protection. Storage management is currently based on historical climate responses, but adaptive management would be a more effective alternative in the face of climate and demand changes (Georgakakos et al. 2012). As has been noted, floods and sea-level rise combine to threaten the aging levees at the heart of California's water system, and the consequences of widespread levee failures could be essentially crippling to the state's economy (e.g., Porter et al. 2011). The Delta is a localized and extreme weakness at the heart of California's water systems unlike any found in the other basins considered here, and unlike any others around the West. California is blessed with a forward looking population as regards climate-change matters and this will likely be a very important asset, perhaps the most important asset as it comes to terms with the challenges (not just floods and levees) to come.

## Conclusions

The western United States is a region that is defined by the water challenges that it faces and that it has accommodated throughout its history. Climate change adds to those historical challenges, but does not, for the most part, introduce entirely new challenges; rather it is likely to stress water supplies and resources that are already in many cases stretched to, or beyond, their limits. Current projections are for continued and, likely, increased warming trends across the region, with a strong potential for attendant increases in evaporative demands. Projections of future precipitation in the region are less conclusive, but it seems likely that the northernmost West will see precipitation increases while the southernmost West will see precipitation declines. However, most of the region lies in a broad area where some climate models project precipitation increases and others project precipitation declines, so that only increased precipitation uncertainties can be projected with any confidence. Even with the precipitation uncertainties, the net effect of the projections of evaporative changes and the precipitation changes is an expectation that, nearly everywhere, the amount of runoff and recharge yielded by each increment of precipitation will fall, with increased likelihoods and persistence of droughts becoming the new norm. Changes in the annual hydrograph are likely to challenge water managers, users and attempts to protect or restore environmental flows, even with similar annual volumes. Other kinds of impacts from climate change (e.g., floods and water quality changes) are poorly understood and will likely be very location dependent.

In this context, the four iconic river basins surveyed here offer a glimpse into specific challenges that climate change may bring to the West. At risk of oversimplifying, the Colorado River is a system in which overuse and the growth of demands is projected (by the U.S. Bureau of Reclamation) to be even more challenging than climate-change induced flow reductions. With or without large climate-change flow reductions, in the next few decades, the region faces the prospect of reservoir drying with water and power supplies for 40 million people placed at risk. The Rio Grande offers the best example of how climate-change induced flow declines might sink an admittedly smaller, multistate, water system into permanent drought. The Klamath may be in best shape, if current precipitation-change projections hold, in terms of volumes of runoff, but the fisheries (and by extension, irrigation management) may be placed into dire straits by warming temperatures, rising irrigation demands, and especially warming waters in a basin that is hobbled by the tensions between endangered fisheries and agricultural demands. Unlike the other basins, some promising initial solutions are at hand, albeit with a very large price tag. Finally, the Bay-Delta system is the remarkably localized and severe weakness at the heart of California's trillion dollar economy. It is threatened by the full range of potential climate-change impacts seen elsewhere in the West, along with unique and major vulnerabilities to increased flooding and rising sea levels.

All told, western water and projected climate change is a precarious mix. Nineteenth-century water law, twentieth-century infrastructure, and twenty-first-century population growth and climate change are on a collision course throughout the West. The sooner and more comprehensively we can address the historical water difficulties that define the region, the more likely we will be able to meet and accommodate the new challenges that climate change will bring.

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# RECLAMATION
*Managing Water in the West*

# West-Wide Climate Risk Assessment: Upper Rio Grande Impact Assessment

**U.S. Department of the Interior**
**Bureau of Reclamation**
**Upper Colorado Region**
**Albuquerque Area Office**

**December 2013**

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8 June 2016

Ms. Rhea Graham
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***RE: Draft EIS for the Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project, New Mexico and Texas; NMDGF No. 16999***

Dear Ms. Graham:

The New Mexico Department of Game and Fish (Department) has reviewed the *Draft Environmental Impact Statement for the Continued Implementation of the 2008 Operating Agreement for the Rio Grande Project, New Mexico and Texas*. The study area includes habitat for special status species including the Southwestern willow flycatcher (*Empidonax traillii extimus*), yellow-billed cuckoo (*Coccyzus americanus occidentalis*), Rio Grande silvery minnow (*Hybognathus amarus*), and numerous other wildlife species. The Department provides the following recommendations to enhance the quality of and minimize impacts to wildlife habitat within the study area. The Department recognizes that implementation of the following measures are contingent upon water availability, but recommends that these management practices be implemented whenever yearly or seasonal conditions allow.

➢ **Management recommendations for the deltas forming above and within the maximum pools of Elephant Butte Reservoir and Caballo Reservoir:**

1

- Modify reservoir storage rules to better mimic the natural flow regime: higher water in late spring and lower water in summer and fall. Declining water levels during the seed dispersal period (spring and early summer) would increase recruitment of cottonwood, Goodding's willow, and coyote willow on exposed sediments.
- Promote and maintain a diverse mosaic of riparian vegetation, especially early-mid successional cottonwood-willow communities. Over time, periodic high reservoir stages may be necessary to remove (kill) mature upland vegetation and allow recruitment of young riparian vegetation. Conditions for young vegetation may be most favorable within the lower portions of the deltas where reservoir inundation is most frequent and extreme. Conversely, conditions for mature riparian vegetation may be most favorable within the upper portions of the deltas above the normal reservoir boundary.

2

- Periodically inundate the deltas for short durations during the growing season to deposit new sediments, flush accumulated salts, irrigate the site, introduce nutrients, and halt conversion to upland vegetation communities.
- 3 Consider planting and/or seeding cottonwoods and willows on bare delta sediments, especially where exotic vegetation has been removed and immediately following reservoir drawdown.
- 4 Control noxious weeds, but avoid complete removal of live tamarisk, which may continue to provide habitat for special status species.
- 5 Continue to apply the recovery actions identified in the Southwestern willow flycatcher and Rio Grande silvery minnow recovery plans to the Delta Channel Maintenance Project.
- In the Elephant Butte delta, maintain riverine and shallow floodplain habitat suitable for the Rio Grande silvery minnow (especially during the spawning period), particularly in the upper portion of the delta that connects to critical habitat for this species.

➢ **Management recommendations for the reach between Elephant Butte Reservoir and Caballo Reservoir:**

- 6 Maintain flows that help sustain native riparian vegetation along and within the channel.
- 7 Continue to maintain the no-mow zones and selective treatment of noxious weeds (excluding tamarisk) to allow development of native riparian vegetation.

➢ **Management recommendations for the reach downstream of Caballo Reservoir:**

- When possible, maintain flows that sustain native riparian vegetation along and within the channel.
- Retain established no-mow zones that promote native riparian vegetation.
- 8 Incorporate the proposed additional 350 acres into the no-mow zones.

Thank you for the opportunity to review and comment on the Draft EIS. If you have any questions, please contact Malia Volke, Aquatic/Riparian Habitat Specialist, at (505) 476-8160 or malia.volke@state.nm.us.

Sincerely,

Matt Wunder, Ph.D.
Chief, Ecological and Environmental Planning Division

MW/mv
cc: USFWS NMES Field Office