BUREAU OF RECLAMATION

Calendar Year 2023 Report to the Rio Grande Compact Commission

Interior Region 7: Upper Colorado Basin

U.S. Department of the Interior

March 2024

Mission Statements

The U.S. 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, Native Hawaiians, and affiliated 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.

Calendar Year 2023 Report to the Rio Grande Compact Commission

Interior Region 7: Upper Colorado Basin

prepared by Bureau of Reclamation, Albuquerque Area Office, Albuquerque, New Mexico

For the Rio Grande Compact Commission:

Colorado
Jason Ullmann

New Mexico
Mike Hamman

Texas
Robert Skov

Federal Chairman
Hal Simpson

Cover Photo: Grout Cap work at El Vado Reservoir (Reclamation, 2023)

Contents

Figures

Tables

Acronyms

AAO	Albuquerque Area Office
ABCWUA	Albuquerque Bernalillo County Water Utility Authority
ac-ft	acre-feet
AIS	Aquatic Invasive Species
ANWR	Alamosa National Wildlife Refuge
Article VII	Article VII of the Rio Grande Compact of 1938
ASG	Applied Science Grants
BdA	Bosque del Apache National Wildlife Refuge
BWHA	Blanca Wildlife Habitat Area
CADSWES	Center for Advanced Decision Support for Water and Environmental Systems
CBD	San Luis Valley Project-Closed Basin Division
cfs	cubic feet per second
Compact	Rio Grande Compact of 1938
CPUE	Catch-Per-Unit-Effort
cuckoo	Western Yellow-billed Cuckoo
CWMP	Cooperative Watershed Management Program
D.N.M.	District Court of New Mexico
DMI	Data Management Interface
DOI	U.S. Department of the Interior
EBID	Elephant Butte Irrigation District
EDW	Emergency Drought Water
EPCWID	El Paso County Water Improvement District No. 1
EPWSD	El Prado Water and Sanitation District
ESA	Endangered Species Act
ET	Evapotranspiration
flycatcher	Southwestern willow flycatcher
HCCRD	Hudspeth County Conservation and Reclamation District No. 1
HDB	Hydrologic Database
IBWC	International Boundary and Water Commission
JPL	NASA's Jet Propulsion Laboratory
jumping mouse	New Mexico Meadow Jumping Mouse
kWhr	kilowatt-hour
LFCC	Low Flow Conveyance Channel
MDWCA	Llano Quemado Mutual Domestic Water Consumer Association
MF-OWHM	MODFLOW One-Water Hydrologic Flow Model
MODFLOW	Modular Three-Dimensional Finite-Difference Groundwater Flow Model
MRG	Middle Rio Grande
MRG BO	2016 Middle Rio Grande Biological Opinion
MRGP	Middle Rio Grande Project
MRGCD	Middle Rio Grande Conservancy District
NASA	National Aeronautics and Space Administration
NCAR	National Center for Atmospheric Research
NMDGF	New Mexico Department of Game and Fish
NMISC	New Mexico Interstate Stream Commission
NMOSE	New Mexico Office of the State Engineer

NRCS.....Natural Resources Conservation Service
O&M.....operation and maintenance
P&P.....Prior and Paramount
P.L. .....Public Law
Reclamation .....Bureau of Reclamation
RGP .....Rio Grande Project
RGP BO.....2016 Rio Grande Project Biological Opinion
RGSM.....Rio Grande silvery minnow
RGTIHM.....Rio Grande Transboundary Integrated Hydrologic Model
Rio Chiquito .....Acequia Madre del Rio Chiquito/Acequia del Monte del Rio Chiquito
RM.....River Mile
RWS.....Regional Water System
S&T.....Science and Technology Program
SECURE.....Science and Engineering to Comprehensively Understand and Responsibly Enhance Water Act
SJCP.....San Juan-Chama Project
SWEP .....Small-Scale Water Efficiency Project
Title XVI.....Title XVI of P.L. 102-575, Water Reclamation and Reuse Program
TRGWM.....Transboundary Rio Grande Watershed Model
ToT .....Town of Taos
URGWOM.....Upper Rio Grande Water Operations Model
USACE.....U.S. Army Corps of Engineers
USFWS.....U.S. Fish and Wildlife Service
USGS.....U.S. Geological Survey
WaterSMART.....DOI's Sustain and Manage America's Resources for Tomorrow program
WCFSP.....Water Conservation Field Services Program
WEEG.....WaterSMART Water and Energy Efficiency Grant
WIIN .....Water Infrastructure Improvements for the Nation

Introduction

The Albuquerque Area Office (AAO) of the Bureau of Reclamation (Reclamation) is responsible for operation, maintenance, and oversight of four projects on the mainstem of the Rio Grande and its upper basin tributaries. These projects are the San Luis Valley Project, the San Juan-Chama Project (SJCP), the Middle Rio Grande Project (MRGP), and the Rio Grande Project (RGP).

The San Luis Valley Project consists of the Conejos Division, which includes Platoro Dam and Reservoir, supplies water for approximately 81,000 acres within the Conejos Water Conservancy District and the Closed Basin Division (CBD), a groundwater salvage project located near Alamosa, Colorado, which pumps water from the shallow, unconfined aquifer primarily to assist Colorado in meeting its commitment under the Rio Grande Compact (Compact) of 1938.

The SJCP consists of a system of diversion structures, tunnels, and channels for transbasin movement of water from the San Juan River Basin to the Rio Grande Basin as a component of the Colorado River Storage Project. The transbasin water stored in Heron Reservoir supplies water for municipal, domestic, industrial, recreation, fish and wildlife purposes, and supplemental water for irrigation. Another part of the SJCP is the Pojoaque Tributary Unit including Nambé Falls Dam. The Pojoaque Tributary Unit supplies water for approximately 2,800 irrigated acres in the Pojoaque Valley.

The MRGP consists of El Vado Dam and Reservoir, Angostura, Isleta, and San Acacia Diversion Dams, the Low Flow Conveyance Channel (LFCC), and over 1,000 miles of irrigation and drainage facilities in the Middle Rio Grande Valley. It supplies water to 50,000 – 70,000 acres of land within the Middle Rio Grande Conservancy District (MRGCD) which includes irrigated lands of the Six Middle Rio Grande Basin Pueblos (Pueblo de Cochiti, Santo Domingo Tribe, Pueblo of San Felipe, Pueblo of Santa Ana, Pueblo of Sandia, and Pueblo of Isleta). Additionally, it maintains valley drainage and provides flood protection to over one million people. The MRGP also includes the LFCC and 260 miles of the Rio Grande channel from Velarde, New Mexico south of Caballo Reservoir, where the natural hydrological effects of the river's flow create some of the highest sediment loads in the world requiring ongoing maintenance by Reclamation to maintain and ensure Reclamation's ability to deliver water to and through the Middle Rio Grande Valley directly supporting New Mexico's commitments under the Compact.

The RGP includes Elephant Butte and Caballo Reservoirs and Percha, Leasburg, and Mesilla Diversion Dams. It stretches from the lower Rio Grande Valley of southern New Mexico to Fort Quitman, located south of El Paso, Texas. The RGP provides an agricultural water supply for approximately 178,000 acres of land within the Elephant Butte Irrigation District (EBID) in New Mexico and the El Paso County Water Improvement District No. 1 (EPCWID) in Texas. Water is also supplied for diversion to the Republic of Mexico by the United States Section of the International Boundary and Water Commission (IBWC), according to the terms of the Convention of 1906 between the United States and Mexico. Drainage waters from the Project lands provide a supplemental supply for approximately 18,000 acres of land within the Hudspeth County Conservation and Reclamation District No. 1 (HCCRD) in Texas. Elephant Butte Dam also generates hydroelectric power that is marketed by the Western Area Power Administration.

San Luis Valley Project, Colorado

There are two divisions within the San Luis Valley Project (Figure 1), the Conejos Division and CBD.

The Conejos Division facilities include Platoro Dam and Reservoir, which is operated and maintained by the Conejos Water Conservancy District, and which regulate the water supply for up to 81,000 acres of irrigated land.

The CBD salvages shallow groundwater in San Luis Valley's Closed Basin. The salvaged water is delivered to the Rio Grande to help meet Colorado's water delivery requirements in accordance with the Compact and the Convention of 1906, a treaty with the Republic of Mexico. This project also conveys water to Alamosa National Wildlife Refuge (ANWR), Bureau of Land Management's Blanca Wildlife Habitat Area (BWHA), and San Luis Lake. Reclamation operates the project under the guidance of the San Luis Valley's CBD Operating Committee (Operating Committee).

Conejos Division

Platoro Operations

On January 1, 2023, Platoro Reservoir had a midnight water surface elevation of 9,971.44 ft and 13,923 acre-feet (ac-ft) in storage. Of note, Article VII[1] restrictions were in effect January 1 through April 14 and again September 7 through December 8. The December 31, 2023, reservoir storage volume was 33,182 ac-ft (10,003.06 ft). The minimum storage was on May 8, at 13,324 ac-ft (9,970.20 ft) and the maximum storage was on June 27, when the reservoir peaked at 52,164 ac-ft (10,026.03 ft). 2024 Platoro Reservoir Outlook

2024 Conejos Division Outlook

The April 2024 Natural Resources Conservation Service (NRCS) most probable forecast for Platoro Reservoir inflow is for 48,000 ac-ft (94 percent of median). For early 2024, Platoro is not under Article VII restrictions but could go back under restrictions in 2024 around June as irrigation season commences and releases are made for the RGP.

[1] See the Article VII section under Rio Grande Project

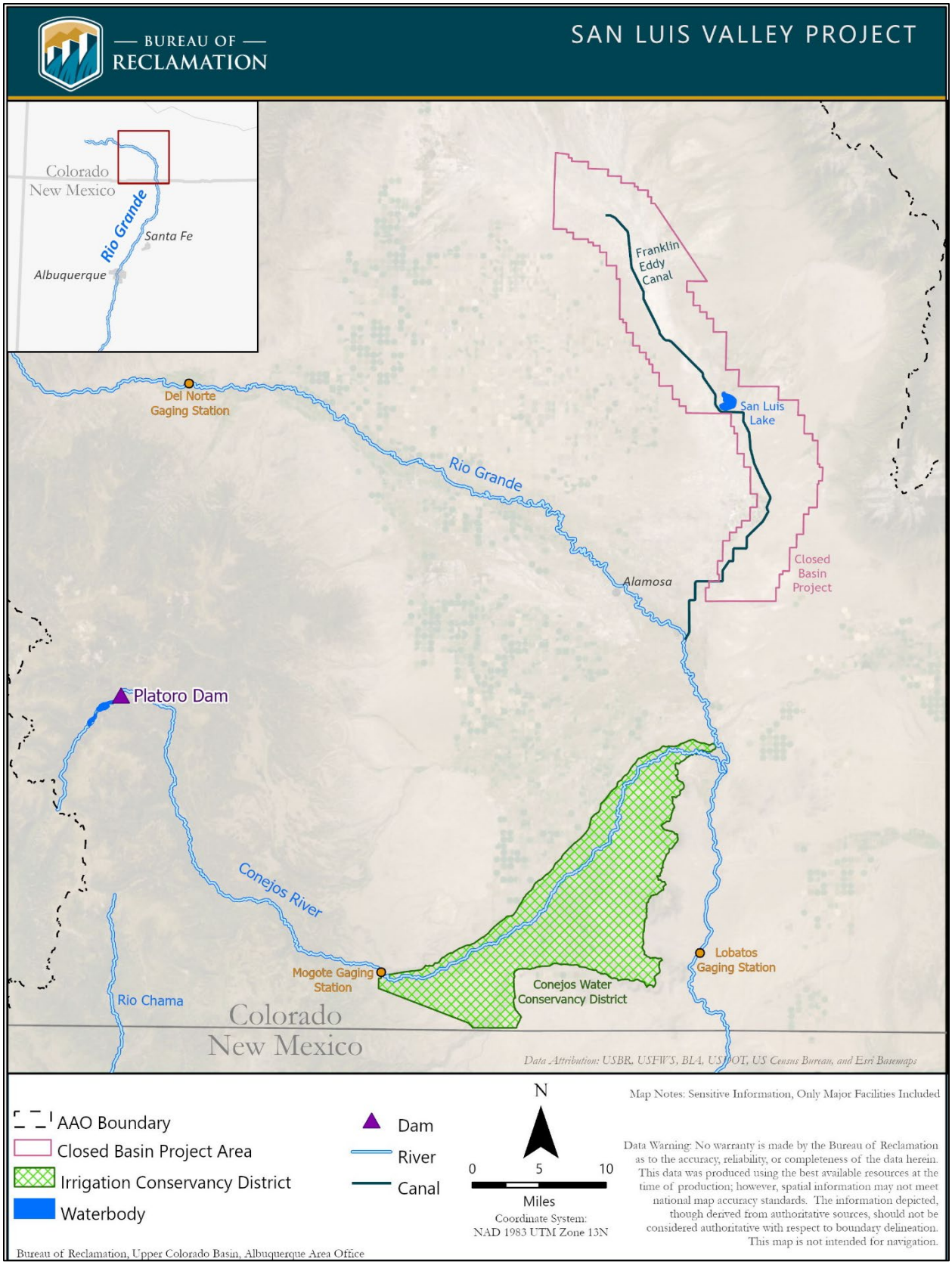


Figure 1: Map of the San Luis Valley Project, Colorado

Platoro Dam Facility Review and Safety of Dams Program

Platoro Dam and Dike has no significant dam safety-related operation and maintenance (O&M) issues**.** In June 2023, a solar photovoltaic power system was installed at Platoro Dam. The new solar power supply during grid power loss has been satisfactory. The Annual Site Inspections were completed in August 2023 and there were no new O&M recommendations. The Facility Reliability Rating was completed in September 2023 with Platoro Dam receiving a score of 88 which equates to an overall rating of "Good". Additionally, in September 2023, Reclamation conducted an Emergency Management Annual Orientation Seminar.

Closed Basin Division

Operations

The CBD continues to supply Compact and mitigation water deliveries. The San Luis Valley remains in a long-term drought. Since 2002, some areas of the water table in the unconfined aquifer have dropped significantly. CBD salvage wells are operated to minimize aquifer impacts outside of the project area. Salvage wells turned off at the recommendation of the Operating Committee remain off while nearby water levels are monitored.

Deliveries by the CBD included deliveries to the Rio Grande, BWHA, ANWR, and San Luis Lakes State Wildlife Area (SWA). In 2023, the CBD delivered 11,004 ac-ft. Of that, total creditable Compact water delivered to the Rio Grande was 7,602 ac-ft. This included 7,440 ac-ft delivered at the CBD canal outlet, plus a 148 ac-ft exchange with Bureau of Land Management (BLM) and a 14 ac-ft exchange with Colorado Parks and Wildlife delivered to the San Luis Lakes SWA. Delivery to the Rio Grande was reduced from October through December at the request of the Operating Committee. The ANWR was owed a total mitigation amount of 2,599 ac-ft. Of this total, 2,107 ac-ft was delivered to the ANWR, while 492 ac-ft was delivered to the BWHA through an exchange between U.S. Fish and Wildlife Service (FWS) and BLM. Table 1 reports total production and Compact deliveries in 2023 and the four preceding years. Table 2 shows total water accounting by delivery location and month.

Table 1: CBD Deliveries 2019-2023[2]

Year	Total CBD Production	Delivered at CBD Canal Outlet	Delivered by Exchange[3]	Total Creditable Delivery
2023	11,004	7,440	162	7,602
2022	11,673	8,110	166	8,276
2021	11,600	7,777	462	8,239
2020	9,911	6,188	310	6,498
2019	12,334	8,567	400	8,967

[2] Units are ac-ft

[3] CBD water delivered to BWHA or San Luis Lakes SWA in exchange for other water sources delivered upstream to the Rio Grande

Table 2: 2023 CBD Water Accounting[4]

	BWHA CH03 Sta. 730+00	BWHA CH04 Sta. 798+60	BWHA Total[5]	Parshall Flume Total Passing	Parshall Flume Creditable	ANWR CH01 Chicago Turnout	ANWR CH02 Mum Turnout	ANWR Pumping Plant	ANWR Total	Parshall Flume less ANWR	CBD Canal Creditable Delivery	Non-Creditable Delivery	Total CBD Production
Jan	0	0	0	976	976	0	0	0	0	976	976	0	976
Feb	9	0	9	861	861	0	0	0	0	861	861	0	870
Mar	152	190	342	664	664	299	303	0	602	62	62	0	1,006
Apr	0	0	0	910	910	48	44	0	92	818	818	0	910
May	0	0	0	930	930	0	0	0	0	930	930	0	930
Jun	125	139	264	630	630	0	0	0	0	630	630	0	894
Jul	173	173	346	524	524	0	0	0	0	524	524	0	870
Aug	150	162	312	605	605	225	211	0	436	169	169	0	917
Sep	98	72	170	787	787	259	238	0	497	290	290	0	957
Oct	0	0	0	996	996	246	234	0	480	516	516	0	996
Nov	0	0	0	867	867	0	0	0	0	867	867	0	867
Dec	0	0	0	797	797	0	0	0	0	797	797	0	797
Annual	707	736	1,443	9,547	9,547	1,077	1,030	0	2,107	7,440	7,440	0	10,990

Water Quality

The Compact specifies that creditable water delivered to the Rio Grande cannot exceed 350 parts per million total dissolved solids based on a 10-day average. Reclamation continues to monitor the water quality of CBD salvage wells, the Rio Grande, San Luis Lake, Head Lake, and the conveyance channel with 1,201 samples collected during 2023. All 2023 water deliveries met these water quality standards.

Maintenance

Routine preventive maintenance and repair activities continue at all observation and salvage wells, lateral line valves, canal structures, pumping plants, and canal and lateral access roads. In 2023, seven new pumps were installed, and 16 salvage wells were rehabilitated.

[4] Units are ac-ft

[5] Delivery to BWHA includes a 162 ac-ft exchange (48 ac-ft Treasure Pass, 100 ac-ft Don La Font, 14 ac-ft Colorado Parks and Wildlife) and 492 ac-ft mitigation water transfer from ANWR.

San Juan-Chama Project, Colorado – New Mexico

The SJCP diverts water at three diversion dams from the upper tributaries of the San Juan River in Colorado through the Azotea Tunnel to Heron Reservoir in New Mexico, ultimately for use in the Rio Grande Basin of New Mexico and provides water for municipal, domestic, and industrial use (Figure 2). In addition, supplemental irrigation water is provided to the Middle Rio Grande Conservancy District (MRGCD) and to the Pojoaque Valley Irrigation District (PVID) through depletion offsets. The Compact requires this transbasin water from the SJCP to be accounted for separately from native Rio Grande flow.

San Juan-Chama Project Accounting

Reclamation is responsible for water contracts and water accounting for the SJCP. SJCP accounting for 2023 is provided in the separate *2023 Water Accounting Report*. Reclamation continued to use Microsoft Excel to create the water accounting report by mining accounting data from Reclamation's hydrologic database (HDB), Reclamation's database of record. The data are computed and recorded in RiverWare and sent to HDB via a Data Management Interface (DMI).

Heron Dam and Reservoir Operations

Diversions into the Azotea Tunnel began on March 20 and continued until September 16 during 2023. The total volume diverted was 142,195 ac-ft, the 9th highest on record over the 54 years of diversions. The running 10-year average of Azotea Tunnel diversions increased slightly this year, from 81,211 ac-ft for the period 2013 through 2022, to 90,855 ac-ft for the period 2014 through 2023 (Table 3).

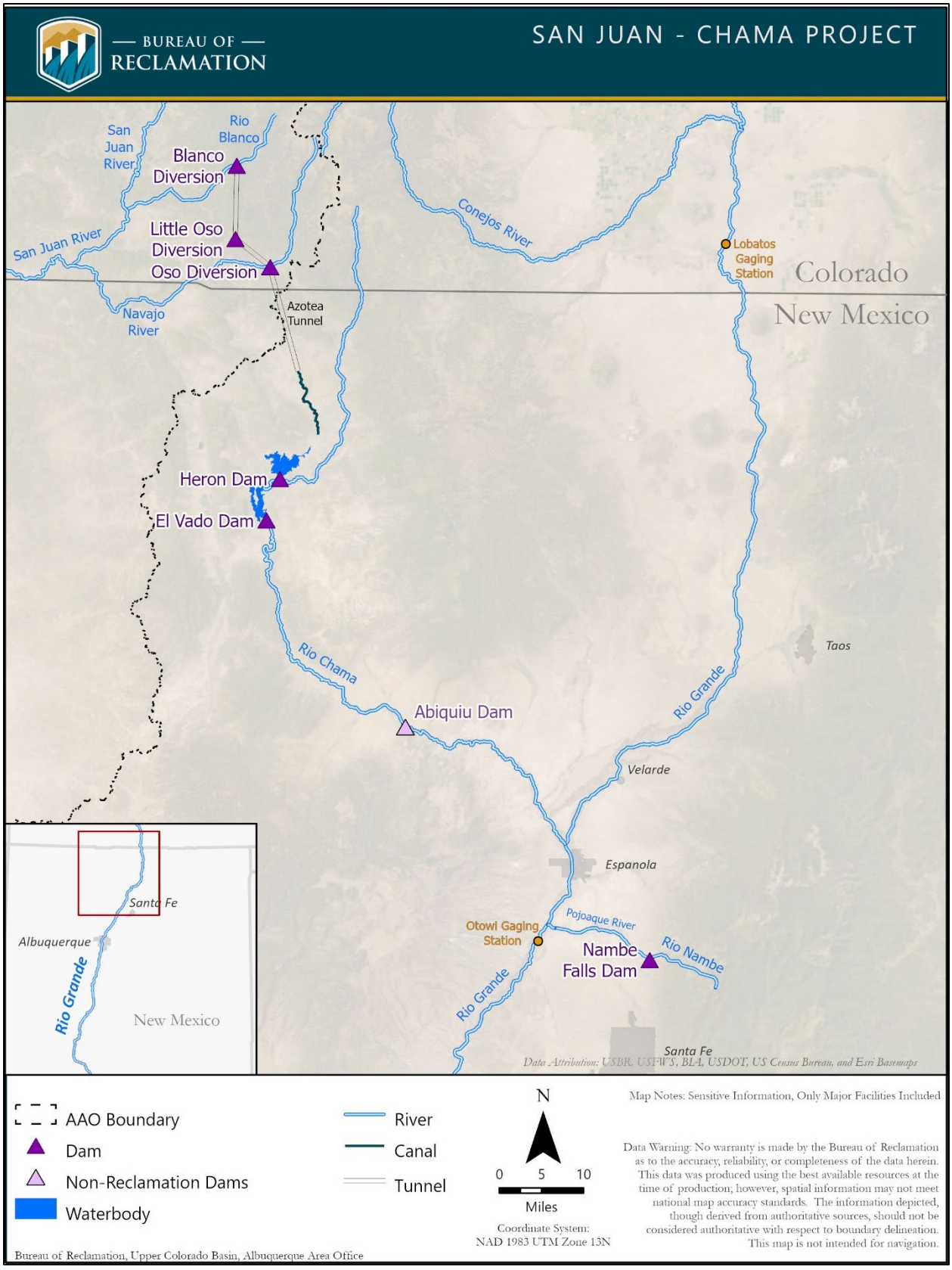


Figure 2: Area Map of the San Juan-Chama Project

Table 3: SJCP Diversions Through Azotea Tunnel 2014-2023[6]

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	10-Year Total
Jan	0	28	109	0	0	0	0	0	0	0	137
Feb	227	974	1,917	1,488	0	0	9	0	0	0	4,615
Mar	1,984	6,890	6,489	16,839	1,598	1,036	1,644	816	2,172	204	39,672
Apr	13,808	8,163	13,687	32,628	12,869	24,049	10,605	13,446	17,079	23,661	169,995
May	20,251	24,470	27,940	45,326	15,616	33,926	26,972	24,778	29,871	59,441	308,591
Jun	18,851	38,438	35,427	46,227	2,636	56,925	7,866	17,907	6,550	47,357	278,184
Jul	1,550	8,581	3,535	10,617	152	26,285	876	2,439	4,556	10,903	69,494
Aug	788	889	3,681	4,809	7	5,841	159	627	4,707	592	22,100
Sep	902	126	1,271	1,806	0	208	83	116	848	37	5,397
Oct	1,334	811	253	2,413	1,216	0	0	0	2,151	0	8,178
Nov	335	862	0	279	283	0	0	0	0	0	1,759
Dec	0	334	0	90	0	0	0	0	0	0	424
Annual	60,030	90,566	94,309	162,522	34,377	148,270	48,214	60,129	67,934	142,195	908,546

Heron Reservoir began the year at elevation 7,078.56 ft (41,195 ac-ft). The maximum elevation and storage were reached on July 15 at 7,136.96 ft (167,700 ac-ft). Heron Reservoir ended the year at elevation 7,114.02 ft (99,662 ac-ft). The low point of the year was 7,073.88 ft (36,247 ac-ft) on March 8.

There was insufficient storage in the project pool on January 1 to make an initial allocation to the SJCP contractors. The first allocation of 25,000 ac-ft was made in May, and subsequent allocations were made in June and July. A robust runoff season allowed for a full allocation of 96,200 ac-ft to be made in July.

The SJCP contractors' 2023 and waivered 2022 allocations were delivered as shown in Table 4, for a total delivery of 69,958 ac-ft. The remaining 2023 allocations are being held in Heron according to waivers, which grant an extension of the delivery date into 2024. It should be noted that some contractors lease their allocation to Reclamation which shows up as an internal transfer within Heron and not a release from the individual contractor's account. Table 5 presents actual monthly Heron water operations in 2023.

[6] Units in ac-ft

Table 4: 2023 SJCP Water Releases by Contractor from Heron Reservoir[7]

SJCP Contractor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
MRGCD	0	0	0	0	0	0	5,039	0	0	0	0	0	5,039
Santa Fe	2,407	1,363	0	0	0	0	0	0	0	0	0	0	3,770
Santa Fe County	0	0	0	0	0	0	0	0	0	0	0	375	375
Cochiti	0	0	0	0	0	0	0	0	1935	2355	0	0	4290
Albuquerque	0	703	476	0	0	0	5,791	25,273	0	0	7,540	1,568	41,351
Pojoaque Unit	0	0	0	0	0	0	0	0	0	669	361	0	1,030
Taos	0	0	0	0	0	0	0	0	0	0	0	0	0
Los Alamos County	0	0	0	0	0	0	0	0	0	0	482	718	1,200
Española	0	0	0	0	0	0	0	0	239	0	0	1,000	1,239
Taos Ski Valley	0	0	0	0	0	0	0	0	0	0	15	0	15
Los Lunas	0	0	0	0	0	0	0	0	100	0	22	0	122
Bernalillo	0	0	0	0	0	0	0	0	150	0	400	0	550
Belen	0	0	0	0	0	0	0	50	100	0	121	0	271
Red River	0	0	0	0	0	0	0	0	0	0	0	0	0
Jicarilla Apache	0	0	0	0	0	0	0	0	0	0	0	0	0
Ohkay Owingeh	0	0	0	0	0	0	0	0	0	0	0	0	0
Reclamation	0	0	0	0	0	0	0	0	0	0	0	0	0
El Prado	0	0	0	0	0	0	1,052	1,616	7,054	982	0	0	10,704
Taos Pueblo	0	0	0	0	0	0	0	0	0	0	0	0	0
Aamodt Settlement	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	2,407	2,066	476	0	0	0	11,883	26,939	9,578	4,006	8,942	3,661	69,958

[7] Units in ac-ft

Table 5: 2023 SJCP Monthly Water Operations at Heron Reservoir[8]

	Rio Grande Inflow	SJCP Inflow	Rio Grande Outflow	SJCP Outflow	SJCP Loss	Rio Grande Content	SJCP Content	Total Content
Dec 2022	-	-	-	-	-	350	40,845	41,195
Jan	359	0	359	2,407	0	356	38,432	38,788
Feb	204	0	204	2,066	0	356	36,366	36,722
Mar	6,327	204	4,116	476	0	2,567	36,094	38,661
Apr	4,732	23,614	5,192	0	0	2,107	59,708	61,815
May	60	59,322	60	0	1,003	2,107	118,027	120,134
Jun	2,347	47,263	705	0	4,232	3,749	161,058	164,807
Jul	1,963	10,881	5,098	11,883	3,591	613	156,466	157,079
Aug	453	592	244	26,939	1,471	822	128,648	129,470
Sep	74	37	251	9,578	1,200	645	117,906	118,551
Oct	73	0	73	4,006	1,255	645	112,645	113,290
Nov	67	0	67	8,942	764	645	102,939	103,584
Dec	66	0	66	3,661	261	645	99,017	99,662
Sub-Total	16,725	141,913	16,435	69,958	-	-	-	-
Adjustment[9]	-	-	-	-	-	-350	-	-
Annual	-	158,638	-	86,393	13,777	295	99,367	-

All daily operations decisions were made using provisional data available at the time of the decision. For that reason, reservoir data in the final accounting model, which uses Compact-approved data, may differ from reservoir data used to make daily operational decisions. Therefore, the dates mentioned above may differ slightly from those found using final 2023 data.

Pojoaque Tributary Unit- Nambé Falls Dam and Reservoir

Operations at Nambé Falls Reservoir consist of non-irrigation and irrigation season activities. During non-irrigation season (November – April), all inflow in excess of the bypass requirement of 0.5 cfs is typically stored until an elevation of 6,825.60 ft is reached. Once that elevation is attained, the outlet gates are regulated weekly to stabilize the reservoir at 6,825.60 ft, or the elevation at 100 percent ice cover. An uncontrolled spill begins at the top of the spillway crest (6,826.60 ft). During irrigation season (May – October), water is stored and released on demand to meet downstream requirements.

In 2023, Nambé Falls Reservoir began at an elevation of 6,825.30 ft (1,657.28 ac-ft). The reservoir filled on March 12 and remained full and spilling until late June. The maximum elevation was 6,826.98 ft (1,751 ac-ft) which occurred on April 12. A peak outflow of 77 cfs occurred on May 27.

[8] Units in ac-ft, Content is End of Month

[9] 350 ac-ft of native Rio Grande water is annually retained in Heron to cover water use by New Mexico State Parks' facilities under a water rights file No. 1545

The minimum elevation of 6,803.65 ft (729 ac-ft) was reached on August 24. The reservoir ended 2023 at elevation 6,817.74 ft (1,277 ac-ft).

The Nambé Falls depletion for the year was 474 ac-ft at Otowi (484 ac-ft from Heron). In addition, a deficit of 796 ac-ft has been carried over from previous years, bringing the total depletion to 1,270 ac-ft. A release of 1,030 ac-ft from Heron Reservoir was made in 2023. No additional water was available to be released in 2023 to cover the remaining deficit, therefore 240 ac-ft will need to be released in 2024 or in subsequent years, as supply is available.

Table 6 shows all SJCP water at Otowi, and includes a summary of Nambé Falls use above Otowi and the Pojoaque Unit return flow credit used to calculate depletions during 2023. A summary of 2023 Nambé Falls Reservoir operations is provided in Table 7.

Table 6: 2023 SJCP Water at Otowi[10]

	Release from Heron	Heron Release Stored in El Vado	Release from El Vado	Total Below El Vado	Release from or Storage in Abiquiu	Transit Losses	Nambé Falls Use Above Otowi	Return Flow Credit - Pojoaque Unit	SJCP Water at Otowi
Jan	2,407	0	166	2,573	2,212	71	55	99	4,758
Feb	2,066	0	40	2,106	298	45	39	58	2,378
Mar	476	0	55	531	6,437	69	117	18	6,801
Apr	0	0	562	562	1,363	23	42	19	1,878
May	0	0	0	0	0	0	39	20	-19
Jun	0	0	1,394	1,394	-1,379	15	25	16	-9
Jul	11,883	0	0	11,883	7,088	301	2	11	18,679
Aug	26,939	595	0	26,344	-6,967	464	110	68	18,872
Sep	9,578	100	0	9,478	-4,243	151	95	76	5,064
Oct	4,006	0	207	4,213	3,998	120	27	32	8,094
Nov	8,942	1,106	0	7,835	12,471	269	176	24	19,886
Dec	3,661	391	0	3,270	-2,621	43	211	23	547
Annual	69,958	2,192	2,424	70,189	18,657	1,571	938	464	86,929

[10] Units in ac-ft

Table 7: 2023 SJCP Monthly Water Operations at Nambé Falls Reservoir[1]

	Inflow	Outflow Bypassed	Outflow Storage Release Operational	Outflow Storage Release Irrigation	Reservoir Losses	Total Outflow + Losses	Content
Dec 2022	-	-	-	-	-	-	1,657
Jan	340	285	77	0	-1	361	1,636
Feb	325	287	37	0	0	324	1,638
Mar	875	755	0	17	6	777	1,736
Apr	2,562	2,511	0	20	27	2,558	1,740
May	3,872	3,829	0	26	13	3,868	1,744
Jun	2,418	2,386	0	30	21	2,437	1,725
Jul	653	631	0	512	21	1,164	1,214
Aug	282	162	0	485	10	657	839
Sep	228	129	0	50	5	184	882
Oct	223	192	0	4	10	205	900
Nov	241	64	0	1	6	71	1,069
Dec	262	53	0	0	3	54	1,277
Annual	12,281	11,283	114	1,145	121	12,660	

All daily operations decisions were made using provisional data available at the time of the decision. Because of that, reservoir data in the final accounting model, which uses Compact-approved data, may differ from reservoir data used to make daily operational decisions. Therefore, the dates mentioned above may differ from those found using final 2023 data.

2024 San Juan-Chama Project Outlook

On January 1, 2024, the allocable SJCP water in Heron Reservoir was 30,000 ac-ft and the contractors were notified of this initial allocation. Allocations must leave sufficient water in SJCP storage to cover both the dead pool and anticipated reservoir evaporation from January 1 until runoff begins in the spring. Water scarcity was contemplated in the San Juan-Chama Project Authorization (P.L. 87-483), and all SJCP water contracts state that "when the actual available water supply may be less than the estimated firm yield, [Contractors] shall share in the available water supply in the ratio that the above allocation bears to the firm yield." Subsequent allocations are made monthly beginning in April, although there was insufficient water to make an April allocation in 2024. Allocations continue monthly until December, unless a full allocation is made earlier. The April NRCS' most probable forecast for the Rio Blanco and the Navajo River at the diversions are for 42,000 and 48,000 ac-ft (88 percent and 86 percent of median), respectively, and Reclamation anticipates that this is likely to result in a full allocation or a minor shortage.

[1] Units are in ac-ft, Content for End of Month

Facility Review and Safety of Dams Program

Nambé Falls Dam

The Annual Site Inspection for Nambé Falls Dam was completed in May 2023. The inspection resulted in two Category 2 and one Category 3 O&M recommendations. Additionally, there is one incomplete Safety of Dams recommendation and three incomplete Category 2 O&M recommendations, and nine incomplete Category 2 emergency management recommendations for Nambé Falls Dam from previous inspections.

Reclamation continues to gather data to address the Safety of Dams recommendation including a probabilistic seismic hazard assessment estimated to be completed in 2024 and work continues for the other O&M recommendations. The Nambé Falls Dam Facility Reliability Rating was completed in September 2023 with the dam receiving a score of 88 which equates to an overall rating of "Good."

A bathymetric survey was completed in July 2023 and new capacity tables were generated in December 2023. The new capacity tables were implemented starting January 1, 2024. In August 2023, after various meeting and data reviews, a new automated weather station was installed at the previous location.

Heron Dam

There are no significant dam safety related O&M issues associated with Heron Dam and Dike. The Annual Site Inspection was completed in July 2023. The inspection resulted in two Category 2 O&M recommendations. The Facility Reliability Rating was completed in September 2023 with Heron Dam receiving a score of 88, which equates to an overall rating of "Good."

Middle Rio Grande Project, New Mexico

The MRGP consists of El Vado Dam and Reservoir, three low-hazard diversion dams (Angostura, Isleta, and San Acacia), over 1,000 miles of canals, laterals, and drains, 260 miles of the Rio Grande channel, 57 miles of LFCC, and Reclamation's River Maintenance program from Velarde, NM to Caballo Reservoir (Figure 3). The MRGP delivers water for irrigation, maintains valley drainage, and provides flood protection. The MRGCD has O&M responsibility for the entire project between the outlet works at Cochiti Dam to the southern extent of the MRGCD's benefitted area, Bosque del Apache Wildlife Refuge (BdA), including all conveyance features, the LFCC within the MRGCD boundaries, and the three diversion dams. Reclamation owns and administers the storage permit, lands, and rights-of-way activities of El Vado area. Upon completion of title transfer in 2021, MRGCD assumed ownership of the MRGP lands and facilities south of Isleta Pueblo except for the LFCC.

El Vado Dam and Reservoir Operations

El Vado Reservoir began 2023 at an elevation of 6,785.96 ft (2,266 ac-ft) and ended the year at 6,785.07 ft (1,937 ac-ft). The maximum elevation was on May 8 at 6,802.68 ft (11,080 ac-ft). The low point of the year occurred on April 15 with an elevation of 6,781.23 ft (920 ac-ft). All storage at the end of the year was Albuquerque's SJCP water. Table 8 provides a summary of monthly operations and water accounting for El Vado Reservoir.

Due to elevation and storage restrictions for El Vado Dam during construction[1], Reclamation operated the reservoir targeting storage elevations of 6,785 ft +/- 1.5 ft (1,420 ac-ft to 2,476 ac-ft) starting after runoff in 2022 through the start of 2023. El Vado was not used for storing water for Prior and Paramount (P&P) lands of the Six Middle Rio Grande Pueblos, but this water was retained in Abiquiu Reservoir until released for delivery before the end of the year. Since Article VII[2] Compact restrictions on storage of native water were in effect at the beginning of the year until April 15, El Vado started 2023 with no native Rio Grande water and only MRGCD's SJCP water in storage.

The high runoff in 2023 brought a large amount of debris into the reservoir, clogging or reducing flow through the outlet works numerous times. During the runoff period, defined as April 1 to May 15, and during construction, the reservoir elevation may rise to 6,800 ft (9,405 ac-ft). Inflow exceeded 2,000 cfs from late April to early June and the debris clogging made it difficult to release excess water to remain below 6,800 ft. Elevation exceeded that construction limit for 10 days in mid-May and fell below the limit on May 19.

[1] See El Vado Dam Construction Section below
[2] See Article VII Section under Rio Grande Project

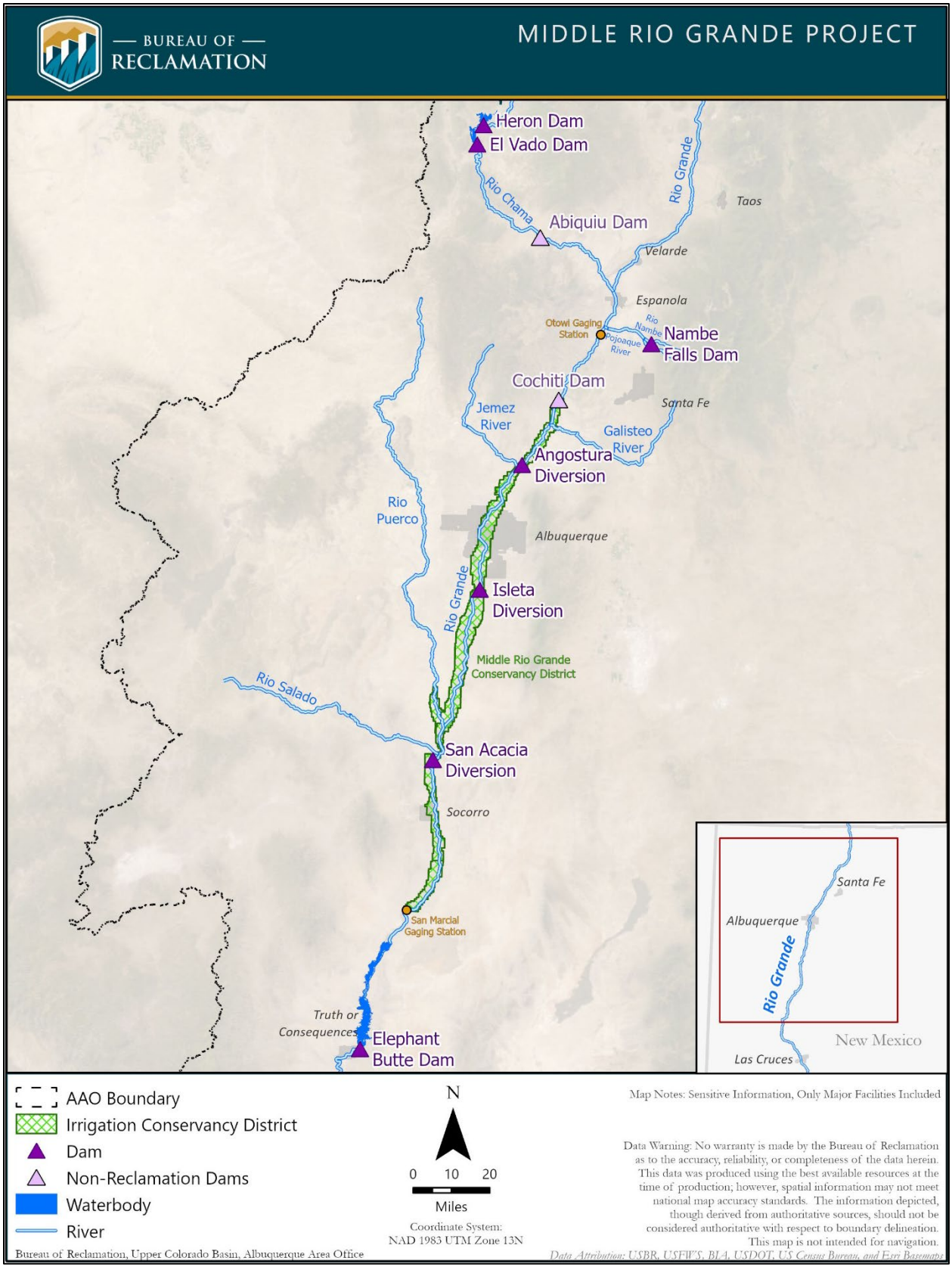


Figure 3: Map of Middle Rio Grande Project

Because of the difficulty changing gate settings, a continuous release from Heron was made to allow a steady release of 500 cfs from El Vado for most of the season after runoff. The steady release provided continuos flows at levels high enough for rafting while also moving waivered SJCP water out of Heron Reservoir, passing through El Vado, and downstream for storage in Abiquiu Reservoir.

MRGCD started 2023 with 2,277 ac-ft of SJCP water in storage in El Vado Reservoir. Reclamation did not store any native water for MRGCD during the year due to the reservoir restriction[1]. MRGCD operated using natural flow of the Rio Chama and Rio Grande and their 2023 SJCP allocation as well as a small amount of SJCP from previous years and from depletions offsets.

Table 8: 2023 Reservoir Operations for El Vado Dam[2]

	Rio Grande Inflow	SJCP Inflow	Rio Grande Outflow	SJCP Outflow	Rio Grande Losses	SJCP Losses	Rio Grande Content	SJCP Content	Total Content
Dec 2022	3,920	2,433	5,046	1,413	10	1	-15	2,277	2,262
Jan	3,757	2407	3674	2,573	0	0	68	2,111	2,179
Feb	3,151	2066	3503	2,106	0	0	-284	2,071	1,787
Mar	12,341	476	12,024	531	92	-10	-60	2,026	1,966
Apr	61,052	0	58,230	562	-135	45	2,897	1419	4,316
May	194,638	0	192,694	0	88	10	4,752	1408	6,161
Jun	48,378	0	51,265	1,394	-176	14	2042	0	2,042
Jul	11,072	11,883	11,968	11,883	-359	0	1,505	0	1,505
Aug	4,234	26,939	4,261	26,344	-204	6	1,681	589	2,270
Sep	3,220	9,578	3,386	9,478	-71	13	1,586	676	2,262
Oct	2,291	4,006	2,359	4,213	-62	11	1,580	458	2,038
Nov	2,621	8,942	4,112	8,402	7	-459	82	1,457	1,539
Dec	2,886	3,661	2,927	4,904	41	-1723	0	1,937	1,937
Annual	349,641	69,958	350,403	72,390	-779	-2093	-	-	-

All daily operations decisions were made using provisional data available at the time of the decision. For that reason, reservoir data in the final accounting model, which uses Compact-approved data, may differ from reservoir data used to make daily operational decisions. Therefore, the information mentioned above may differ from those found using final 2023 data.

Prior and Paramount Operations

Reclamation typically retains native water in El Vado Reservoir for use on the P&P acreage of the six MRG Pueblos when natural Rio Grande flows may not meet irrigation demand. Because of storage limitations at El Vado during construction, U.S. Army Corps of Engineers (USACE) issued a deviation beginning in 2022 to allow storage of native water in Abiquiu. The Bureau of Indian Affairs' call for P&P in 2023 was 14,500 ac-ft. Retention of native water for P&P started in January at Abiquiu and the full volume was retained on May 4 when Article VII restrictions were in effect. There was no call for release of P&P water in the irrigation season indicating the irrigation demand

[1] See El Vado Dam Construction Section below
[2] Units in ac-ft; Content for End of Month

from the P&P lands was met with available natural flows. Evaporation losses were 1,108 ac-ft. A volume of 13,434 ac-ft was released to Elephant Butte Reservoir from November 1-15.

Emergency Drought Water

Under Article VII of the Compact, when New Mexico relinquishes Accrued Credit Water to Texas and Texas accepts that relinquishment, New Mexico may store a like amount in upstream post-Compact reservoirs when Article VII[1] storage restrictions are in effect. New Mexico allocates this water through a series of Emergency Drought Water (EDW) agreements with Reclamation, MRGCD, and others. Under a 2016 multi-party EDW Agreement, MRGCD agreed to jointly manage Reclamation's EDW allocation for the sole purpose of Endangered Species Act (ESA) compliance.

The following EDW amounts remain available to the MRGP for capture and storage at El Vado in the future: 19,000 ac-ft for Reclamation and 53,767 ac-ft for MRGCD. In 2016, the United States assigned 5,000 ac-ft of Reclamation's remaining allocated EDW to the Albuquerque Bernalillo County Water Utility Authority (ABCWUA) as repayment for water released during the early 2000s pursuant to the Supplemental Order in litigation entitled "Rio Grande Silvery Minnow v. United States."

No EDW was stored in El Vado during 2023.

Compact Debit Water

Under Article VI of the Compact, native water in El Vado Reservoir for the MRGP may be retained to the extent of the New Mexico's accrued debit. As noted above, there was no native water in storage at El Vado at the beginning of the year and Article VII restrictions on native storage were in place. On April 15, Article VII restrictions were lifted, and on June 1 a total of 2,500 ac-ft of native Rio Grande storage was retained as Compact Debit. An additional 45 ac-ft was retained on June 13 for a total of 2,545 ac-ft for the year. On August 14, 357 ac-ft were transferred to general Rio Grande storage to balance the reservoir accounts. Evaporation losses were 692 ac-ft, and the remaining 1,496 ac-ft of Compact Debit storage was released between November 1-15.

2024 Middle Rio Grande Project Outlook

The April 2024 NRCS March to July runoff forecast for the Rio Grande at Otowi is 400,000 ac-ft (71 percent of median) and El Vado Reservoir inflow of 150,000 ac-ft (81 percent of median). This is much lower than 2023, when observed March to July volume at Otowi, excluding SJCP flows and adjusted for upstream storage, was 972,200 ac-ft (171 percent of median) and El Vado's March to July inflow was 328,600 ac-ft (177 percent of median). MRGCD irrigation demand should be met through June from natural flows and their SJCP allocation. After that, their supply will be variable and dependent on rain from the monsoon season.

[1] See the Article VII section under Rio Grande Project

El Vado Dam Facility Review and Safety of Dams Program

The El Vado Dam Facility Reliability Rating was completed in September 2023 with the dam receiving a score of 56 resulting in an overall rating of "Poor". The "Poor" rating is due, in part, to one incomplete Safety of Dams recommendation which results in a 2023 Dam Safety Priority Rating of 2, denoting an "Urgent Priority." There are also eight incomplete Category 2 O&M recommendations for El Vado Dam. The Annual Site Inspection was completed in July 2023. The inspection resulted in one Category 3 O&M recommendation.

During the 2023 spring and summer runoff, the exposed intake structure in El Vado Reservoir clogged with sticks and debris on multiple occasions, limiting releases and the ability to regulate reservoir elevations within the current restrictions of 6,785 ft +/- 1.5 ft for the current construction. Design efforts are underway for an anchored log boom system that will reduce debris buildup at the intake structure, with the goal to have the system installed in Spring 2024.

The current El Vado construction projects, see section below, and resulting modifications will address the outstanding incomplete Safety of Dams recommendation and several of the Category 2 O&M recommendations.

El Vado Dam Construction Update

The goal of this project is to address the Safety of Dams recommendation to reduce the risk imposed by the condition of the dam and spillway to allow safe storage and delivery of water. Risks at the facility significantly exceed Federal Guidelines for Dam Safety. El Vado Dam and its spillways carry high risk for failure under normal and flood operations. The utilization of steel plates on a dam or spillway is not consistent with current state-of-the-art engineering practices and needs to be mitigated to reduce the risk and extend the life of the facility.

Planned actions to address the Safety of Dams recommendations are split into two separate projects. The first is a seepage reduction project and the other is a spillway replacement project. Seepage reduction entails placing grout behind the steel faceplate, performing remedial foundation grouting, and installing a geomembrane liner over the faceplate. The second project will involve the removal of the existing spillway including the gates and bridge and replacing it with a reinforced concrete spillway, new gates and a new bridge. Other improvements include widening of the crest. realignment of the roadway to better convey traffic across the right abutment and installation of a new emergency fuse plug dike southwest of the facility.

In September 2021, the El Vado Seepage Reduction Modification Project, Phase 1, was awarded to Carpi USA, Inc., for $31.2M to excavate foundations, perform welding repairs to the steel face plate, grout under the face plate, and install a geomembrane liner on the steel face plate. To allow for the necessary work, reservoir levels are required be within the elevation restriction of 6,785 ft +/- 1.5 ft by May 15th under most conditions. Unusually high runoff and debris caused by such made it difficult to reach that level in 2023 and was a factor impacting the contractor's ability to begin the grouting work.

Carpi re-mobilized in the spring of 2023 continuing repairs to the steel face plate, preparing for foundation grouting by installing the grout cap along the left abutment, and continued grouting beneath the face plate.

Related Reservoir Operations

Abiquiu Dam and Reservoir

Abiquiu Dam and Reservoir is a USACE facility. P.L. 97-140 authorizes storage up to 200,000 ac-ft of SJCP water in Abiquiu Reservoir. SJCP water storage in 2023 peaked at 99,366 ac-ft on January 3. Total storage in the reservoir peaked at 232,686 ac-ft (6,230.74 ft) on June 3. Mostly due to the lack of storage in El Vado during construction, Abiquiu held floodwater from July 1 to October 31. On July 1, the reservoir held 120,158 ac-ft of flood storage. Evaporative losses on the stored floodwater were 4,967 ac-ft. From August 22 to October 31, 115,191 ac-ft of flood storage was released to Cochiti Reservoir in preparation for reduced releases from Abiquiu for outlet works construction. Abiquiu ended 2023 with 75,225 ac-ft of SJCP water in storage. Table 9 provides a summary of monthly operations and water accounting for Abiquiu Reservoir. As noted above, USACE issued a deviation to allow native water retention.

Table 9: 2023 Reservoir Operations for Abiquiu Dam[1]

	Rio Grande Inflow	SJCP Inflow	Rio Grande Outflow	SJCP Outflow	Rio Grande Losses	SJCP Losses	Sediment Content	Rio Grande Content	SJCP Content	Total Content
Dec 2022	-1,493	8,440	5,527	10,158	4	-351	180	510	99,422	100,112
Jan	5009	2,347	1,518	4,559	3	59	181	3,999	97,151	101,330
Feb	5,647	2,281	1569	2,579	30	256	181	8047	96,596	104,824
Mar	17,677	526	9048	6,962	83	376	186	16,593	89,783	106,562
Apr	78,226	555	66,234	1,918	321	860	312	28,263	87,560	116,135
May	207,088	0	92,985	0	732	507	887	141,634	87,053	229,574
Jun	54,745	1,379	60,597	0	1531	499	959	134,250	87,933	223,142
Jul	10,660	10,937	10,623	18,024	2414	789	966	131,873	80,056	212,895
Aug	2,296	25,933	8,737	19016	1666	490	978	123,766	86,482	211,227
Sep	3,229	9,551	53,920	5,890	945	-83	982	72,131	90,226	163,339
Oct	3,973	3,634	61,800	8,214	435	621	982	13869	85,024	99,875
Nov	-10,173	21,514	3,715	33,587	22	243	985	-42	72,708	73,652
Dec	4,077	738	3,487	651	1	-2301	986	419	75,225	76,629
Annual	382,454	79,395	374,233	101,400	8,183	2,316	-	-	-	-

Cochiti Dam and Reservoir

Located downstream from the confluence of the Rio Chama and the Rio Grande, Cochiti Dam and Reservoir is another USACE facility. Congress authorized a permanent pool of 1,200 surface acres for recreational purposes (recreation pool) and for fish and wildlife. This pool is composed of SJCP water, and evaporation losses are replaced with additional SJCP water to maintain 1,200 surface acres. Recreation pool water may be released from Heron Reservoir and temporarily stored in Abiquiu, then released over the winter to provide flows in the Rio Chama between Abiquiu and the confluence with the Rio Grande.

In 2023, a total of 7,054 ac-ft was released from Abiquiu Reservoir and 6,967 ac-ft arrived in Cochiti Reservoir to fill the recreation pool and maintain flows on the Rio Chama. This was composed of water in storage in Abiquiu from previous years and the full 2023 allocation. Release of 2,833 ac-ft from previous years occurred between January 9 and February 8 from Abiquiu. The 2023 allocation of 4,290 ac-ft

[1] Units in ac-ft; Content for End of Month

was released from Heron between September 9 and October 24 and from Abiquiu from September 16 to October 12. The year ended with a deficit of 305 ac-ft needed to reach 1,200 surface acres. Table 10 is a summary of monthly operations and water accounting for Cochiti.

Table 10: 2023 Reservoir Operations Cochiti Dam[1]

	Authorized SJCP Area (acres)	Authorized SJCP Content Capacity (ac-ft)	Wetlands Elevation (ft)	Wetlands Area (acres)	SJCP Content (ac-ft)	SJCP Area (acres)	SJCP Losses (ac-ft)	SJCP Demand (ac-ft)	SJCP Delivery (ac-ft)	Hold Pool= SJCP Pool + Sediment (ac-ft)
Dec 2022	1,200	44,137	5,354	0	40,234	912	62	3,903	124	40,723
Jan	1,200	44,137	5,354	0	42,377	1,068	61	1,760	2,205	42,873
Feb	1,200	44,137	5,354	0	42,861	1,104	109	1,276	592	43,362
Mar	1,200	44,137	5,354	0	42,631	1,085	230	1,506	0	43,148
Apr	1,200	44,137	5,354	0	42,269	1,063	362	1,868	0	42,947
May	1,200	44,137	5,354	0	41,858	1,046	411	2,279	0	43,017
Jun	1,200	44,137	5,354	0	41,325	1,014	533	2,812	0	42,629
Jul	1,200	44,137	5,354	0	40,741	951	585	3,396	0	42,080
Aug	1,200	44,137	5,354	0	40,294	914	447	3,843	0	41,654
Sep	1,200	44,137	5,354	0	40,026	906	268	4,111	0	41,415
Oct	1,200	44,137	5,354	0	42,513	1,077	232	1,624	2,719	43,920
Nov	1,200	44,137	5,354	0	43,850	1,184	114	287	1,451	45,271
Dec	1,200	44,137	5,354	0	43,832	1,183	18	305	0	45,260
Annual	-	-	-	-	-	-	3,370	-	6,967	-

[1] Data for End of Month

MRG River Gage Operation and Maintenance

Data from river gages helps Middle Rio Grande water management agencies meet the needs of water users, fulfill the requirements of the Compact, maintain adequate water in the river to support ESA operations, and provide information needed to improve the daily management of the river system from Cochiti Dam to Elephant Butte Reservoir. Data from these gages are available to the public at http://waterdata.usgs.gov/nm/nwis/current/?type=flow.

Reclamation continues to fund four gages operated and maintained by the U.S. Geological Survey (USGS) to support ESA operations: Rio Grande near Bosque Farms, NM (08331160); Rio Grande at State Hwy 346 near Bosque, NM (08331510); Rio Grande at bridge near Escondida, NM (08355050); and the Rio Grande above U.S. Hwy 380 near San Antonio, NM (08355490).

MRGCD continues to operate and maintain gages on many of their facilities. These gages show diversions and return flows to the river and how water is moving through the irrigation system. Funding from Reclamation allowed MRGCD to set up the first set of these gages. Reclamation also hosts a website that includes schematics of MRGCD's system and associated gage data (https://www.usbr.gov/uc/albuq/water/ETtoolboxV2/home.html).

River Maintenance and River Efficiency Projects

Reclamation has authorization for maintenance of the Rio Grande from Velarde, New Mexico, south to the headwaters of Caballo Reservoir. Responsibilities include maintenance of the river channel and floodplain. Project purposes include improving water delivery and sediment transport, protecting riverside facilities and property, and preventing flooding. River maintenance consists of any work done in the channel and floodplain, including habitat restoration. Reclamation conducts an annual assessment of sites and reaches after the spring runoff and summer monsoon events to identify maintenance needs.

Maintenance needs are prioritized based on the geomorphic trends and conditions, public and infrastructure risk, and water delivery effects for the 260-mile reach of the MRGP. Maintenance projects involve planning, design, environmental compliance, construction, and adaptive management. Most maintenance projects require adaptive and recurring maintenance over the life cycle of each project's intended design life.

Reclamation is attempting to improve its ability to acquire Clean Water Act (CWA) compliance for river maintenance projects, utilizing the various types of permitting approaches including individual permits, nationwide permits, regional permits, and Letters of Permission. Two nationwide permits (habitat restoration and bank stabilization) were acquired for river maintenance projects in 2023.

Middle Rio Grande River Maintenance Plan

The MRGP River Maintenance program has developed a long-term Comprehensive Plan and Guide (CP&G) that will assist in accomplishing project purposes in an environmentally and economically sound manner. A final report is posted at the following web address: https://www.usbr.gov/uc/albuq/envdocs/reports/mrgRivMaint/CompPlan/start.pdf.

This maintenance plan is an engineering and geomorphic document that can be used to readily implement the most cost effective and environmentally sound strategies that reduce Reclamation's long-term commitment of resources. Ongoing work on the CP&G involves evaluating reach-based strategies for feasibility, prioritization, and effects of implementation between reaches, including upstream and downstream.

Work is also being pursued with respect to reach-based planning across multiple reaches, to include concepts for management of channel capacity and width along with river bars/islands/and bank attached bars. Reach-based planning is underway to evaluate the geomorphic reaches from Angostura to Montaño Bridge, and Isleta downstream to Elephant Butte, including the ongoing Lower San Acacia Reach Improvements[1] (LSARI) effort evaluating alternatives in the high priority San Acacia Reach to improve water and sediment conveyance and meet ecological goals.

Determination of River Maintenance Needs

In 2014, Reclamation completed its "Determination of River Maintenance Needs" process. using a rating system for sites and reaches along the river channel that considers geomorphic trends and conditions, public and infrastructure risk, and water delivery effects for the 260-mile reach of the MRGP. All monitored, existing, and completed sites were rated using the system and criteria again in 2023. Monitoring during the spring runoff and monsoon season in 2023 and work progress were considered in the 2023 site and reach ratings. These ratings help prioritize project development and implementation. This approach for the ratings and maintenance class designation complements what is in the CP&G and the MRG Biological Opinion (MRG BO) for River Maintenance Actions[2].

River Maintenance Sites

Reclamation is pursuing work at 23 total sites and reaches along the MRGP. There are five active sites that require an annual review of channel capacity and possible maintenance due to sediment accumulation.

Reclamation's efforts at all maintenance sites include data collection, geomorphic and sediment investigations, design studies, alternative evaluations, design and development of construction drawings, material supply and development, lands access, environmental compliance, project and construction management, construction maintenance, and adaptive maintenance/monitoring.

In the following sections, the terms "new," "existing," and "adaptive" are used to describe the various river maintenance sites and reach status. "New" sites developed following high flow events on the Rio Grande in the previous year. "Existing" sites are in the process of completion. "Adaptive" sites have been substantially completed and are being monitored for function and performance.

Salazar Dike Repair (New)

Flooding of agricultural lands in the Velarde reach of the Rio Grande was observed during aerial reconnaissance during the 2023 runoff season (Figure 5, Figure 6). Following this observation and communication from the landowner, Reclamation initiated a small project to repair the Reclamation-built dike protecting agricultural lands from river flows up to the 2-year return flow. The dike was

[1] See the Lower San Acacia Reach Improvements Project section below
[2] See the Programmatic Water Operations and River Maintenance ESA Compliance Section

damaged by rodent activity and no longer served its intended purpose. The repair work consists of excavating and re-compacting the dike in-place and restoring its original dimensions. Roughly 1,650 ft of dike will be repaired and is scheduled for construction in spring 2024.

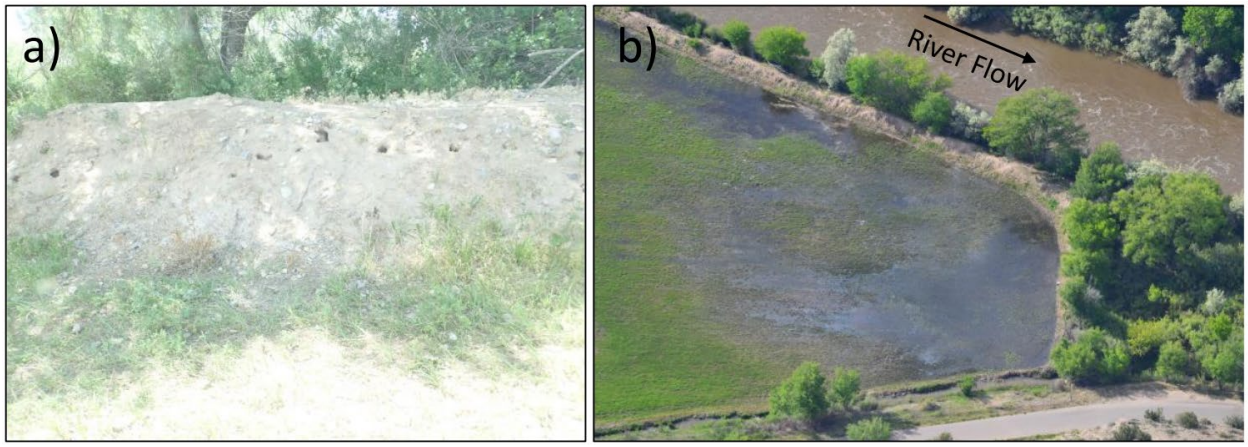


Figure 4: Photograph showing the damaged dike (a) and aerial photograph showing the flooded land across the dike from the river (b) (Reclamation, 2023).

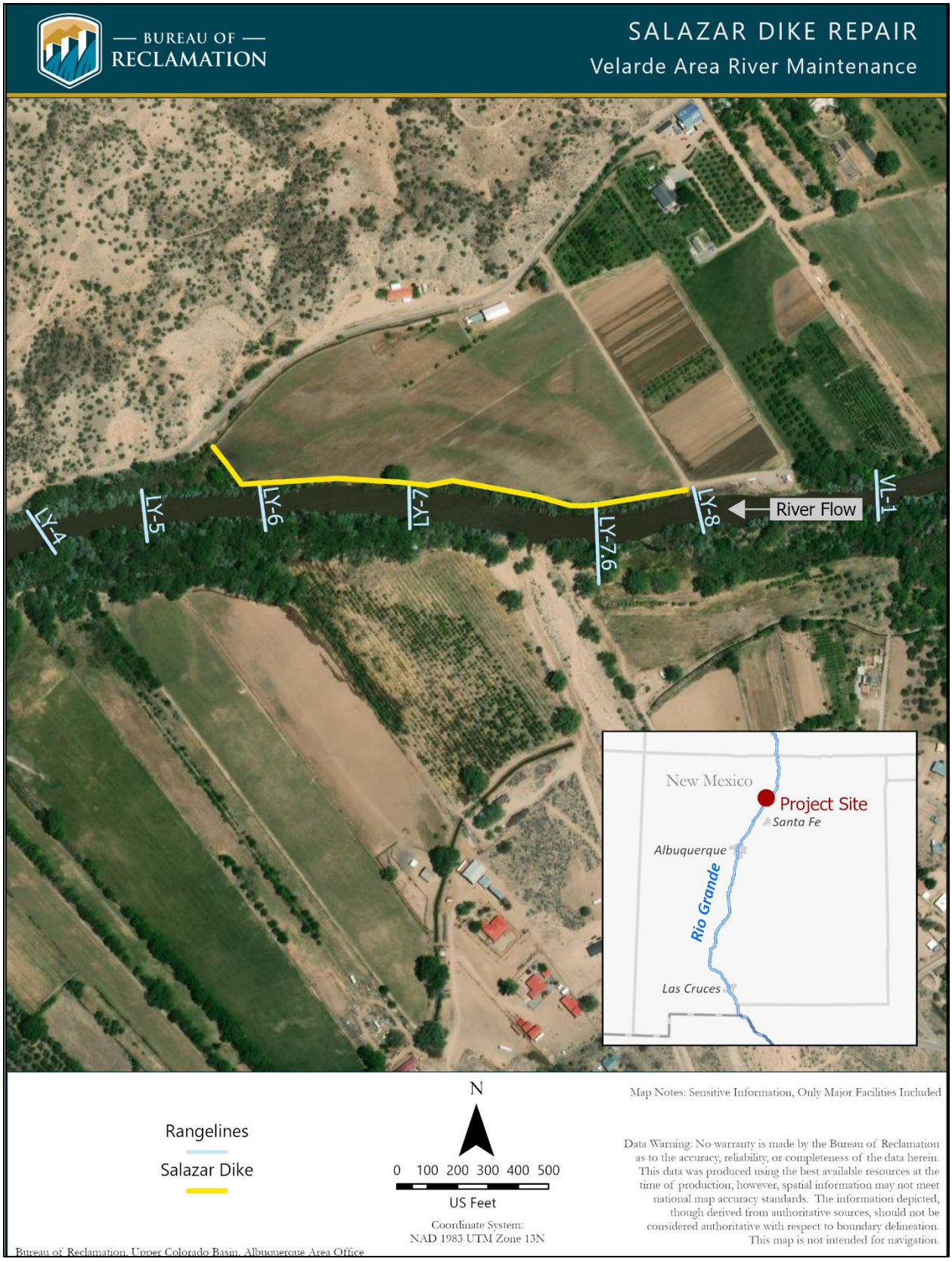


Figure 5: Plan view map showing the location and extents of the repair work.

San Felipe Pueblo (Existing)

A total of 10 river maintenance sites have been identified on the Pueblo of San Felipe. Seven sites have been completed, and three are ready for construction. The remaining three sites are RM 211.3, RM 212.8, and RM 214.4. Construction on longitudinal fill stone toe protection at RM 211.3 began in the fall of 2015 and was partially completed by March 2016. The work was put on hold at that time by the Pueblo of San Felipe for a review of impacts to vegetation of traditional or medicinal value. All construction work at the remaining sites is currently pending permission by the Pueblo of San Felipe. During the 2019 spring runoff, the bank eroded towards the levee at the two eastern bends at RMs 212.8 and 214.4. Again, work at these locations is currently on hold. A letter was sent to the Pueblo of San Felipe on October 31, 2019, informing the Pueblo of the potential risk to riverside facilities presented by conditions at these locations. During the 2023 spring runoff, the bends at RMs 212.8 and 214.4 continued to experience bank erosion and lateral migration towards the levee system. In addition, the eastern river bend at RM 211.9 also experienced bank erosion and some migration towards the eastern levee system. Reclamation's Albuquerque Area Manager met with the San Felipe Pueblo Governor and staff in July 2023 and agreed to start working on a planning P.L.93- 638 Project between Reclamation and the Pueblo to start addressing some of the river channel needs identified by the Pueblo along with the bank erosion areas. Reclamation continues to monitor these sites related to potential impacts to the adjacent riverside levee, drain, and canal systems.

Santa Ana River Mile 205.8 (Adaptive)

This site is within the Pueblo of Santa Ana on the east bank of the Rio Grande, across from the Tamaya Resort pavilion. Nine bendway weirs and a low elevation floodplain were constructed in 2014 and the site re-vegetated in 2015. During the 2015 spring runoff, erosion at the site washed away the newly planted vegetation and caused bankline scalloping between some of the weirs shortly after completion. An interim adaptive maintenance project was completed in January 2016 while a longer-term solution could be investigated. The site experienced additional bank erosion during the 2016 and 2017 runoffs, but the original 2014 works and 2016 temporary controls minimized the extent (see Figure 6).

Figure 6: Looking downstream at Santa Ana RM 205.8 east bankline bendway weirs prior to 2023 repairs (Reclamation, 2021)

Following the investigation, completed in 2018, Reclamation completed adaptive management work at this site in March 2023. These repairs included the placement of longitudinal stone toe protection between the existing bendway weirs for toe strength, construction of a new side channel on the opposite bankline to relieve hydraulic pressure on the eat bankline, and the installation of vegetated, mechanically stabilized earth along the hillslope above the stone toe to promote further bank stability. Construction of these channel and bank features began in November of 2022. Figure 7 shows the conditions at the longitudinal stone toe post-runoff in 2023.

Figure 7: Looking downstream from same vantage point as in previous figure at the longitudinal stone toe protection on the eastern bankline; photo taken post-runoff 2023 (Wolf Engineering, 2023)

Angostura to Montaño Reach Planning (Existing)

In 2014, Reclamation identified the reach of the Rio Grande from RM 201 to Montaño Bridge for hydraulic and geomorphic assessment and project planning. This reach is transitioning, with riverbed incision and migrating bends that have caused problematic erosion at locations such as the Sandia Priority Site, the Bernalillo Priority Site, the Corrales Siphon, Corrales RM 199, and private land south of the Highway 550 Bridge. The goal of this reach planning is to analyze the current geomorphic and hydraulic trends and identify potential river projects that both minimize the need for future river maintenance and improve habitat value. Two hydraulic models of this reach were created using 2015 and 2017 hydrographic data. The hydraulic and geomorphic report is complete and located at the following website: https://www.usbr.gov/uc/envdocs/reports/AngosturaDamtoMontanoBridge-GeomorphicandHydraulicAnalysis.pdf.

Sandia Priority Site Bendway Weir Repairs (Adaptive)

In collaboration with the Pueblo of Sandia, Reclamation constructed the Sandia Priority Site in 2008 as the river was approaching the east levee. Upon completion, Reclamation transitioned the site to the adaptive maintenance and monitoring phase. In 2017, Reclamation strengthened the bankline at the bendway weirs following additional erosion in 2016.

Subsequent adaptive maintenance work at this site was implemented in two phases. Phase I, completed in 2021, involved rehabilitating the side channels on the western floodplain and constructing a new side channel to facilitate water and sediment transport from an arroyo on the western floodplain (Figure 8). Phase II, currently under construction, will include two new side channels (Figure 9) just downstream of the original project in an area that is also eroding. Phase II work is expected to be completed by early April 2024. Spoil material from the side channels has been spread in the channel such that normal river flows mobilize the spoils downstream.

Figure 8: Construction of new side channels on the western floodplain of the Sandia Priority Site (Reclamation, 2023

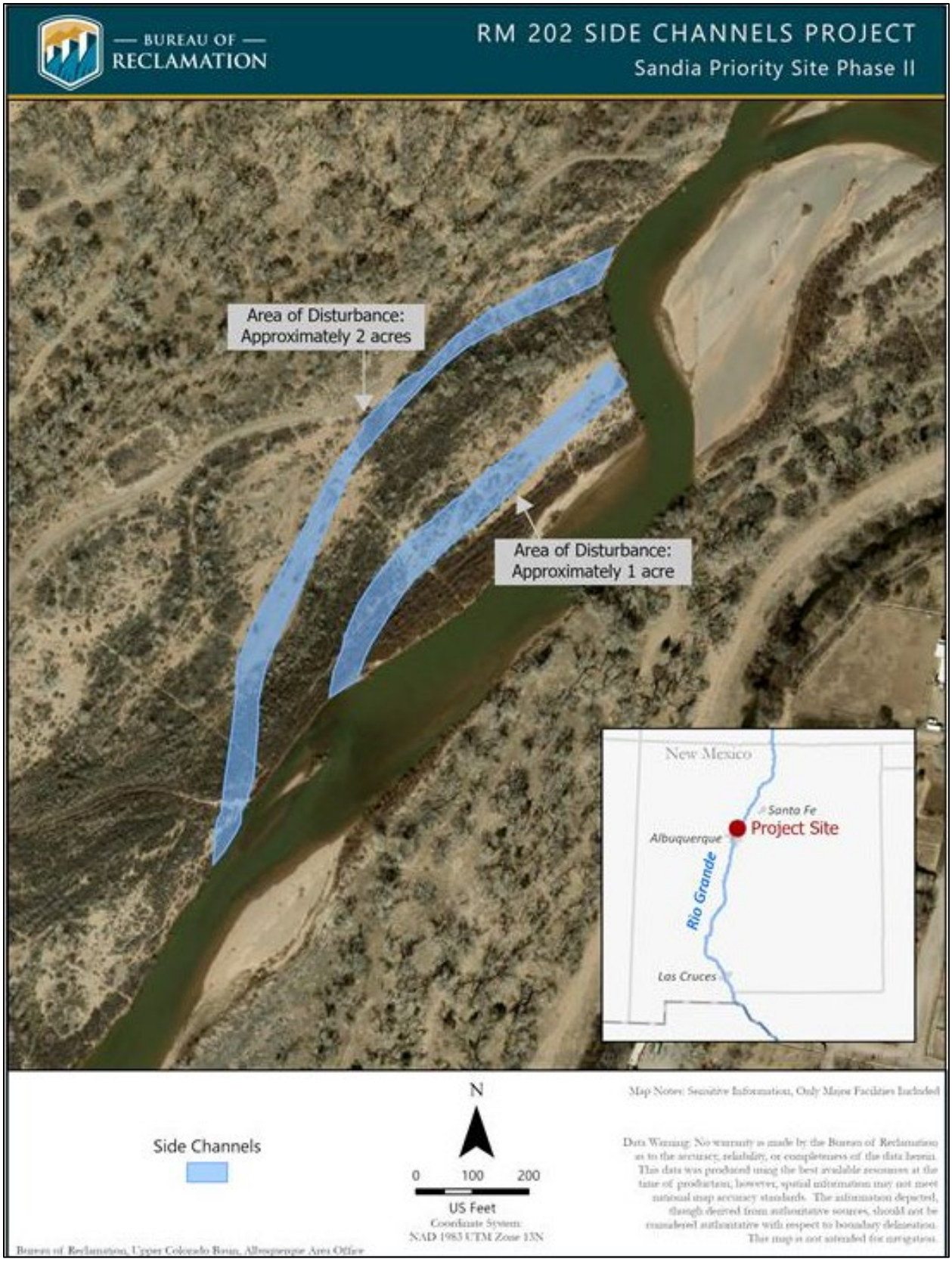


Figure 9: Plan view of the designed Sandia Priority Site Phase II side channels

Corrales Siphon and Bankline Repair (Adaptive)

The Corrales Siphon at RM 199.7 is in Corrales, New Mexico, just north of Albuquerque and about 700 ft downstream of the Arroyo de la Barranca confluence. The siphon was constructed in the early 1930s by the MRGCD to supply irrigation water to the Corrales Main Canal. During river reconnaissance in 2012, Reclamation discovered that degradation in the area had exposed the siphon. MRGCD requested emergency technical assistance and construction support from Reclamation to temporarily protect it during the 2016 runoff, the emergency, short-term project placed riprap in a scour hole downstream of the exposed siphon and upstream and downstream of the siphon along the west bankline. In 2020, MRGCD placed more riprap downstream of the siphon extending the entire width of the river and keying a short distance into the bankline (Figure 10).

Figure 10: Looking east at the Corrales Siphon and the 2020 riprap protection placed downstream of the siphon (Reclamation, 2023

In 2022, the siphon wooden stave pipe experienced a failure near the western inlet transition not directly associated with river-bed erosion and scour. This siphon failure resulted in discontinuity of flows the western Corrales main canal given that the siphon is inoperable. MRGCD established temporary pumps to provide irrigation water during the 2022 and 2023 irrigation seasons which will be used again in 2024. MRGCD had a feasibility study performed by their engineering consultant (Wilson and Company) and is looking at a long-term solution with a new subsurface siphon

accomplished via horizontal directional drilling and pipe installation. Currently the MRGCD is planning to break ground on the replacement pipe in fall of 2024.

River Mile 199 (Existing)

In 2017, Reclamation identified a new erosion site near RM 199 in the Corrales area. This site is on the west side of the river, approximately 120 ft from the west levee toe. The Angostura to Montaño reach plan provides a detailed geomorphic and hydraulic study of the reach and sub-reaches and has helped evaluate erosion at RM 199 in the context of the overall reach needs.

Project goals include dissipating energy in the surrounding two-mile reach between the Corrales Siphon and RM 198 and improving ecological function at this site. The Pueblo of Sandia's Tribal Council approved the project in 2021, allowing Reclamation access to perform project construction on their lands. Reclamation completed a value engineering study on the project in February 2022. Design is currently underway (Figure 11) with plans for completion of 90% design work in June 2024, followed by environmental compliance. Construction is targeted for fall 2025.

In the spring of 2023, erosion of the western bank of the Corrales Siphon Bend (northern most bend) toward the levee following runoff flows raised concern that future runoff flows could threaten the levee and the Corrales Main canal (Figure 12).

In fall 2023, Reclamation implemented a short-term project to provide bank stabilization sufficient to withstand at least one similar runoff season. A riprap windrow was constructed along roughly 560 ft of eroded bankline to halt the erosion in the eastern direction. The riprap was sized to withstand flow rates up to the 2-year return flood flow with enough riprap placed to line the existing bank and the expected scour hole. Construction was completed January 2024 (Figure 13).

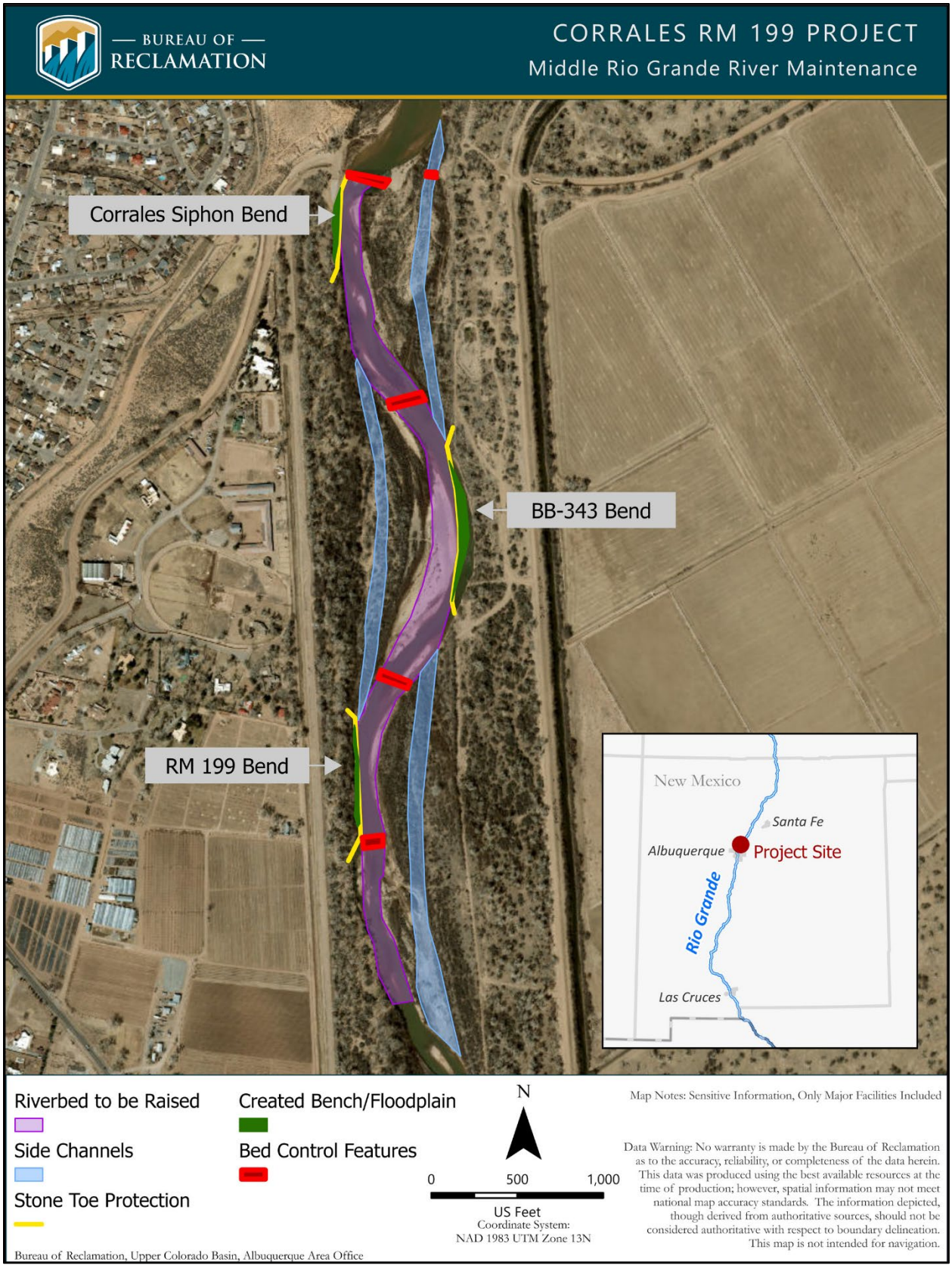


Figure 11: Plan view showing the design layout of the RM 199 maintenance project.

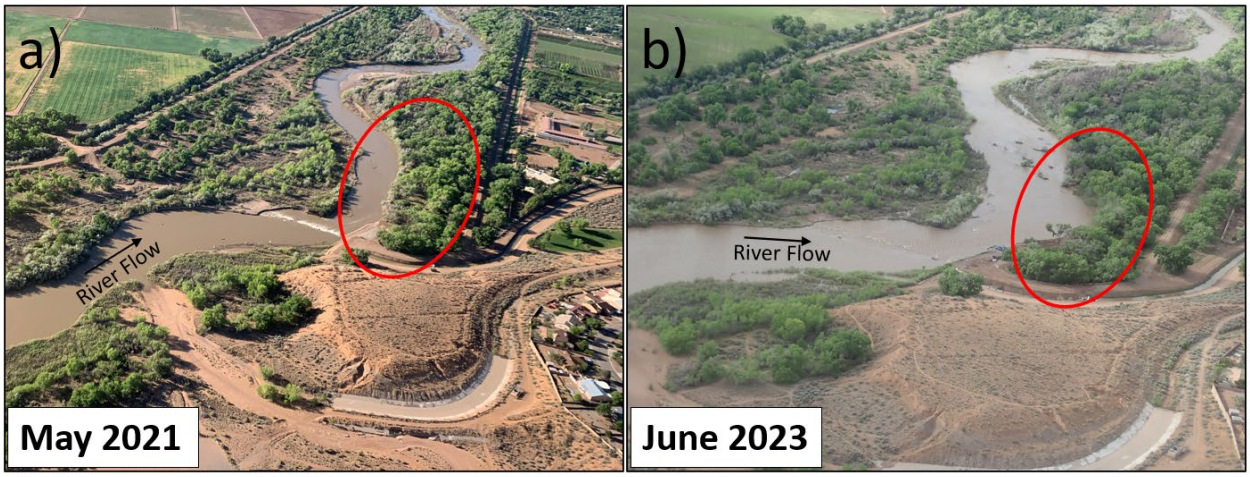


Figure 12: Aerial photographs showing the location of the bank erosion that took place in 2023 to threaten the levee and Corrales Main Canal (Reclamation, 2021 and 2023).

Figure 13: Riprap windrow constructed along the eroded bankline at the Corrales Siphon Bend (Reclamation, 2024).

Isleta to San Acacia Reach Planning (Existing)

In 2014, Reclamation identified the Rio Grande stretch from Isleta to the San Acacia Diversion Dams for further investigation to analyze the geomorphic and hydraulic trends. This investigation was especially relevant given the observed overbank flooding in portions of the reach during the 2017 and 2019 runoffs. Geomorphic and hydraulic analysis reports for this reach were completed in March and December 2018, respectively. These analyses will be used to identify potential projects that have river maintenance and habitat value.

In 2021, Reclamation finished a report identifying sites that may need river maintenance or offer opportunities to perform habitat restoration in support of the MRG BO. Part of that effort included a focused study on the Los Lunas subreach which has been completed and which identified Los Lunas RM 163 and RM 161 for future river maintenance work, see section below.

The reach report can be found at the follow weblink: https://www.usbr.gov/uc/envdocs/reports/20181200-IsletaSanAcaciaHydraulicModeling-Report-AAO.pdf.

Los Lunas River Mile 163 (Existing)

In 2020, Reclamation analyzed the hydrology, hydraulics, and habitat of the Los Lunas subreach. The Los Lunas subreach overbanks at low flows and due to the semi-perched nature of the floodway, the overbanked water often becomes trapped against the levee toes. Data shows that the flow at which overbanking occurs is getting lower over time. This investigation identified five locations along the eastern floodplain that overbank at flows less than the two-year return flow.

RM 163 is one of the first locations where water overbanks and saturates the levee toes during a rising hydrograph. In collaboration with NMISC and MRGCD, Reclamation plans to lower the banks of the channel to improve aquatic habitat and water conveyance. Reclamation completed project designs in fall 2022 (Figure 14). The project is currently going through environmental approvals funded by the NMISC. CWA approvals from the USACE and the New Mexico Environment Department for Section 404 and 401 permitting, respectively, have caused delays. Reclamation provided additional technical materials in January 2023 in response to a request for information from the USACE for following up on the CWA application materials apart from a Wetland Mitigation and Monitoring Plan. Construction of Los Lunas RM 163 is tentatively targeted for fall 2024, pending approval of the environmental mitigation plan with the USACE.

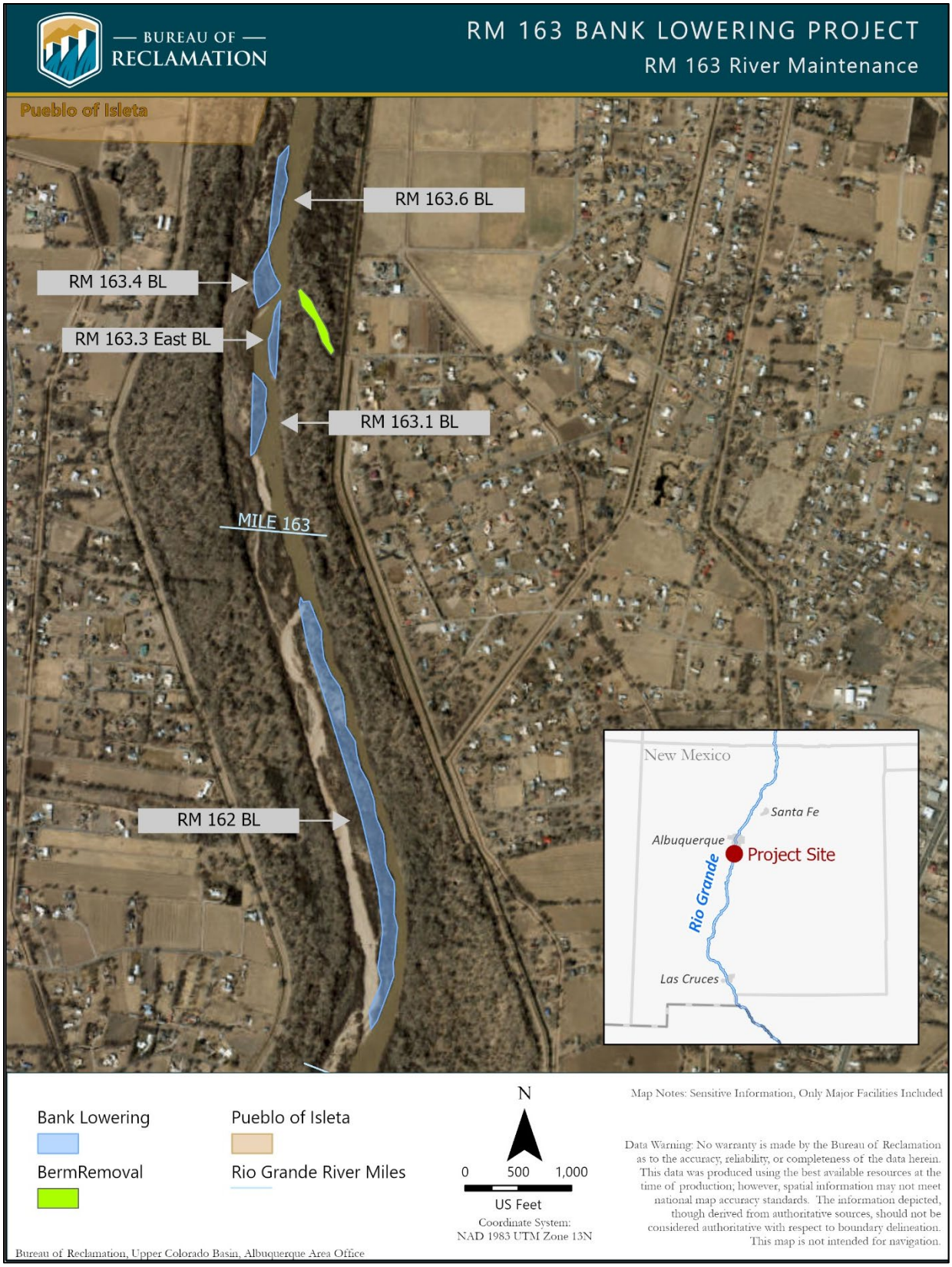


Figure 14: Plan view showing the design bank lowering (BL) berm removal features of the RM 163 maintenance project immediately upstream of U.S. Highway 6 bridge

Highway 380 to Elephant Butte Reservoir Reach Planning (Existing)

Continued monitoring efforts are underway to identify any new river maintenance and habitat restoration sites along this 50-mile-long stretch of the Rio Grande. This river reach has essential habitat for several Federally listed threatened and endangered species, including the Rio Grande Silvery Minnow (RGSM), the Southwestern Willow Flycatcher (flycatcher), and the Yellow-billed Cuckoo (cuckoo). Riverside infrastructure in this reach delivers irrigation flows to the BdA to support terrestrial habitat for the endangered New Mexico Meadow Jumping Mouse (jumping mouse). In addition to providing critical habitat for these endangered species, this reach of the Rio Grande is critical for the delivery of surface water flows to Elephant Butte Reservoir. Reclamation's planning in this reach looks to balance water conveyance goals with creation of nursery and mature habitat sites for the listed species. This reach planning effort complements the ongoing LSARI effort[1].

The reach report on recent geomorphic, hydraulic, and vegetative trends can be found at the following location: https://www.usbr.gov/uc/DocLibrary/Publications/20200500-RioGrandeChannelAnalysisHighway380ElephantButteDelta-508-AAO.pdf.

Bosque del Apache River Realignment Upstream Phase (Existing)

Planning work is underway for the approximately 4.5-mile river realignment on the Rio Grande, extending from just downstream of the Highway 380 bridge near San Antonio, NM near RM 86, to just below the north boundary of the BdA near RM 81. This realignment is intended to prevent sediment plug formation in the main channel by redirecting river flows to a lower point of the active floodplain east of the existing channel alignment (see Figure 15). Like the downstream phase of this project (see next section), the upstream phase is intended to reduce river perching and reconnect floodplain areas with the main body of channel flow. It is expected that this project will improve riverside habitat and channel conveyance. A draft Environmental Assessment is currently underway for the project which is nearing its final design phase. Vegetation clearing and heavy excavation work on the realignment channel is expected to begin in September 2024.

[1] See the Lower San Acacia Reach Improvements Project section below

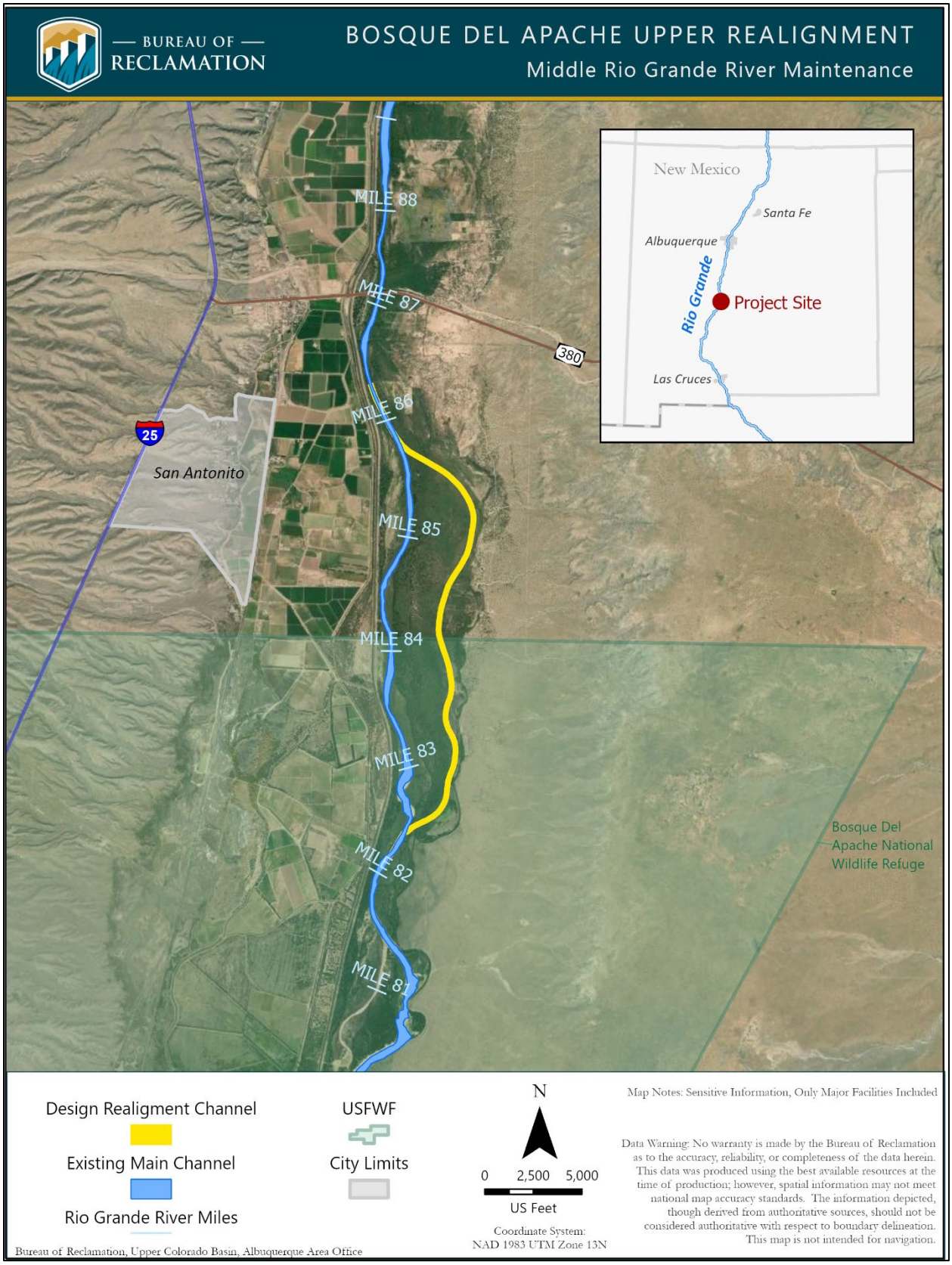


Figure 15: Plan view showing proposed Bosque del Apache River Realignment project.

Bosque del Apache River Realignment Downstream Phase (Adaptive)

During the 2008 and 2017 spring runoffs, sediment plugs formed in the main channel of the Rio Grande at RM 81, located within the BdA. In 2014, a multi-agency project team began to pursue a realignment of the current channel to the east to address river maintenance concerns in the area. This project has moved 2.5 miles of the river channel and reconnected it with the current channel.

Excavation of a pilot channel along the planned realignment to restore river conveyance was conducted in 2019. The excavation phase of the project was completed in September 2020, despite construction delays caused by the COVID-19 pandemic. Moving excavation spoil into the old river channel was completed in March 2021.

Project monitoring by Reclamation and NMISC during 2022 identified a section of the realignment channel bed that had failed to mobilize as intended, most likely due to poor spring runoff conditions within the reach (Figure 16). This had led to a condition where the slope of the riverbed did not adjust to the downstream equilibrium slope, leading to potential future issues with downstream water delivery. Reclamation crews were again mobilized to address this concern through partnership with the NMISC. Channel maintenance at what is now being called the "knickpoint" site (Figure 17) on the downstream phase project was completed in February 2023. Ongoing habitat monitoring efforts continue within the project's wetland mitigation area with most of the Year 3 habitat recovery metrics being met under the project's CWA permit with the USACE.

Figure 16: View of realigned Rio Grande channel on the BdA from the west bank following summer monsoonal flows (Reclamation, 2023)

Figure 17: Channel maintenance work at the knickpoint site on the BdA River Realignment Downstream Phase Project (Reclamation, 2023)

Bosque del Apache, Tiffany, and San Marcial Levee and Delta Channel Capacity Analyses (Adaptive)

The hydraulic channel capacity criteria used in the analysis of levee systems in this reach is to both effectively and safely pass the two-year flow of 7,700 cfs. The maintenance design criteria of the Delta Channel used in the analysis was to effectively convey a normal spring runoff peak flow of 4,000 to 5,000 cfs to the Elephant Butte Reservoir pool.

NMISC's contractor removed debris from the lower delta channel that deposited following the 2023 snowmelt runoff season and reductions in reservoir levels over the summer and fall months. The Socorro Field Division was successful at removing a sediment plug that had formed in the Delta Channel following the runoff season this past year, restoring main channel connection to the reservoir after this work was completed in early November 2023. The Tiffany and San Marcial Levee sections continue to maintain sufficient channel capacity. Work on realigning a section of the river through the BdA is expected to begin in September 2024 as is detailed in an earlier section of this report; this effort should restore sufficient channel conveyance capacity through the BdA section of the river.

Several severe river bends in the lower reach (Fort Craig Bend at RM 64.2, RM 63.4 and RM 60) continue to be monitored by Reclamation and will need to be evaluated post-runoff this year. Launchable riprap at two of these bends has seen multiple runoff seasons now and much of this rock has already dropped into the river along the bankline. There is a potential that some of this bank protection material will need to be replenished in 2024.

Fort Craig Bend and River Mile 60 (Existing)

Historically, the Rio Grande between Fort Craig and RM 60 was a wide, braided, and relatively straight river channel. However, development of a more sinuous planform over the last few years has led to increased degree of meandering in several areas. This has caused the formation of multiple bends, including Fort Craig Bend near RM 64 and the S-curve bend at RM 60. The outer side of these bends are near the west edge of the confined floodplain, adjacent to the spoil levee and the LFCC. Continued bank erosion and lateral channel migration at these locations threaten to breach the spoil levee and cause damage to the LFCC and access road. This is likely to negatively affect downstream water delivery and endangered species. In 2012, a rock windrow was placed on the west bank of the river as a temporary solution to bank toe erosion near the abandoned Fort Craig pump site. Recent observations show that the windrow has partially dropped into the channel along the bankline.

Additional repair work may be needed at the RM 60 bend in 2024. Currently the Fort Craig bend appears to be stable. The multi-disciplinary interagency LSARI team has developed alternatives to reduce maintenance frequency, increase water salvage, and enhance habitat throughout the San Acacia Reach. The alternatives are being evaluated via a feasibility-level study and through the LSARI effort, see below.

River Mile 60 (New)

Reclamation worked with MRGCD and NMISC to design and construct a project that re-established a more direct outfall to the river channel at the terminus of the LFCC at RM 60. This outfall returns irrigation return and valley drainage flows and will improve downstream deliveries to Elephant Butte reservoir. The project took place on an accelerated timeline with design beginning in spring 2022 and preliminary site work beginning in the fall of 2022. As of January 2024, the major components of the project are completed, and only automation of the flow control structures remains to be done.

The project design consists of an open-channel outfall to the river at RM 60, an earthen berm housing three gated culverts to control flows through the outfall, and an additional set of gated culverts controlling flows to the LFCC West area (Figure 18). The open channel is riprap lined at the sides and outfalls to prevent erosion, and automation of the culvert gates is planned to be installed in early 2024. Figure 19 and Figure 20 show the completed outfall and flow control structure. Following construction of the outfall, plans are in place for adaptive management and experimental operations for optimizing outfall operations for both water delivery and sustaining western riparian and wetland habitats.

The primary purpose of the RM 60 project is to enhance irrigation supplies and assist with New Mexico's Compact deliveries by returning LFCC flows to the Rio Grande main channel at RM 60 to convey such flows more efficiently to Elephant Butte Reservoir[1]. Previously these flows were not managed and collected in the western valley in a series of ponds and relic channels (the "LFCC West") in the floodplain before reaching the Rio Grande roughly 6 miles downstream. Additionally, the low conveyance capacity of the LFCC West has led to debris plugs and LFCC flows nearly overtopping the levee during monsoons.

[1] See River Mile 60 Operations section below

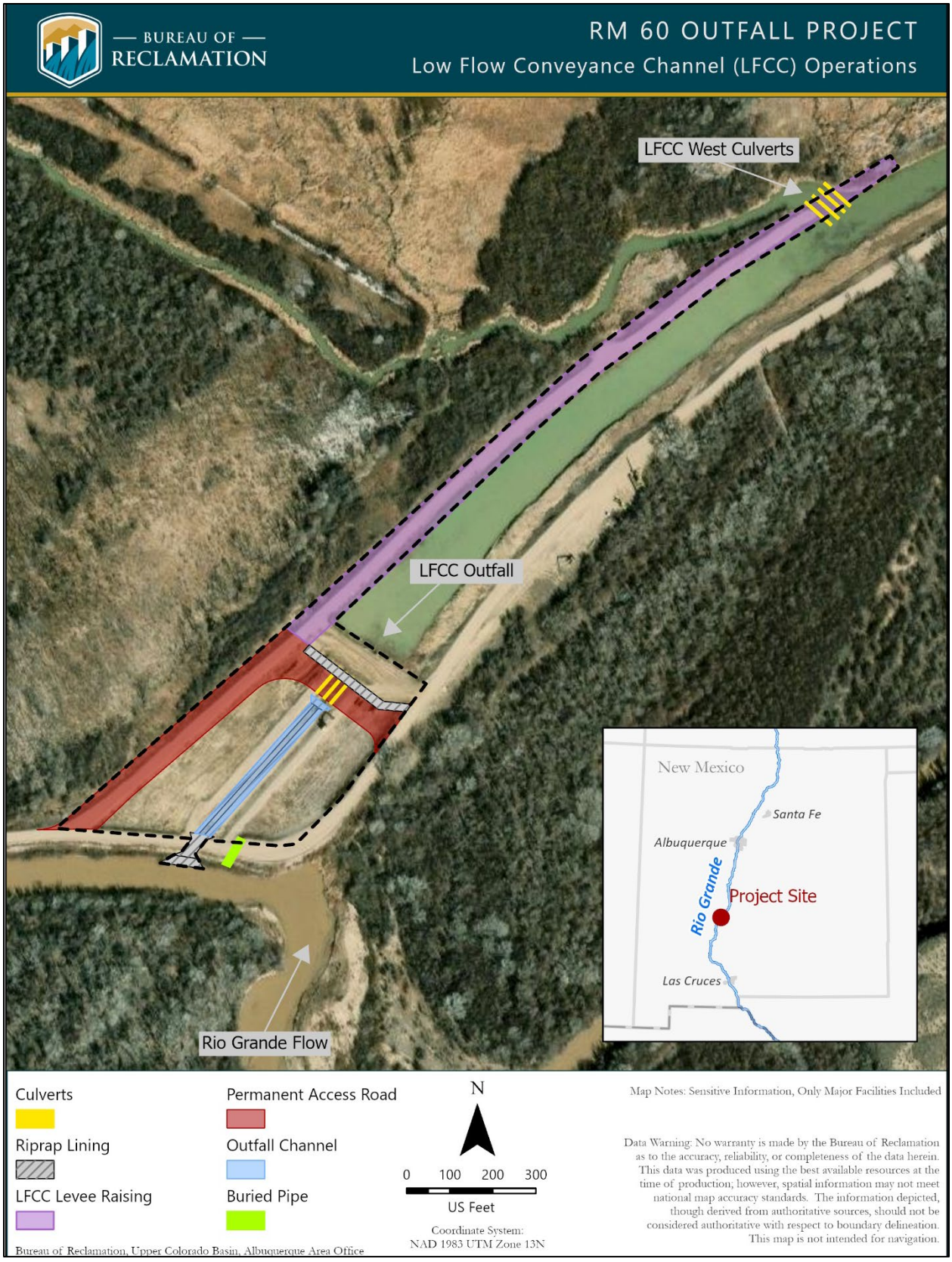


Figure 18: RM 60 Proposed Project Outfall

Figure 19: RM 60 looking down the completed open outfall to the river (Reclamation, 2023).

Figure 20: RM 60 looking upstream along the outfall channel toward the gated culvert structure (Reclamation, 2023)

River Mile 60 Operations

The goal of the RM 60 operations is to increase downstream water delivery to Elephant Butte Reservoir by managing flow distribution between the river and LFCC West at RM 60 without negatively impacting federally listed bird habitat along the LFCC West.

Reclamation developed an experimental gate operations plan in 2023. The plan was implemented by Reclamation and MRGCD in January 2024. MRGCD is overseeing data operations and Reclamation is monitoring and analyzing the experimental operations.

Experimental gate operations started on January 2, 2024, and will assist Reclamation in answering the following questions to develop a long-term RM 60 gate operations plan:

- Is there a minimum flow threshold and corresponding groundwater level threshold in the LFCC West that would avoid or minimize negative impacts to habitat?

- How will water levels in the upstream LFCC and the RM 61 ponds be affected by culvert installation and operation? Are the RM 61 ponds primarily supplied by seepage from the LFCC, or are there other flow sources such as the breach 600 ft upstream from the LFCC West culverts?

- Is there a minimum flow threshold and corresponding groundwater level threshold in the LFCC West that would avoid or minimize negative impacts to habitat?

- How will water levels in the upstream LFCC and the RM 61 ponds be affected by culvert installation and operation? Are the RM 61 ponds primarily supplied by seepage from the LFCC, or are there other flow sources such as the breach 600 ft upstream from the LFCC West culverts?

Monitoring includes the following:

- Three flow measurements above and below RM 60

- Three flow measurements in the LFCC and LFCC West

- Ten ground water monitoring wells throughout the LFCC West

- Ten surface water transducers- 3 in the river and 7 in the LFCC and LFCC West

Delta Channel Maintenance with the State of New Mexico

In 2023, a new agreement between Reclamation and NMISC was signed to provide funding for joint Delta Channel maintenance, river maintenance projects, and riverside irrigation drain improvements with water salvage potential within the MRGP and reservoir vegetation management in the Rio Grande Project.

Work authority continued under the Letter of Permission issued by USACE in 2022, which is valid for five years and provides necessary compliance allowing continued Delta Channel Maintenance in accordance with Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899.

Work continued through the Delta Channel to maintain a 20-mile channel into the Elephant Butte Reservoir pool for effective water delivery. The maintenance work was conducted by NMISC's contractor and focused primarily on sediment excavation from the channel, sandbar de-vegetation, and vegetation removal along channel berms to maintain berm integrity between RM 37 and RM 54.

In fall 2023, Reclamation's construction crews provided rapid response to remove a 1.2-mile-long sediment plug and construct a pilot channel from RM 47 to RM 46 just south of Red Rock staging area. In addition to construction personnel, Reclamation provided necessary engineering services, environmental compliance, and construction inspection associated with both the identified recurring Delta Channel Maintenance, as well as the urgent plug removal in accordance with the agreement.

Truth or Consequences (Existing)

Reclamation annually excavates sediment from the river channel to maintain the authorized 5,000 cfs capacity in the reach between Elephant Butte Dam and Caballo Reservoir. Maintenance is conducted each fall after releases are shut off from Elephant Butte Dam. Primarily, sediment is removed at arroyo mouths. Secondary activities include sediment removal in other areas throughout the reach and bank stabilization with riprap at selected sites. Roughly 30,000 cubic yards of sediment was excavated from 3 sites in 2022. Work identified for 2023 involved sediment removal at the mouths of three major tributaries (Mescal, Cuchillo Negro, and Palomas) and is estimated at roughly 14,000 cubic yards of sediment. This work was completed in the winter of 2023.

In addition, during periods of non-release, Reclamation installs a dike in the river to increase the alluvial groundwater levels for the benefit of the artesian hot spring bathhouse owners in Truth or Consequences.

Aggradation/Degradation Data Acquisition and Hydraulic Analysis

In 2022, Reclamation hired a contractor to acquire Digital Imagery and LiDAR data collection for the MRGP from Cochiti to Elephant Butte Reservoir. Topographic data was collected along 1,800 historic rangelines established for monitoring sediment aggradation/degradation along the floodway and levee system. In 2023, the LiDAR data was modified by Reclamation to approximate the underwater bathymetry covered by the water surface at the time of data acquisition. Plans are underway in early 2024 to start performing one-dimensional and two-dimensional hydraulic analysis to evaluate the bankfull flow rate, flow rate that inundates the floodplain between the levee systems, and the flow rate that overtops the levees. Reclamation is conducting the analysis in partnership with NMISC, USACE, and MRGCD. Reclamation's goal is to have both Federal and non-Federal partners in agreement on the current hydraulic conveyance conditions and capacities along the river and floodway. Currently, draft deliverables are being peer-reviewed with this hydraulic analysis expected to be finalized in mid-2024.

Lower San Acacia Reach Improvements Project

The goals of the LSARI Project are to improve water delivery, ecosystem function, and the benefits of maintenance actions by working with geomorphic trends. The project area begins near RM 74 at the southern border of BdA and continues south to the Rio Grande's confluence with the LFCC west at RM 54.5.

Within the San Acacia Reach sediment supply exceeds transport capacity. The section of river between BdA's southern boundary and RM 60 has experienced 33 million cubic yards of cumulative sediment deposition between 1962 and 2012 (Holste, 2023). The long-term and prevailing condition is a depositional environment despite periods of channel incision caused by low reservoir levels. Attaining an equilibrium condition or transporting all sediment delivered from upstream is likely not possible and it is important to manage how sediment is deposited in the project area to ensure water is delivered and environmental resources are conserved (Holste, 2023).

Key issues the project targets include channel perching, conveyance losses, and decline in ecosystem health. Channel perching maintains the riverbed at an elevation above the water table, allowing for seepage loss and river drying. Perching increases sediment concentration in the main channel, allowing sediment plugs to form (see Figure 21), leading to levee breeches and significant losses as water spills into low-elevation areas disconnected from the main channel (Figure 22). Several factors contribute to conveyance losses. Transpiration, evaporation, seepage from the river channel, and stranded water on the floodplain after high flow events all significantly reduce river flows. Historically a wide and shallow river, the Rio Grande in this reach presents a narrow and uniform channel that has contributed to the decline in ecosystem health. The RGSM and the flycatcher and their habitat require frequent floodplain inundation to thrive. Less frequent floodplain inundation stresses native vegetation and allows invasive phreatophytes to dominate riparian areas, reducing native habitat availability.

The LSARI Project is currently being evaluated through a feasibility-level analysis and Environmental Impact Statement (EIS). The feasibility-level analysis will be complete in fall 2024 and the EIS in summer 2025. If an action alternative (see Figure 23 and Figure 24) is selected as the preferred alternative, construction is anticipated to begin in December 2025.

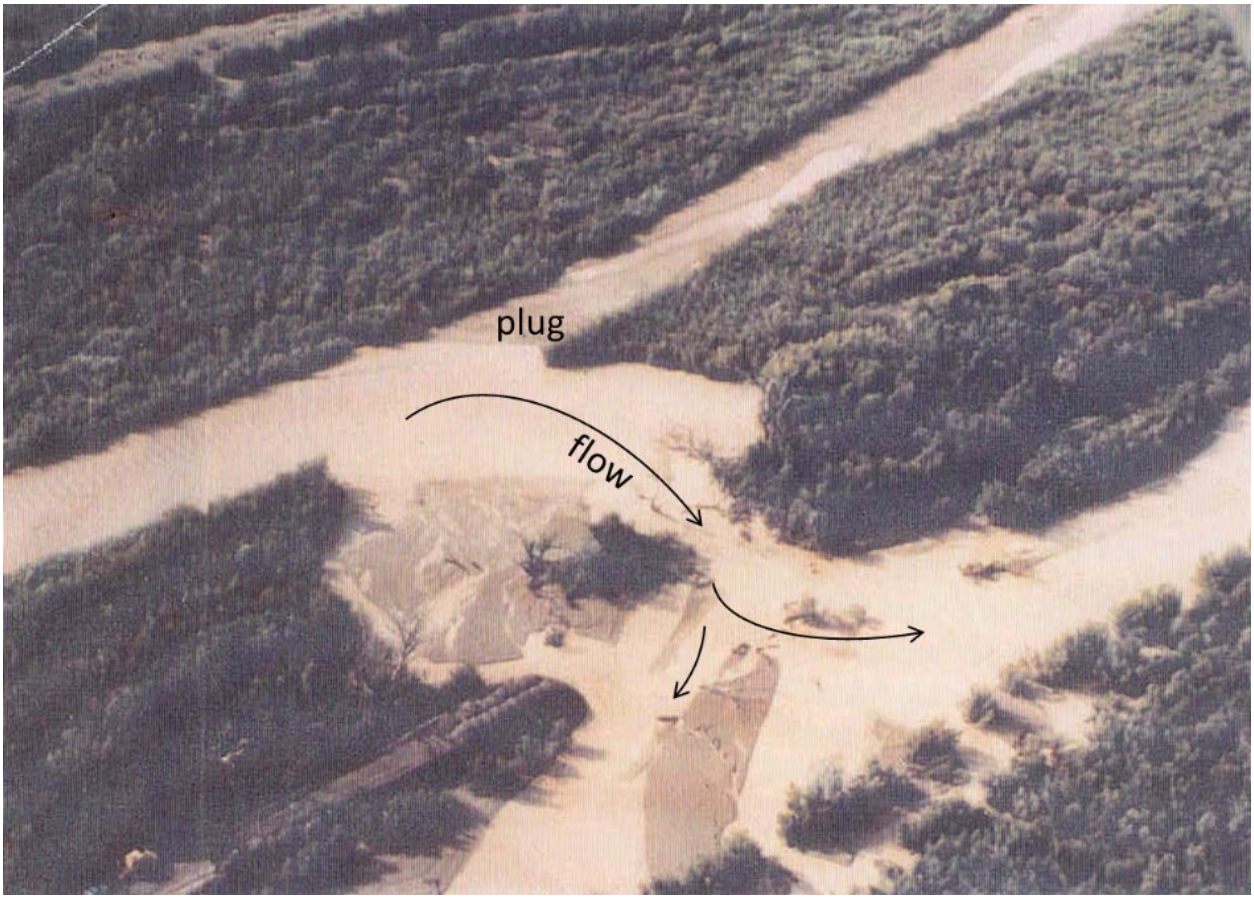


Figure 21: 1991 aerial photograph of a channel breach above the Tiffany Basin just downstream of RM 72 (Reclamation, 1991) a sediment plug formed here in 1991, 1995, and 2005. Then the channel incised, and sediment plugs formed upstream at RM 81 in 2008, 2017, and 2019.

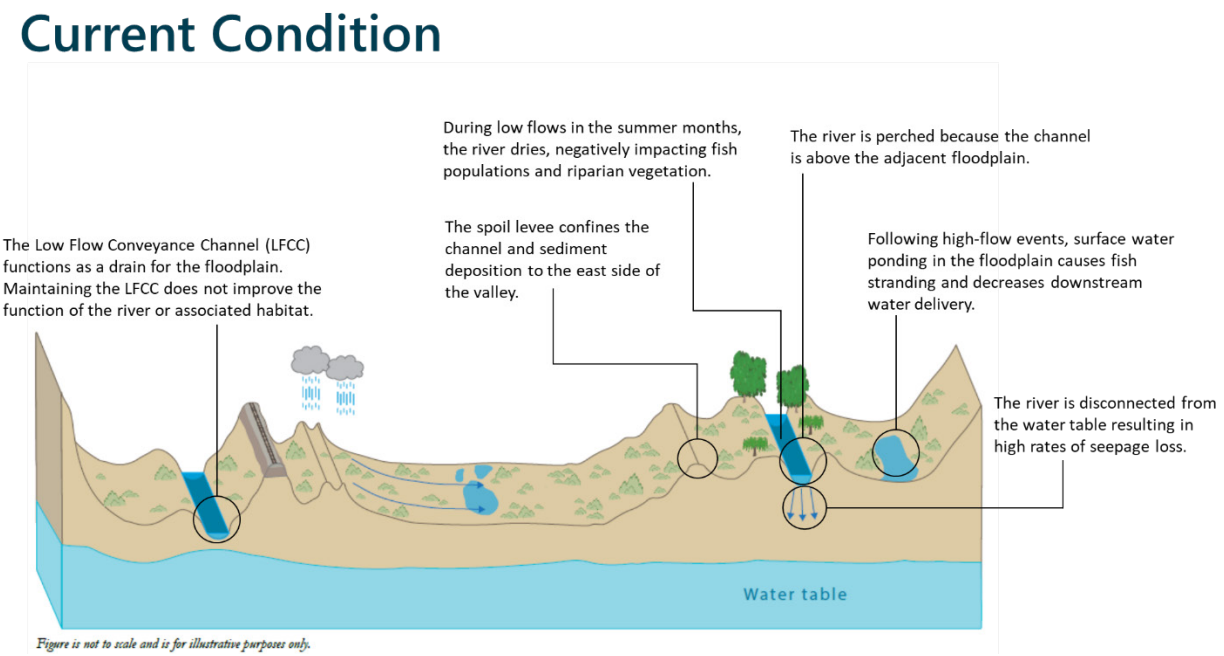


Figure 22. Lower San Acacia Reach schematic of the current condition

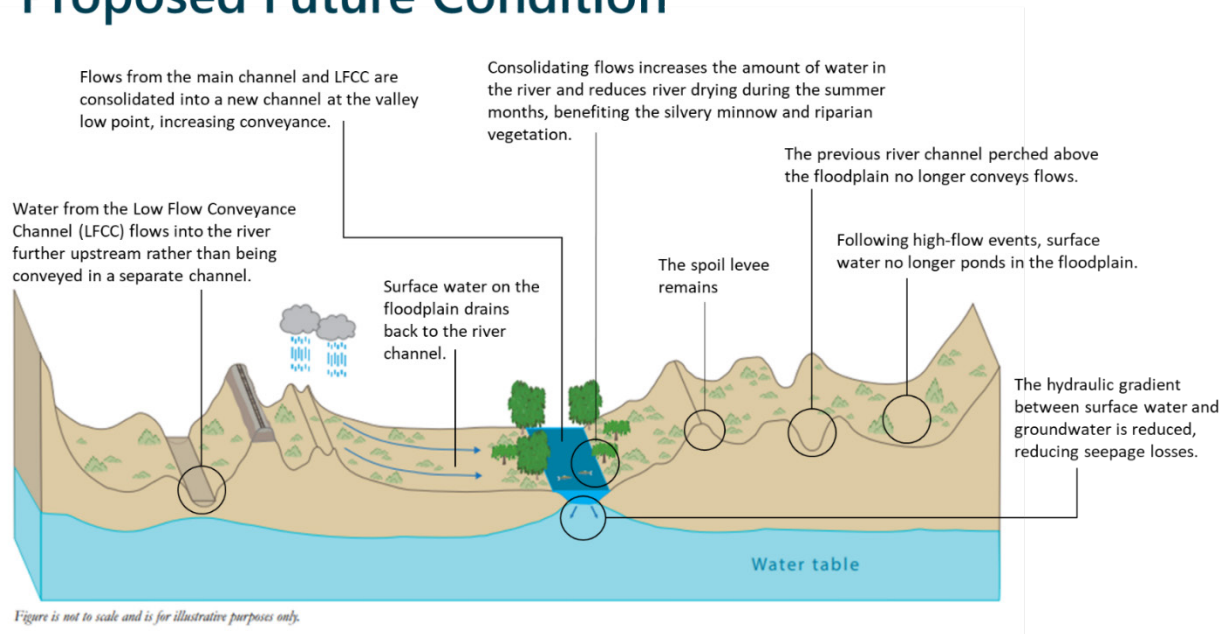


Figure 23. Lower San Acacia Reach schematic of the proposed future condition

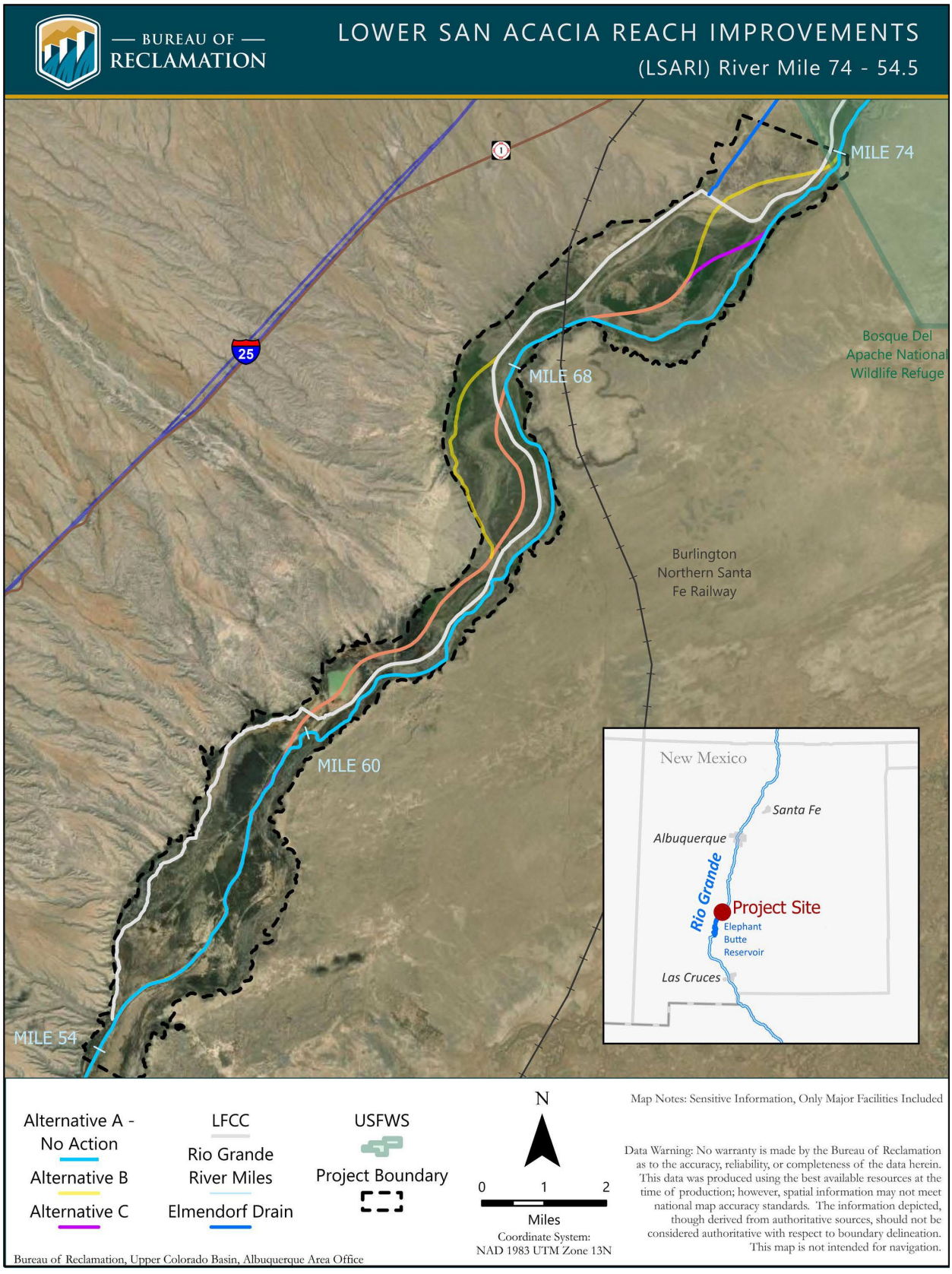


Figure 24. LSARI alternatives map

Programmatic Water Operations and River Maintenance ESA Compliance

The U.S. Fish and Wildlife Service (USFWS) issued a final *Biological and Conference Opinion for Bureau of Reclamation, Bureau of Indian Affairs, and Non-Federal Water Management and Maintenance Activities on the Middle Rio Grande* (Consultation Number 02ENNM00-2013-F-0033) (MRG BO) on December 2, 2016. The non-jeopardy determination in the MRG BO is based on the Proposed Action and mandatory accomplishment of numerous commitments by Reclamation and the MRG BO partners (86 Conservation Measures, 11 Reasonable and Prudent Measures, and 50 Terms and Conditions). The USFWS provided an Incidental Take Statement for the RGSM, flycatcher, and cuckoo.

In 2023, Reclamation and the MRG BO Partners continued implementing the commitments set forth in the MRG BO. Several large-scale projects, (excluding Delta Channel maintenance; see River Maintenance section of this report), had no effect on suitable flycatcher habitat due to avoidance measures or lack of suitable habitat affected by Reclamation. Activities along the MRGP included the following in 2023:

- Maintenance of Low Flow Conveyance Channel (LFCC), including maintenance in the RM 60 area
- Truth or Consequences Reach channel maintenance
- Delta Channel maintenance (incidental take listed)
- BdA Pilot Realignment – knickpoint removal
- Santa Ana RM 205.8
- LFCC Sloughing repair (BdA)
- San Antonio stockpile relocation
- Ft. Craig Mitigation mastication
- South Boundary cattle fencing

The 2023 MRG BO annual report to the USFWS will provide more information on the implementation of BO requirements and the Proposed Action.

Rio Grande Silvery Minnow

Since 1993, Reclamation has funded or supported the systematic sampling of the fish community in the MRGP with a focus on the endangered RGSM (*Hybognathus amarus*). With some exceptions (e.g., 1998), fish sampling by seining has been conducted monthly from April to November at 20 standard monitoring sites along the river (Dudley et al. 2023a). For comparison among years, seasons, and sites, the catch of RGSM is standardized as density or CPUE (RGSM/100m^2). In 2017, 10 additional sites (30 total) were added to the survey protocol during October with 10 additional sites (40 total) added to the survey protocol in October 2023 (Dudley et al. 2023b). CPUE is reported for the 20 standard sites, 30 sites, and 40 sites (Standard, Standard and Additional 10, Standard and Additional 20).

Incidental take of RGSM is authorized for the Proposed Action if October density is greater than or equal to 1.0 fish per 100 m^2 for 10 of the 15 years of the MRG BO's duration, October density is less than 1.0 fish per 100 m^2 for no more than five of the 15 years, and October density is less than

0.3 fish per 100 m^2 for no more than two of the 15 years. Incidental take for the RGSM will be considered exceeded if these densities and time limits are not met because of the Proposed Action.

Based on monitoring data from the 20 standard sites, RGSM were present at 13 of 20 sites with an overall CPUE of 3.4 RGSM/100 m^2 during October 2023 (Dudley et al. 2023b, Dudley et al. 2024). At these 20 standard sites, the October 2023 CPUE was substantially higher than the October 2022 CPUE of 0.08 RGSM/100 m^2.

Based on the 30 sampling sites, RGSM CPUE in October 2023 was 4.8 RGSM/100 m^2 (Dudley et al. 2024). This estimate was higher the 20 standard site CPUE estimate of 3.4 RGSM/100m^2. The species was present at 22 of those 30 sites in October 2023 (Dudley et al. 2023b).

Based on the 40 sampling sites, RGSM CPUE in October 2023 was 4.5 RGSM/100m^2 (Dudley et al. 2024) This estimate was higher than the 20 standard site CPUE estimate of 3.4 RGSM/100m^2, but lower than the 30 site estimate of 4.8 RGSM.100m^2. The species was present at 27 of 40 sampling sites (Dudley et al. 2023b).

In the annual reports, RGSM status, trends, and mixture model-estimated RGSM CPUE are used for long-term analyses, mesohabitat associations, sampling variation evaluation, and modeled to evaluate their relationships to flows or other environmental conditions (see Dudley et al. 2023a). A two-model approach is used to separate presence or absence of RGSM from their actual abundance so that the errors are properly estimated.

The changes in the occurrence and estimated CPUE of RGSM were reliably predicted by seasonal differences in flows across years (1993–2023; Dudley et al. 2023a). Extended high flow during spring runoff appears to be crucial in explaining why some years had dramatically elevated RGSM CPUE. In contrast, poor spring runoff and extended low flow during summer were key to explaining reductions in the occurrence of this species across years. Prolonged high flow during spring runoff was most predictive of increased CPUE and prolonged low flow during summer was most predictive of decreased CPUE of RGSM over time in the river (Dudley et al. 2023a).

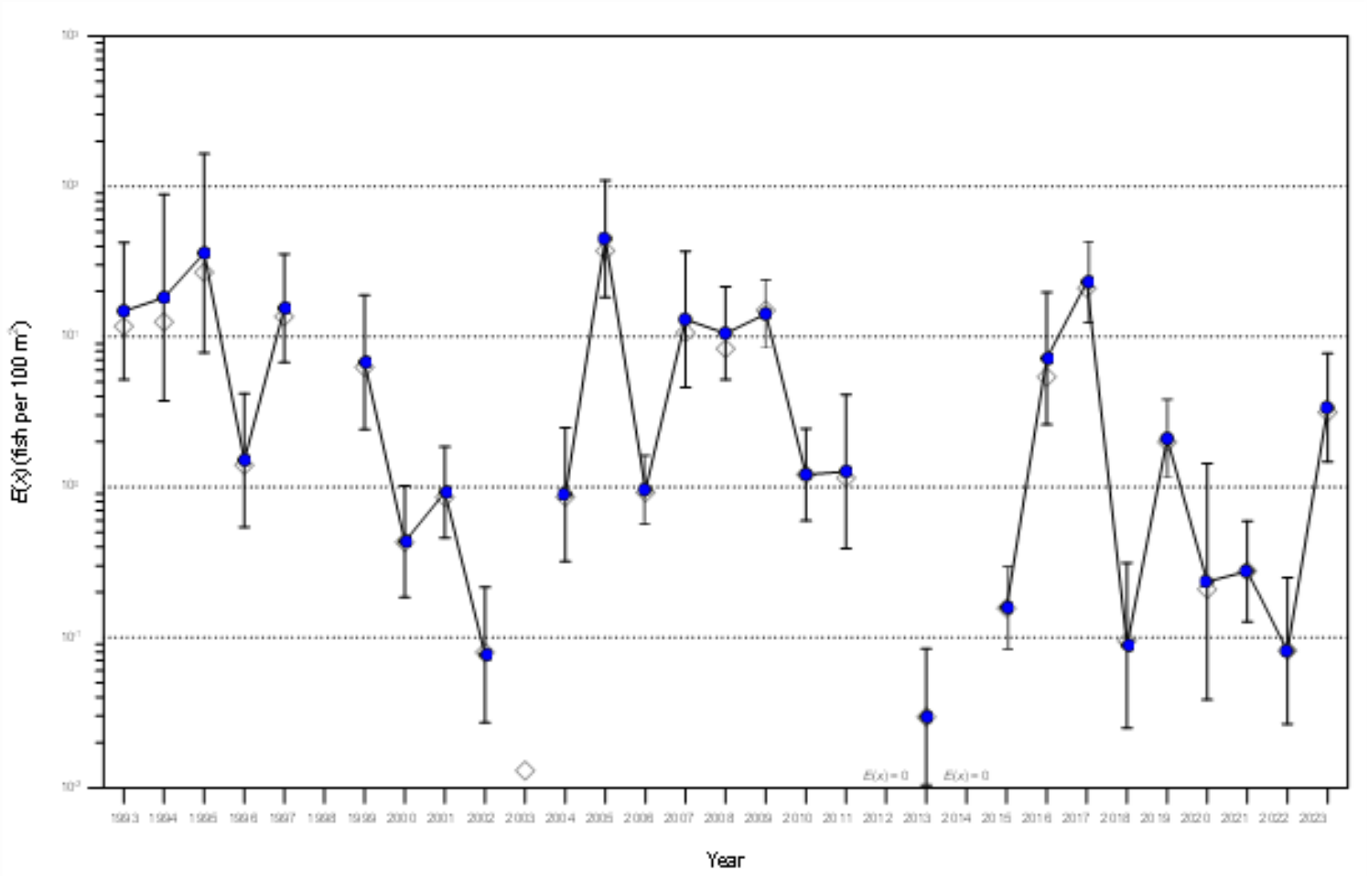


Figure 25. RGSM estimated CPUE (E(x)) using stand site (20 sites) October data for 1993-2023 (Dudley et al. 2023b, Dudley et al. 2024).

Literature Cited:

Dudley, R.K., S.P. Platania, and G.C. White. 2023a. Rio Grande Silvery Minnow Population Monitoring during 2022. Annual Contract 140R4019P0048 Report to Bureau of Reclamation, American Southwest Ichthyological Researchers, Albuquerque, NM.

Dudley, R.K., S.P. Platania, and G.C. White. 2023b. Rio Grande Silvery Minnow Population Monitoring during October 2023. November Contract 140R4019P0048 Report to Bureau of Reclamation, American Southwest Ichthyological Researchers, Albuquerque, NM.

Dudley, R.K., S.P. Platania, and G.C. White. 2024. Rio Grande Silvery Minnow Population Monitoring during 2023, Annual Summary Written Communication. Annual Contract 140R4019P0048 Report to Bureau of Reclamation, American Southwest Ichthyological Researchers, Albuquerque, NM.

Southwestern Willow Flycatcher

The flycatcher (*Empidonax traillii extimus*) was listed as endangered by the USFWS effective March 29, 1995. The 2013 final designation of critical habitat defines two units located along the Rio Grande in New Mexico: the Upper Rio Grande Management Unit and the Middle Rio Grande Management Unit. No critical habitat was designated for the Lower Rio Grande Management Unit (Elephant Butte Dam to El Paso, TX).

Incidental take of flycatcher would be considered exceeded if more than 26 flycatcher territories are displaced in any year because of the Proposed Action, or if more than 2,071 acres of suitable flycatcher habitat are impacted because of the Proposed Action over the 15-year MRG BO duration.

In 2023, incidental take occurred to vegetation with 47 acres of temporary and permanent impacts to moderately suitable and suitable habitat for the flycatcher. There was no incidental take of flycatcher nest territories in 2023 from on-the-ground project activities.

During the summer of 2023, Reclamation conducted surveys and nest monitoring of flycatchers in 11 distinct reaches along approximately 161 miles of the Rio Grande, between the Isleta Pueblo and El Paso, TX (Table 11). Surveys were performed to contribute to the baseline population data of the flycatcher along the Rio Grande, and to meet Reclamation's ESA compliance commitments for the MRG BO as well as the ESA compliance for the Rio Grande Project (see ESA Compliance for Operating Agreement and Storage of SJCP Water).

In 2023, a total of 850 resident flycatchers were documented. These flycatchers established 467 territories, of which 383 had pairs. This represents a 34 percent decrease in territory numbers from 2022, although comparisons are difficult as only selected sites were surveyed in certain reaches. As in previous years, the San Marcial Reach was by far the most productive, containing 589 resident flycatchers and 321 territories, of which 268 were pairs – a 9 percent decrease in territories from 2022.

Table 11: Southwestern Willow Flycatcher Territories 2014-2023[1]

Location[2]	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014
Frijoles	N/S[3]	N/S	N/S	N/S	N/S	0	0	0	0	0
Belen	12	95	85	25	N/S	20	17	20	17	18
Sevilleta	N/S	17	N/S	N/S	N/S	12	4	5	8	4
San Acacia	N/S	0	N/S	N/S	0	0	0	0	0	0
Escondida	2	5	2	3	9	4	8	5	7	4
BdA	27	35	39	35	24	24	16	14	11	23
Tiffany	1	N/S	N/S	N/S	0	0	0	5	1	8
San Marcial	321	352	252	200	293	277	257	302	300	307
MRGP Subtotals	**363**	**504**	**378**	**263**	**326**	**337**	**302**	**351**	**344**	**364**
Caballo Reservoir	20	12	18	11	9	7	8	9	14	15
Caballo to El Paso, TX	84	96	107	109	91	77	60	41	31	26
RGP Subtotals	**104**	**108**	**125**	**120**	**100**	**84**	**68**	**50**	**45**	**41**
Total	**467**	**612**	**503**	**383**	**426**	**421**	**370**	**401**	**389**	**405**

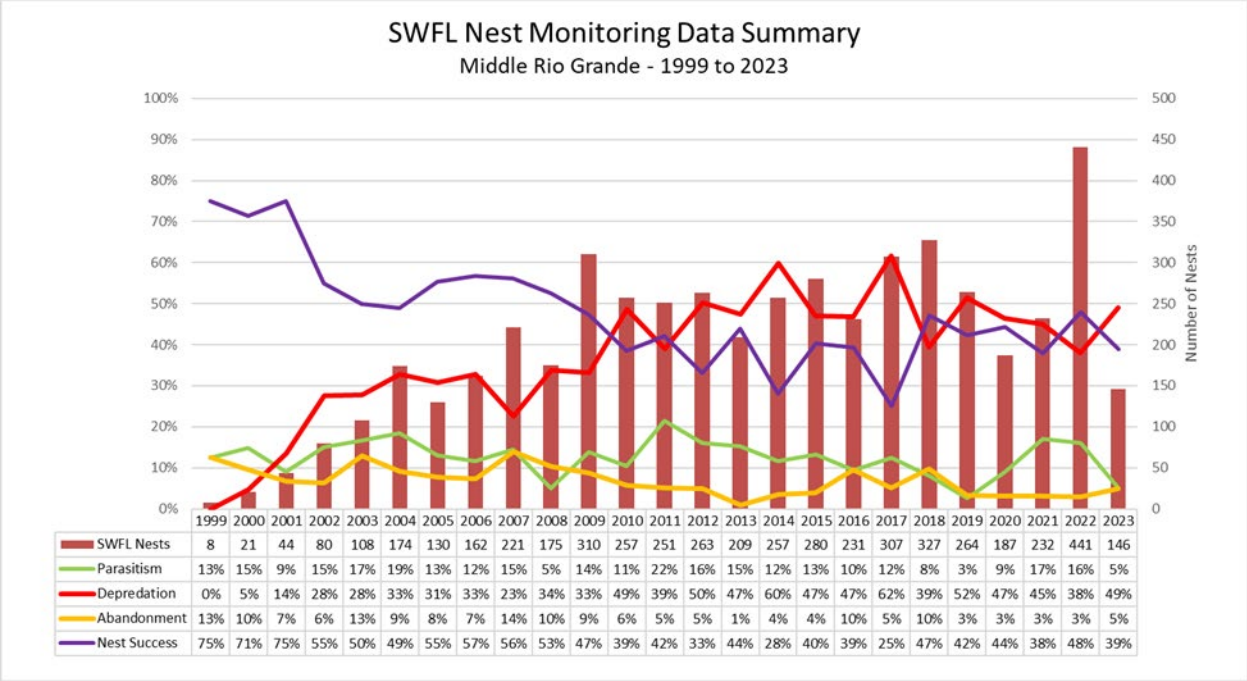
Other studies continued or updated in 2023 for ESA compliance in the MRGP and RGP areas include 1) flycatcher nesting hydrology and habitat variable study; 2) river maintenance impact monitoring; 3) saltcedar leaf beetle (*Diorhabda* spp.) impact monitoring; and 4) Elephant Butte delta hydrology monitoring. These studies are designed to provide insight into potential threats and habitat requirements of flycatcher and cuckoo populations.

At Elephant Butte Reservoir, flycatchers have expanded their occupied habitat south, to near Mitchell Point at RM 38. Flycatcher-occupied areas in the Elephant Butte Reservoir delta – RM 60 downstream to RM 54 – were previously mostly in dense Goodding's and coyote willow of various age classes, with water provided by the LFCC outfall. However, much of this willow-dominated habitat has declined in quality during the past 12 years due to drought and natural succession. Invasive saltcedar is also encroaching and becoming a larger component of occupied habitat. Although this provides some habitat characteristics for flycatchers, observations indicate that breeding flycatchers are not as successful or productive in saltcedar-dominated habitats. Additionally, the presence of the saltcedar leaf beetle is an issue as it will likely defoliate saltcedar during nesting periods, reducing foliage cover, and making nests more vulnerable to predation, parasitism, and changes in microclimate.

Habitat modeling since 2016 has shown that some suitable habitat remains unoccupied, thus indicating that habitat is not a limiting factor for this population. However, an overall reduction in the quality of the habitat is likely reducing success and productivity. It is likely that flycatchers do not expand into all areas of suitable habitat due to their nest site fidelity and overall population size.

[1] Breeding season only
[2] Table does not include detections outside of the active floodplain at BdA
[3] N/S = not surveyed

Nest success in the Middle Rio Grande has remained between 38 and 48 percent for the past six years following a study period low of 25 percent in 2017 (Figure 26).

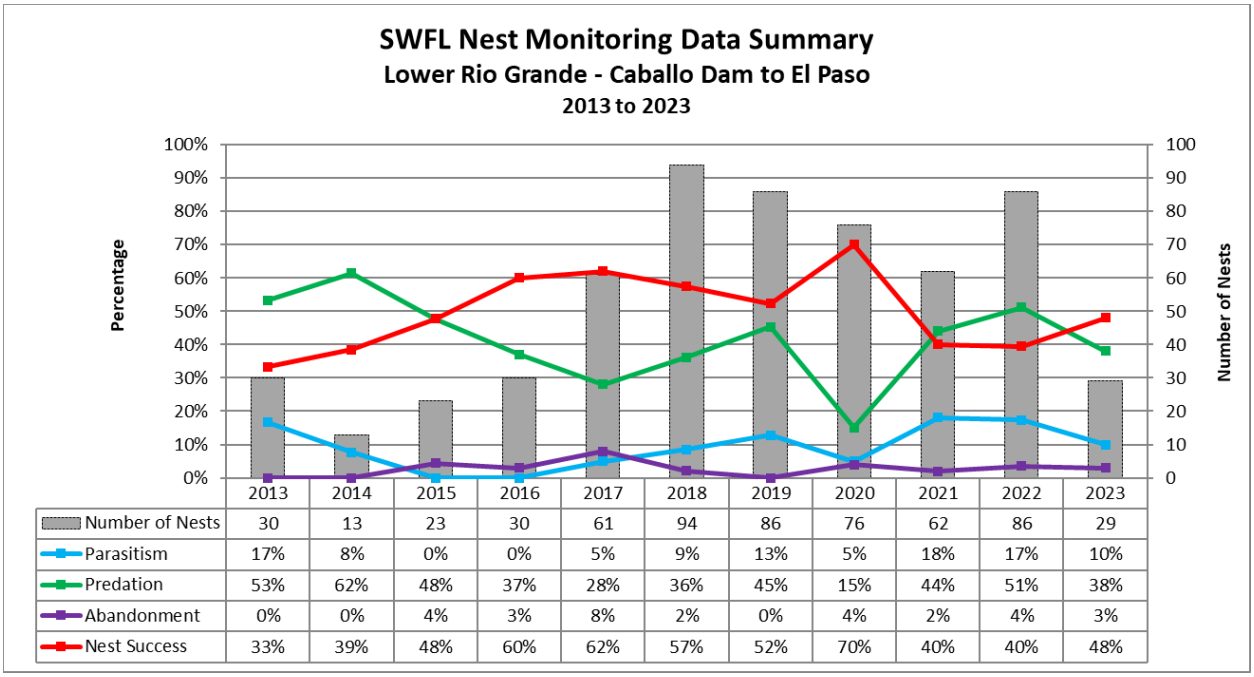


	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
SWFL Nests	8	21	44	80	108	174	130	162	221	175	310	257	251	263	209	257	280	231	307	327	264	187	232	441	146
Parasitism	13%	15%	9%	15%	17%	19%	13%	12%	15%	5%	14%	11%	22%	16%	15%	12%	13%	10%	12%	8%	3%	9%	17%	16%	5%
Depredation	0%	5%	14%	28%	28%	33%	31%	33%	23%	34%	33%	49%	39%	50%	47%	60%	47%	47%	62%	39%	52%	47%	45%	38%	49%
Abandonment	13%	10%	7%	6%	13%	9%	8%	7%	14%	10%	9%	6%	5%	5%	1%	4%	4%	10%	5%	10%	3%	3%	3%	3%	5%
Nest Success	75%	71%	75%	55%	50%	49%	55%	57%	56%	53%	47%	39%	42%	33%	44%	28%	40%	39%	25%	47%	42%	44%	38%	48%	39%

Figure 26: Summary of flycatcher nesting in the MRGP from 1999 to 2023.

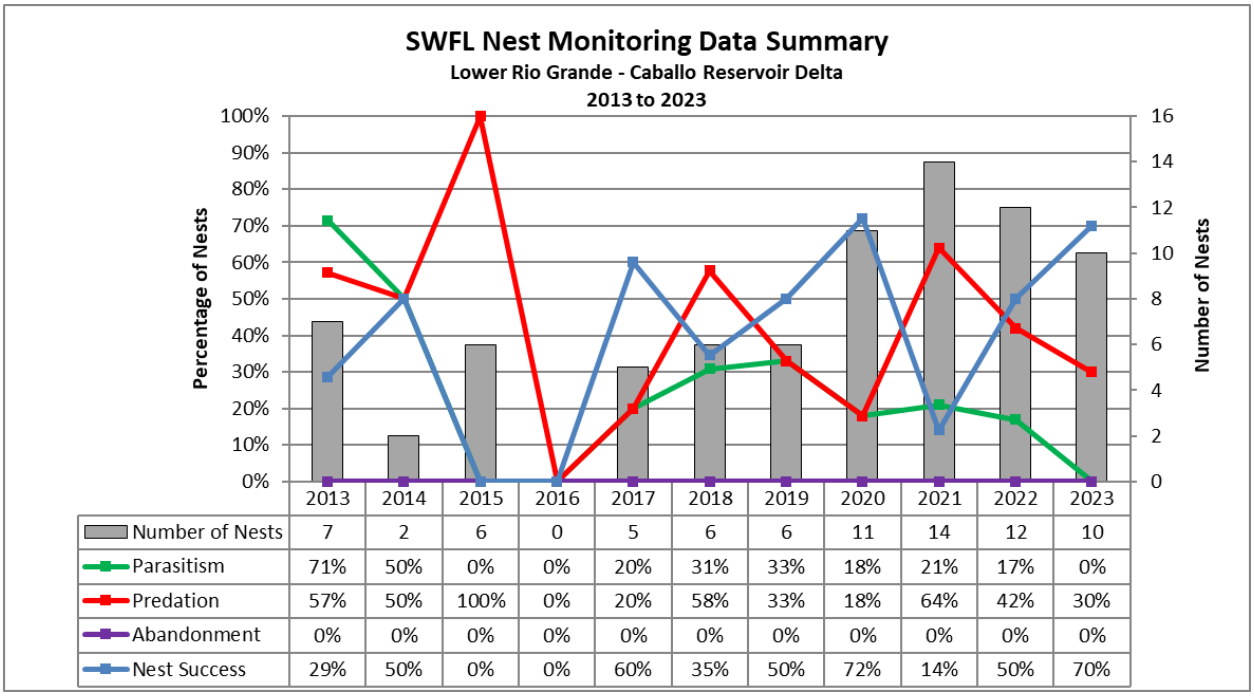
The decline in nest success from 2006 to 2017 may be related to the decline in habitat suitability and quality in heavily populated areas. Depredation, the biggest source of nest failure, averaged 27 percent from 1999 to 2011. Since 2012, the depredation rate has nearly doubled, averaging 49 percent. The depredation rate in 2017 was 62 percent, the highest recorded since 1999, but dropped back to 39 percent in 2018.

These changes may be a result of reduced habitat quality because of lower flows. Drought conditions, which typically result in reduced discharge and groundwater levels, reduce plant vigor and canopy cover. This reduces nest concealment, exposing the nest to predators and changes in microclimate conditions. The saltcedar defoliation by the saltcedar leaf beetle has similar effects and may be of greater concern in the future. Nest success in the RGP area, both within the Caballo Reservoir Delta and downstream of Caballo Dam, has been higher in recent years, averaging 50 and 54 percent, respectively, between 2016 and 2023 (Figure 27, Figure 28).



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Number of Nests	30	13	23	30	61	94	86	76	62	86	29
Parasitism	17%	8%	0%	0%	5%	9%	13%	5%	18%	17%	10%
Predation	53%	62%	48%	37%	28%	36%	45%	15%	44%	51%	38%
Abandonment	0%	0%	4%	3%	8%	2%	0%	4%	2%	4%	3%
Nest Success	33%	39%	48%	60%	62%	57%	52%	70%	40%	40%	48%

Figure 27: Flycatcher nest variables, Caballo Dam to El Paso, TX, 2013-2023



	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Number of Nests	7	2	6	0	5	6	6	11	14	12	10
Parasitism	71%	50%	0%	0%	20%	31%	33%	18%	21%	17%	0%
Predation	57%	50%	100%	0%	20%	58%	33%	18%	64%	42%	30%
Abandonment	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Nest Success	29%	50%	0%	0%	60%	35%	50%	72%	14%	50%	70%

Figure 28: Flycatcher nest variables, Caballo Reservoir delta, 2013-2023

During three of the past eight years (2017, 2019, 2023), the Rio Grande and LFCC both saw higher flows compared to the past several years, resulting in extensive overbank flooding and higher groundwater levels in some areas. This improved plant vigor, structure, density, and overall habitat

quality. Conversely, Rio Grande and LFCC flows were extremely low in 2018 and 2020 which likely had negative impacts on habitat quality. Also, during 2020, a 330-acre fire burned suitable occupied flycatcher habitat in the vicinity of Fort Craig, including an area that in 2019 contained 14 flycatcher territories. Fire has repeatedly impacted occupied habitat in 2021 and 2022, burning roughly 100 acres near Bosque, NM in 2021 and burning almost 400 acres downstream of Fort Craig in 2022.

Western Yellow-billed Cuckoo

The western distinct population segment of the cuckoo (*Coccyzus americanus occidentalis*) was listed as a threatened species by the USFWS in October 2014. Critical habitat for the cuckoo was designated in April 2021.

Along the Rio Grande, two critical habitat units are included in the designation:

- Unit 35 (NM-4), Upper Rio Grande 1, Rio Arriba County: a continuous 5-mile segment of the Upper Rio Grande from Lyden to Alcalde in Rio Arriba County (518 acres)
- Unit 37 (NM-6B), Middle Rio Grande, Sierra and Socorro Counties: a continuous 109-mile segment, from RM 54 within the Elephant Butte Reservoir pool upstream to Bosque Farms. The largest breeding population of cuckoos north of Mexico is within this reach (46,595 acres)

Incidental take of cuckoos would be considered exceeded if more than 11 cuckoo territories are displaced in any year because of the Proposed Action, or if more than 2,071 acres of suitable cuckoo habitat are impacted as a result of the Proposed Action over the 15-year MRG BO duration.

There was incidental take of one cuckoo nest territory in 2023 due to construction activities for one of Reclamation's projects. The Rio Grande Delta Channel Maintenance project between RM 45 and RM 55 involved vegetation and sediment removal for levee maintenance and resulted in incidental take of 1 cuckoo nest territory centered on a levee breach that was fixed. Additionally, incidental take occurred to 30 acres of vegetation with temporary and permanent impacts to suitable habitat for the cuckoo.

During 2023, Reclamation conducted cuckoo surveys in 11 distinct reaches of the Rio Grande, within sites also surveyed for flycatcher, from the south boundary of the Pueblo of Isleta to El Paso, Texas (Table 12). Surveys were conducted to contribute to baseline population data of the cuckoo along the Rio Grande and to meet Reclamation's ESA compliance commitments for the MRG BO and ESA compliance commitments for the Rio Grande Project (see ESA Compliance for Operating Agreement and Storage of SJCP Water). In 2023, there were an estimated 145 breeding territories, all assumed to be pairs, derived from 559 cuckoo detections. The estimated territories and documented detections were most concentrated in the southern portion of the San Marcial Reach, i.e., Elephant Butte Reservoir pool, and in the delta of Caballo Reservoir.

Table 12: Cuckoo Detections/Estimated Territories 2014-2023[1]

Location[2]	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014
Belen	10/1	40/11	22/5	15/3	N/S	41/10	34/4	54/12	39/10	24/5
Sevilleta	N/S[3]	50/11	N/S	N/S	N/S	41/10	12/4	32/10	18/5	9/2
San Acacia	N/S	24/6	N/S	N/S	28/8	47/14	50/13	23/8	27/8	15/4
Escondida	14/6	3/1	13/2	16/5	51/11	55/10	44/11	58/16	62/16	27/7
BdA	98/28	46/14	70/15	49/11	59/14	46/13	43/10	32/11	40/12	34/12
Tiffany	2/0	N/S	N/S	N/S	0	0	2/0	9/0	2/0	2/0
San Marcial	322/79	317/79	198/45	68/17	190/42	193/49	227/56	220/59	215/59	190/61
MRG Subtotal	**452/114**	**480/122**	**303/67**	**148/36**	**328/75**	**423/106**	**412/98**	**428/116**	**403/110**	**301/91**
Caballo	56/16	100/25	90/18	72/16	47/11	58/13	64/16	62/15	48/15	28/8
Percha	13/3	11/2	13/2	22/4	13/2	7/1	8/2	3/1	1/0	0/0
Hatch	27/8	11/3	10/2	21/4	11/2	17/6	11/1	6/2	4/1	0/0
Radium Springs	10/4	7/2	8/1	19/5	9/3	25/7	10/4	16/6	10/4	8/2
Las Cruces	1/0	5/1	0	0	12/2	10/3	9/3	N/S	N/S	N/S
Mesilla	0	0	0	1/0	5/1	9/2	0	N/S	N/S	N/S
RGP Subtotal	**107/31**	**141/35**	**121/23**	**135/29**	**101/21**	**126/32**	**93/23**	**87/24**	**63/20**	**36/10**
Total	**559/145**	**621/157**	**424/90**	**283/65**	**429/96**	**549/138**	**505/121**	**515/140**	**466/130**	**337/101**

[1] Breeding season only
[2] Table does not include detections outside of the active floodplain at BdA
[3] N/S = Not Surveyed

New Mexico Meadow Jumping Mouse

The jumping mouse (*Zapus hudsonius luteus*) was listed as an endangered species under the ESA in June 2014, with final critical habitat designation following in March 2016. While designated critical habitat units for the species occur in Colorado, New Mexico, and Arizona, only Unit 6 (BdA) is within the MRGP. Unit 6 consists of 995 acres along 13.1 miles of ditches and canals associated with managed irrigation for wildlife purposes on BdA in Socorro County, NM. This unit begins in the northern part of the BdA and generally follows the Riverside Canal to the southern boundary of the refuge. Jumping mice have not been found on the Rio Grande in this area. The BdA habitat adjacent to the Riverside Canal is the only known occupied mouse habitat within the Middle Rio Grande Valley.

Except for BdA, systematic surveys for jumping mice and their habitat have not been conducted throughout the riparian corridor of the MRGP. However, since its listing, surveys for suitable jumping mouse habitat have occurred in selected areas as part of environmental compliance activities for specific projects, such as the Delta Channel maintenance (Reclamation, 2014). The Delta Channel is located outside the southern edge of the geographic area that the jumping mouse could potentially inhabit. The habitat assessment determined that the Delta Channel area is not a suitable natural environment based on the herbaceous vegetation composition and structure, lack of soil moisture, high frequency and long history of disturbance, and lack of regular inundation necessary to support jumping mouse habitat. It is therefore unlikely that suitable or occupied jumping mouse habitat exists south of BdA and no additional populations have been identified along the MRGP.

While the MRG BO does not provide any supportive analysis for jumping mouse ESA requirements, Reclamation is committed to support efforts by the BO Partners or others seeking to provide water to BdA when it is available, dependent on available water supply and the water rights of BdA and other users. Reclamation continues to partner with BdA and MRGCD to support water delivery infrastructure improvements on the refuge that are supportive of mouse habitat, including during 2023. Reclamation's activities have included design and construction support, planning, and compliance technical services to facilitate BdA infrastructure improvements.

Literature Cited:

Reclamation. 2014. River Maintenance Program: San Marcial Delta Water Conveyance Channel Maintenance Project Biological Assessment. Bureau of Reclamation, AAO, September 2014, 80 pp.

Active MRG Litigation

On November 30, 2022, the WildEarth Guardians filed a lawsuit against the USFWS and Reclamation (Case No. 1:22-cv-914) regarding the MRG BO. The MRGCD intervened without protest and the State of New Mexico joined as an Amicus party. Numerous stays have been granted for settlement negotiations, which continue as of the date of this report.

Middle Rio Grande Endangered Species Collaborative Program

In response to ESA species listings in the Middle Rio Grande, ESA-related litigation, and the 2001 and 2003 BOs, the Middle Rio Grande Endangered Species Collaborative Program (Collaborative

Program) was formed, bringing various groups together to support ESA compliance for the RGSM and flycatcher, and address environmental issues along the MRGP.

The Collaborative Program consists of stakeholders representing diverse interests including federal, state, and local government entities, Pueblos and Tribes, and non-governmental organizations working to protect and improve the status of listed species along the MRGP while protecting existing and future regional water uses in compliance with applicable state and federal laws, including Compact delivery obligations.

The Collaborative Program is not included in the MRG BO and does not have responsibility or authority for meeting requirements. However, Reclamation and the partners work with the Collaborative Program to provide science recommendations in support of adaptive management. The Collaborative Program also hosts an annual symposium for entities conducting science within the basin to share information and maintains the online portal and common database management system as common repositories for information, reports, and data.

In 2023, Reclamation funded third-party management of the Collaborative Program as well as ongoing monitoring activities and studies related to endangered species. This included funding in the amount of $2,783,404 to the Collaborative Program. 2023 accomplishments include the following.

- Minnow Action Team meetings in March, April and June
- Captive propagation of RGSM at multiple facilities
- Annual monitoring of endangered species, reproductive success, and habitats
- Ongoing genetics studies of RGSM
- RGSM rescue and salvage efforts during river drying
- Hydrobiological Objective was refined through modeling
- Habitat Restoration Field Trips to see how Sandia Pueblo utilizes goats for vegetation control and to see the developments at the City's Candelaria Nature Preserve
- Collaborative Seminars presenting a variety of information including: Climate Modeling, Ecological Recovery Wheel, Water Quality and Ecosystem Processing, RGSM Population Monitoring, Soil Fungal Communities, Post-Fire Flooding and Recovery, National Aeronautics and Space Administration's (NASA) Western Water Application Office (WWAO), and an onsite seminar at the NRCS Plant Materials Center
- Continued advancement and population of the Science and Adaptive Management Information System (SAMIS). The SAMIS is a relational database that draws linkages between implemented or proposed activities and critical uncertainties, management questions, and Collaborative Program objectives. This enables prioritization of research needs and informs decision-making.
- Continued work by the Science & Technical Ad Hoc Groups to complete scientific and technical tasks designed to address specified scientific uncertainties and knowledge gaps, and to further implementation of the Science & Adaptive Management Plan.
- Program management, assessment, reporting, and outreach activities.

RiverEyes

The RiverEyes program was developed to provide current information on river flows and river drying, allowing water management agencies to react quickly to changing river conditions. The MRG

BO does not set specific flow targets or maximum rates of drying and instead focuses on thresholds of RGSM density in October. Water operations coordination is critical to maintaining RGSM densities, and RiverEyes facilitates coordination among agencies that may prevent unexpected drying and helps prepare for and initiate RGSM salvage.

For the 2023 irrigation season, RiverEyes monitored river conditions along the Rio Grande from Albuquerque into the full pool elevation of Elephant Butte Reservoir. Field monitoring occurred from mid-July through late October. Drying started in the San Acacia Reach on July 21 and the river reconnected on November 5. In 2023, only one segment dried in this reach, from the Neil Cupp Hub area near RM 90 extending downstream to the Fort Craig area near RM 64.

The continued decline in natural flow during the summer led to drying in the Isleta Reach beginning on August 4. Two segments dried in that Reach. In the area near the Peralta Wasteway outfall, 7.04 unique river miles dried between August 4 and November 1. The channel near the Abeytas heading had 2.13 unique miles dry between September 9 – 12 and September 30 – October 17.

The total number of river miles affected by drying at some point in 2023 was 40.0 miles: 30.83 miles in the San Acacia Reach and 9.17 miles in the two segments in the Isleta Reach. Flow measured at the Central Avenue Bridge in Albuquerque was at times quite low, but monitoring did not find channel drying in the Angostura Reach in 2023.

The 2023 season had a poor monsoon but the few storms that occurred seemed to provide additional flow when it was needed most, and this helped to keep the Angostura Reach connected. The river fully reconnected from Cochiti Dam to Elephant Butte Reservoir on November 5.

Supplemental Water Program

Reclamation initiated its Supplemental Water Program in 1996 to support water needs of the ESA-listed species in the MRGP. The program originally included water acquisition, reservoir storage, and release of water to support river flows. From 2001 to 2020, it also included operation of a pumping network in the San Acacia Reach to pump water from the LFCC to the river. The Supplemental Water Program supports the MRG BO.

Water Acquisition and Management

In 2023, a total of 14,787 ac-ft of supplemental water was released for endangered species purposes. Of that volume, 5,227 ac-ft was water that Reclamation leased from 2022 SJCP contractor allocations and 9,560 ac-ft came from 2023 leases.

The release of supplemental water began on July 13 at 50 cfs. It increased to 100 cfs from July 18 to 23 to help limit the rate of initial river drying, and then was reduced to 40 cfs on July 29 to August 17. As natural flow into the MRG declined and MRGCD began to limit irrigation deliveries in mid-August, the supplemental release was increased to 80 cfs from August 18 to October 5. The release was slowly reduced to 40 cfs until the final 2023 release on October 30. The river reconnected from Cochiti Dam to Elephant Butte Reservoir on November 5 and remained connected through the remainder of the year.

Reclamation's supplemental water account ended 2023 with 1,331 ac-ft in storage in Heron and 1,015 ac-ft in storage in Abiquiu leased from 2023 SJCP contractor allocations. An additional

approximately 537 ac-ft in storage Abiquiu was leased from an SJCP contractor in early 2024. In 2024, Reclamation is negotiating leases of approximately 12,000 ac-ft from SJCP contractor allocations. However, water available from those leases could be much less than 12,000 ac-ft, depending on the overall SJCP allocation.

Other Sources of Supplemental Water

In addition to the water released by Reclamation, four other sources of water were used to support the needs of the ESA-listed species in 2023. They were pre-1907 native water rights leased by Reclamation, SJCP water leased by Audubon Southwest, pre-1907 native water rights conveyed to Reclamation as part of a settlement with the City of Rio Rancho (RR-SWA), and the Environmental Water Leasing Program (EWLP), a fallowing program within the MRGCD largely funded by Reclamation. Water from all sources was released to the river via MRGCD wasteway outfalls and coordinated closely. Potential points of release for this water were the following outfalls: Sandia Lakes Wasteway, Central Wasteway, Alejandro Wasteway, 240 Wasteway, Los Chavez Wasteway, New Belen Wasteway, Lower Peralta #2 Drain, and San Francisco Drain. The first two outfalls only released Audubon's water.

As shown in Table 13, approximately 4,325 ac-ft was released to the river by MRGCD at various locations. Most of the release came from the EWLP. All releases except Audubon's, which was released at the Sandia Lakes Wasteway in the Angostura Reach, were made in the Isleta Reach.

Table 13: 2023 MRGCD Outfall Deliveries

Delivery Dates, 2023	Delivered Water Volume, ac-ft	Water Source
June 11 – July 11	78.98	Native water acquired, permitted, and used for offset
July 8 – 10	60.63	Native water acquired, permitted, and used for offset
August 31 – September 29	577	SJCP (Audubon New Mexico)
July 13 – September 30	500	Native water acquired by RR-SWA
July 13 – October 31	2,958	Native water acquired by EWLP
TOTAL	4,175	

Reclamation leased 139.61 ac-ft of pre-1907 native water rights from the Town of Bernalillo and they were permitted for offset via the NMISC's Strategic Water Reserve. The offset water released from the 240 Wasteway outfall from June 11 to July 11 and from the Lower Peralta #2 Drain from July 8 to 10.

Audubon Southwest began 2023 with 346 ac-ft of SJCP water acquired in previous years in storage in Abiquiu Reservoir. In 2023, they added leases of SJCP water as follows: 50 ac-ft with the City of Belen from the 2022 allocation, 200 ac-ft with the Village of Los Lunas, and 100 ac-ft with the City of Belen from 2023 allocations. After 2023 releases of 577 ac-ft, Audubon Southwest ended 2023 with no storage in Abiquiu Reservoir. Transit losses moving water from Heron to Abiquiu were 2.75 ac-ft and evaporative losses while in storage in Abiquiu in 2023 were 16.1 ac-ft. Audubon retains 100 ac-ft of Los Lunas' waivered 2023 allocation in Heron Reservoir.

Deliveries of Audubon water were made to the Sandia Lakes Wasteway outfall in the Angostura Reach. Releases from Abiquiu began on August 31 and continued through September 29. Other than the final day, the release was 10 cfs.

A protest of a permit application by the City of Rio Rancho resulted in a May 2019 *Settlement and Cooperative Water Agreement* under which Reclamation leases 500 ac-ft of pre-1907 consumptive use water rights from Rio Rancho. In 2023, the water rights offset releases were from the 240 Wasteway from July 13 to September 30 and from the Los Chavez Wasteway from July 13 to 31.

In 2023, there were 922.66 acres enrolled in the EWLP for the full season and 216.44 acres for the partial season. During the irrigation season, the EWLP receives a credit, in ac-ft, for all enrolled acres, prorated to account for water availability (the extent to which MRGCD supply, defined as the release from Cochiti Dam available for MRGCD use and not including supplemental water and ABCWUA's release, covers MRGCD's daily demand). MRGCD, Audubon, and Reclamation then coordinated on release of EWLP water. The 2023 credit was 2,962 ac-ft, of which 2,958 ac-ft were released. The remaining 4 ac-ft of EWLP credit was not released and does not carryover.

Pumping to the River

The Neil Cupp pumping site, originally developed by Reclamation for temporary pumping operations from the LFCC to the river, was converted to a permanent pumping site by MRGCD after Reclamation ceased LFCC-to-river pumping in 2020. It is owned and operated by MRGCD and is capable of pumping to both the river and irrigation facilities. In 2023, MRGCD pumped 262 ac-ft from the Neil Cupp site to the river from July 16 to 23 at approximately 20 cfs to maintain river connectivity as flow into the reach declined.

Rio Grande Project, New Mexico – Texas

Reclamation's AAO and the Elephant Butte Field Division are jointly responsible for the operations of the RGP (Figure 29). Elephant Butte Field Division operates and maintains Elephant Butte and Caballo Dams and the Elephant Butte Powerplant. Reclamation determines the release from Elephant Butte Dam to meet irrigation demand while supporting hydropower production, maintaining compliance, and achieving other benefits. The release from Caballo Dam is based on irrigation demand to make water deliveries at the canal headings for the EBID, EPCWID, and the Republic of Mexico (under the 1906 Convention).

EBID operates and maintains Reclamation's diversion dams on the Rio Grande – Percha, Leasburg, and Mesilla in New Mexico – under a contract with Reclamation. The IBWC owns, operates, and maintains the American Diversion Dam and the American Canal in Texas in accordance with the International Treaties with Mexico (1906 and 1933). In addition, the IBWC operates the International Diversion Dam, which diverts irrigation waters into the Acequia Madre head gates operated by Mexico.

The irrigation and drainage system of the RGP is owned, operated, and maintained by EBID in New Mexico and EPCWID in Texas. Reclamation owns and administers the lands and rights-of-way activities of the reservoirs and diversion dam areas in New Mexico and retains the title and O&M responsibilities for Elephant Butte and Caballo Dams and the Elephant Butte Powerplant.

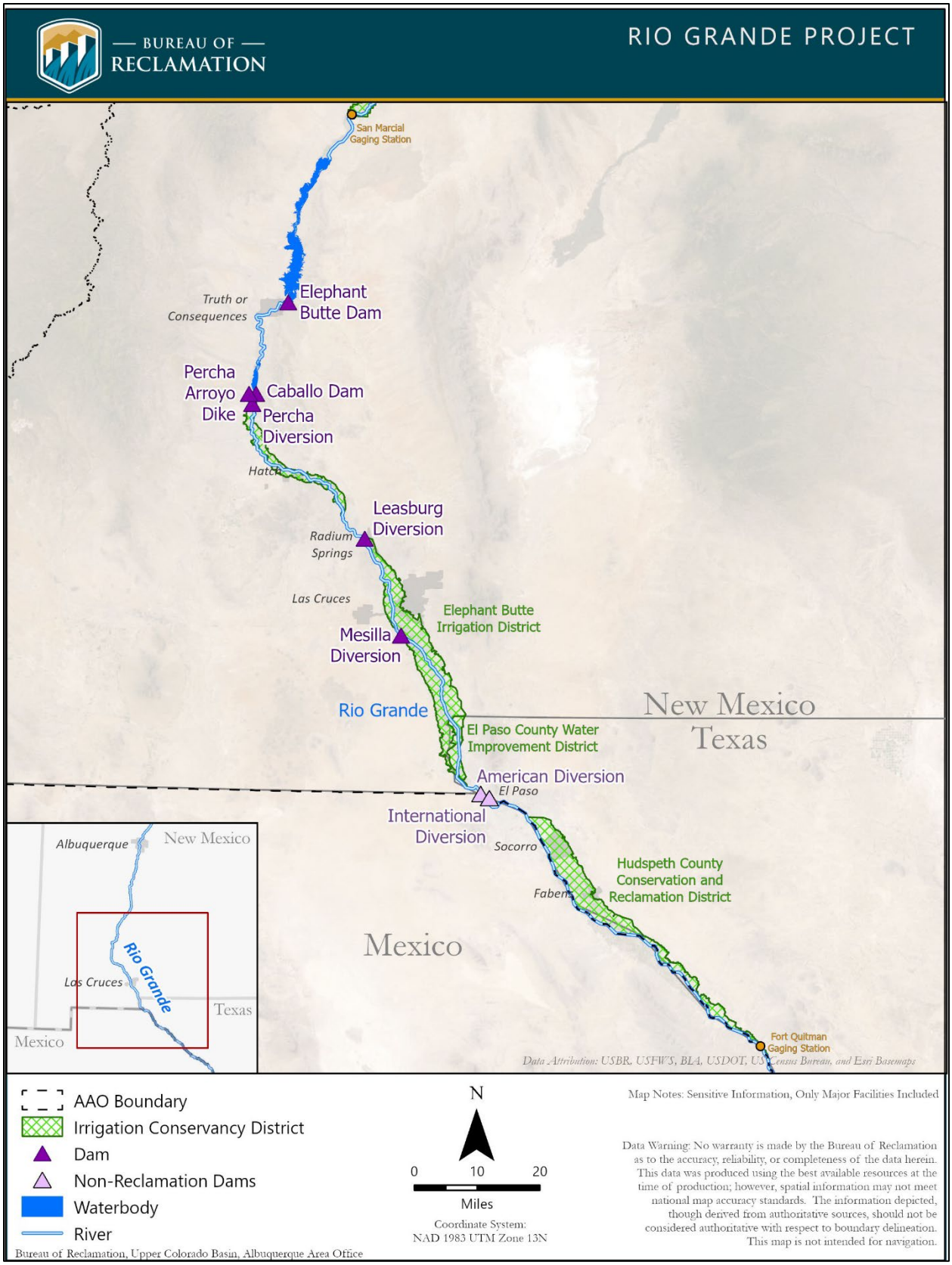


Figure 29: Area Map of the Rio Grande Project

Rio Grande Project Operations

Combined total storage (SJCP, Compact Credit, and RGP) for Elephant Butte and Caballo Reservoirs for 2023 began with 278,321 ac-ft, 12 percent of total capacity, and ended with 476,324 ac-ft (20 percent). Maximum combined total storage was 618,283 ac-ft (26 percent) on July 1 and minimum was 278,321 ac-ft (12 percent) on January 1. Reclamation communicated with stakeholders to provide information and projections of reservoir elevations throughout the irrigation season.

Water Accounting for RGP Operations

Reclamation performs daily accounting of SJCP, Compact Credit, relinquishment credit, and native Rio Grande water for the Rio Grande in New Mexico, including the composition of water in reservoirs from Heron to Caballo. This accounting is needed to make daily water operations decisions. To perform this accounting, Reclamation utilizes the interagency Upper Rio Grande Water Operations Model (URGWOM). In URGWOM, an account with a non-zero value is assessed gains and losses, so for Elephant Butte accounts, end-of-year debits from the previous year are given a value of zero for the current year as to avoid incorrectly adding gains and losses to the debit.

Compact Credit Water

Compact credit water for Colorado and New Mexico is stored in Elephant Butte Reservoir and not included as RGP water. New Mexico began 2023 with a debit of 93,000 ac-ft., and Colorado began 2023 with a credit of 200 ac-ft.

Usable Water Accounting for RGP Operations

RGP supply is determined from the usable water on January 1, as defined in Compact Article 1, and tracked daily for increases from inflows and decreases from evaporation and releases. In 2023, the usable water in RGP storage (Elephant Butte and Caballo Reservoirs combined) was 277,327 ac-ft on January 1. RGP supply in storage started at a low on January 1, reached a high of 618,283 ac-ft on July 1 and ended the year at 468,094 ac-ft on December 31.

Article VII Restrictions

Article VII of the Compact stipulates that when usable water in RGP storage, using Compact the accounting method, is below 400,000 ac-ft, no native Rio Grande water will be stored in post-1929 reservoirs upstream of Elephant Butte Reservoir unless accrued credit water has been relinquished. Article VII restrictions were in place from January 1 through April 14, and was above 400,000 ac-ft from April 15 through September 6, then back below 400,000 acre-ft from September 7 through December 9, and back above 400,000 ac-ft from December 10 through December 31. The was no relinquishment credit stored in any post-1929 upstream reservoirs in 2023.

Elephant Butte Dam, Reservoir and Powerplant

In 2023, the minimum daily storage at Elephant Butte Reservoir was 227,459 ac-ft (elevation 4316.43 ft) on January 1. The maximum daily storage was 570,686 ac-ft (elevation 4346.67 ft) on July 1.

Reclamation began releases at Elephant Butte Dam on May 1 for irrigation demand and continued through October 11. During this period, a release of 511,487 ac-ft was recorded by the USGS Rio

Grande below Elephant Butte Gage. The Elephant Butte powerplant record showed releases of 416,534 ac-ft to meet downstream irrigation demand and manage Caballo Reservoir storage levels. Note that Elephant Butte operators consistently record a lower discharge than the USGS gage. The 2023 annual volume measured, including the seepage outside of releases, was 511,940 ac-ft.

The total gross hydropower generation for 2023 was 52,051,527 kilowatt-hours (kWhr). Net hydropower generation was 51,847,299 kWhr, which is 160 percent of the 10-year average (2013 through 2022) 32,449,587 kWhr.

Caballo Dam and Reservoir

Caballo Reservoir started 2023 at 50,862 ac-ft (4146.76 ft) and ended the year at 9,964 ac-ft (4131.45 ft). During 2023, the maximum storage was 58,055 ac-ft (4148.46 ft) on May 12. The minimum storage occurred on four consecutive days on October 13-16, at 6,048 ac-ft (elevation 4128.73 ft) due to outlet work maintenance operations.

The irrigation release period extended from May 1 through October 13, releasing 547,747 ac-ft as measured at the Rio Grande below Caballo Dam gage. During that period, Reclamation operated Caballo Reservoir to maintain storage levels adequate to respond to irrigation calls while protecting facilities and historical sites. The calendar year 2023 release volume measured at the gage was 548,082 ac-ft.

The diversion from Caballo Dam for Bonita Lateral irrigation was 1,146 ac-ft from January through December.

RGP Warren Act Deliveries

Through a Warren Act contract, Reclamation sells drainage flows from the RGP lands as supplemental irrigation water for approximately 18,000 acres of the HCCRD. Drainage flows out of the RGP to HCCRD are measured at three gaging stations near the Hudspeth County line: the Hudspeth Feeder Canal, the Tornillo Canal at Alamo Alto, and the Tornillo Drain. For 2023, 35,191 ac-ft of RGP drainage flow was measured flowing into Hudspeth County and 22,500 ac-ft during the charged contract period, March 1 through September 30.

Rio Grande Project Water Accounting

2023 Water Accounting

In December 2022, Reclamation allocated 7,374 ac-ft as the initial 2023 allocation to Mexico. The provision of the 1906 Convention for extraordinary drought was applied and Reclamation provided Mexico with monthly updated allocations until June 2023, the last in-season allocation to Mexico, 60,000 ac-ft (full allocation), was made. Mexico's allocation is calculated from the anticipated release of RGP water, and once allocated to Mexico, the U.S. cannot reduce the allocation even if the anticipated or actual release is significantly less than originally anticipated. If the actual release is less than the anticipated, an over delivery to Mexico is calculated only for the purposes of RGP water accounting, not as part of the 1906 Convention. This is further explained below in this section of the report. For 2023, an over delivery to Mexico did not occur.

The U.S. Districts, EBID, and EPCWID were provided an initial allocation in April 2023. Reclamation provided the U.S. Districts with updated allocations monthly as RGP water in storage increased. The last in-season allocation was in May due to the amount of water available for release being more than estimated demands for 2023.

Releases from Caballo for irrigation deliveries began on May 1 and ended on October 13. EBID began orders and diversions for the Rincon Valley only on May 1, then EPCWID and Mexico began the season on May 12 with coordinated orders for release. EBID ended their surface water diversions on August 19 with Mexico following on September 30. EPCWID ended their diversions on October 17.

The total Caballo release for RGP water accounting was 547,721 ac-ft, which was used to calculate the diversion ratio, a quantitative measure of delivery performance. This is 26 ac-ft less than the volume reported for Compact water accounting. The difference is the seepage from Caballo Dam's gates on the days that irrigation releases started and ended, before and after the irrigation releases, and is therefore not charged to the Project. For 2023, the calculated diversion ratio was 0.84.

The measured delivery to Mexico was 46,119 ac-ft. The calculated charges to EBID were 189,551 ac-ft. EPCWID's calculated charges were 225,494 ac-ft. EBID and EPCWID were not charged for an over delivery to Mexico. The allocation balances at the beginning of 2024 were for 40,300 ac-ft for EBID and 218,778 ac-ft for EPCWID. See Table 14 for a summary of the 2023 water accounting.

Table 14: 2023 Rio Grande Project Water Accounting[1]

	Final Allocation	Final Charges	Caballo Release for Irrigation	Calculated Diversion Ratio	Adjustment for Over Delivery to Mexico	Account Balance from 2023
EBID	272,828	189,551	-	-	-	83,277
EPCWID	401,296	225,495	-	-	-	175,801
Mexico	60,000[2]	46,119	-	-	-	-
Total	734,125	461,165	547,721	0.84	-	-

2024 Rio Grande Project Outlook

In April, Reclamation determined the 2024 allocation to Mexico was 39,012 ac-ft (65% of full). Including the U.S. Districts' carryover from 2023, the April 2024 allocation to EBID and EPCWID was 174,714 ac-ft and 256,045 ac-ft, respectively. With the anticipated average snowmelt runoff, Reclamation expects a full allocation to Mexico and increasing allocations to both EPCWID and EBID through June. The 2024 irrigation releases from Caballo Reservoir began on March 8 for EPCWID and Mexico. Releases for EBID are expected to begin around June 1. The length of the release season will depend on inflow to Elephant Butte Reservoir. Elephant Butte likely reached its

[1] Volumes in ac-ft

[2] Based on non-extraordinary drought conditions per 1906 Treaty

peak storage in February and is expected to end the irrigation season (end of September) around 100,000 ac-ft.

RGP River Gage Operation and Maintenance

EBID and EPCWID operated and maintained gages for flow measurements at canal headings, river stations, and lateral headings during 2023. Reclamation operated and maintained the Rio Grande gaging station below Caballo, and coordinated and maintained central control of releases, river operations, and water accounting. To accomplish the water allocation accounting, the U.S. Districts collect field flow measurements and coordinate data from all water user entities. Utilizing the summarized flow data submitted by the U.S. Districts for their areas of responsibility, Reclamation calculated and summarized the monthly and end-of-year RGP water supply use and accounting for 2023.

Drought Resilience Efforts in the Rio Grande Project Area

Congress recognized the increasing stresses on water supplies in the Western U.S. with the passage of the Science and Engineering to Comprehensively Understand and Responsibly Enhance (SECURE) Water Act in 2009 (P.L. 111-11). The law authorizes Federal water and science agencies to work together with state and local water managers to plan for threats to water supplies, as well as take action to secure water resources for the communities, economies, and ecosystems they support.

In response to prolonged aridification of the RGP area and the need for collaborative solutions in support of water users and habitat in the area, Reclamation began several collaborative projects to improve water supply resilience for RGP water users. Reclamation started to work on post-fire mitigation strategies, established the RGP Area Drought Resilience Team (RGPA-DRT) and entered into cooperative agreements with the National Fish and Wildlife Foundation (NFWF) and the NMISC.

Caballo Post-Fire Mitigation

Two major and devastating fires have occurred in the past ten years in the Black Range; the Silver Fire of 2013 and the Black Fire of 2022. The Black Range is located about thirty miles east of Elephant Butte and Caballo Reservoirs in the Gila National Forest in South Central New Mexico with tributaries that flow into these reservoirs and provide additional water for the RGP. The Silver Fire burned approximately 138,698 acres with 57,724 acres being classified as medium to high severity burned areas. The Black Fire burned 327,263 acres with 74,594 acres being classified as medium to high severity burned areas. Combined, these two fires burned 465,961 acres.

In 2016, a precipitation event in the Black Range caused a woody debris arroyo flow from the Silver Fire to wash into Caballo Reservoir. This woody debris flow resulted in the trash rack of the Caballo outlet works to be clogged, and thus enough water could not be released to farmers and municipalities downstream of Caballo Reservoir. During the event, efforts to unclog the trash rack during releases proved to be highly unsafe, and somewhat ineffective. Future post-fire debris flow flooding could completely overwhelm Caballo Reservoir's ability to release to the RGP water users or even make RGP releases impossible during extended periods of an irrigation season. This would

have disastrous impacts for the RGP's farmers and municipalities, specifically the City of El Paso, and the Republic of Mexico since the main source of water for the Mexican farmers and the City of El Paso is the RGP water.

Through an internal competitive funding process, AAO applied and was awarded funding in 2023 to foster strategic partnerships through dialogue and communications with current partners that includes U.S. Forest Service, USGS, and others to seek further post-fire mitigation cooperation, planning, and collaboration for mitigating post fire consequences. By partnering and cooperating with others, Reclamation can participate in forest rehabilitation planning and processes to attempt to reduce sediment deposition into Caballo Reservoir. Reclamation will also seek to contract with modeling experts to conduct an extension of a geomorphological and sedimentation flow study of the Eastern slopes of the Black Range to assess future sediment deposition and debris flow scenarios into Caballo Reservoir.

Rio Grande Project Area Drought Resilience Team

RGPA-DRT is a multi-agency technical team established in 2021 to: (1) enhance the resilience of the aquifer and stream system in order to improve Project performance; (2) improve water management; (3) enhance habitat (4) explore water conservation opportunities; (5) allow for information sharing between governmental agencies and RGP water users; and (6) foster coordination and cooperation between Federal, State, and local agencies with jurisdiction in the RGP area, including exploration of and support for joint funding opportunities.

Four subgroups have evolved out of the RGPA-DRT to focus on specific resilience topics. These subgroups are: (1) a brackish aquifer reuse and desalination; (2) ecological restoration: (3) stormwater capture; and (4) Rincon Lateral conceptual design.

The main participants in the RGPA-DRT and the various subgroups are the New Mexico Office of the State Engineer, NFWF, NMISC, EBID, IBWC, NRCS, City of Las Cruces, New Mexico State University, and Doña Ana County.

Cooperative Agreement with the National Fish and Wildlife Foundation

In 2023, Reclamation entered into a five-year cooperative agreement with NFWF for water conservation and ecological restoration projects with wildlife benefits. This cooperative agreement includes the planning and implementation of stormwater capture projects at RGP area sediment dams, off-channel storage projects, and demand management. These efforts aim to restore and create habitat for the flycatcher and reduce monsoon season type flooding that causes property damage, crop loss, and channel sedimentation.

Cooperative Agreement with NM Interstate Stream Commission

In 2023, Reclamation entered into a five-year cooperative agreement with NMISC to hire water resource professionals to work on drought resilience projects. These professionals will provide water resource expertise to execute drought resilience projects in the RGP area including: (1) performing a rapid assessment on the condition of dams and their potential for stormwater capture; (2) researching and developing opportunities and a plan for depletion management; and (3) exploring desalination and reuse opportunities for brackish aquifers.

Active Rio Grande Project Litigation

United States of America v. Elephant Butte Irrigation District

The United States filed the case *United States of America v. EBID et al.*, Civ. No. 97-0803 JP/RLP/WWD (Quiet Title to the Waters for the RGP) on June 12, 1997, in the U.S. District Court of New Mexico (D.N.M.), petitioning for quiet legal title to the waters of the RGP in its name. The court dismissed the case in August 2000. On May 7, 2002, the U.S. Court of Appeals (10th Circuit) vacated the lower court's August 2000 decision and remanded the case for further proceedings. On remand, the court issued an order to stay the case and close for administrative purposes on August 15, 2002. The court further ordered that, if it becomes necessary or desirable during the pendency of water adjudications in New Mexico and Texas, any party may initiate proceedings as though the case had not been closed for administrative purposes.

Since 2010, interested parties have been proceeding with Stream System Issue No. 104, which involves the United States' water interests in the Lower Rio Grande in New Mexico. In 2012, the court determined that the United States did not have a groundwater right associated with the RGP. However, the court did rule that the United States did have rights in Project return flows which would have to be determined by the State Engineer. Also, the court did not rule on whether the various groundwater inflows into the Rio Grande are considered "project water," which – if so determined by the court – would mean the United States has a right to such inflows once they become surface water again. This proceeding is suspended while the parties negotiate. The suspension was continued on October 26, 2018, and all parties are required to file status reports with the court every 6 months.

State of New Mexico v. United States

On August 8, 2011, the State of New Mexico filed a lawsuit against the United States (*State of New Mexico v. United States et al.*, D.N.M. Civ. No. 11-0691) regarding the RGP 2008 Operating Agreement and a purported change in accounting of the water to be delivered to Texas from the Rio Grande. The case is stayed pending ruling by the Supreme Court on *Texas v. New Mexico*.

Texas v. New Mexico

In January 2013, Texas filed a motion in the U.S. Supreme Court to receive a declaration of the rights of the State of Texas to the waters of the Rio Grande pursuant to, and consistent with, the Compact and the Rio Grande Project Act; issue its decree commanding the State of New Mexico to deliver the waters of the Rio Grande in accordance with the provisions of the Compact and the Rio Grande Project Act; and award damages and other relief for the injury suffered by the State of Texas.

After the first phase of the trial, in the fall of 2021 and based on the recommendation of the parties, the Special Master ordered the case stayed and the parties mediated through September 2022. In September 2022, the parties jointly filed a status report that concluded the parties were not certain the settlement could be reached and recommended a proposed second phase of the trial to begin in January 2023. In November 2022, Colorado, New Mexico, and Texas filed a joint motion to enter into a Consent Decree without the United States. A hearing was held in front of the Special Master in January 2023 on the proposed Consent Decree. In July 2023, the Special Master issued his Third Interim Report to the U.S. Supreme Court recommending the adoption of the proposed Consent Decree. In October 2023, the States jointly filed a no exception brief, the United States filed an

exception brief, and EPCWID and EBID both filed amicus curae briefs in support of the United States' exceptions. The States filed a joint reply to the United States exceptions in December 2023 and the United States filed a sur-reply in January 2024. A ruling by the U.S. Supreme Court is expected by July 2024 with the oral argument schedule for March 20, 2024.

Facility Review and Safety of Dams Program

Elephant Butte Dam

There are no significant dam safety-related O&M issues associated with Elephant Butte Dam other than aging infrastructure. There are currently two incomplete Safety of Dams recommendations and five incomplete Category 2 O&M recommendations for Elephant Butte Dam.

In fall 2023, Reclamation removed 20,864 cubic yards of sediment from confluences of Mescal Arroyo, Hondo Arroyo, and Cuchillo Negro Creek with the Rio Grande to maintain the channel capacity from Elephant Butte to Caballo. This moderate accumulation of sediment was due to the 2023 monsoon season flows.

Reclamation has procured an index velocity meter for use at Elephant Butte. Once installed in the Rio Grande below Elephant Butte near Reclamation's offices, the data collected will study the effects of diurnal powerplant operations on discharge during peak power generation. This will support the operation of the USGS Rio Grande Below Elephant Butte Gage and may provide a cost-effective alternative to in-situ flow meter replacements inside the powerplant.

Caballo Dam

There are no significant dam safety-related O&M issues associated with Caballo Dam other than aging infrastructure. No Safety of Dam recommendations currently exist for Caballo Dam. There are currently two Category 2 O&M recommendations for Caballo Dam scheduled for completion in January 2024.

In the winter of 2023, Reclamation removed approximately 1,200 cubic yards of sediment from the three arroyo confluences immediately downstream of Caballo Dam. These arroyos bring material from the Caballo Mountain range into the Rio Grande near the Caballo gaging station.

During 2023, Reclamation worked on the Bonita Lateral Irrigation Pipe Project Phase 2, a feasibility study based on the inspection reports to determine possible repair methods. In April 2023, a value engineering study was conducted onsite to evaluate potential proposals. In September 2023, a constructability review also took place onsite. The constructability review provided a risk and feasibility report to the baseline engineering design and alternatives presented in the value engineering study. The current schedule is being updated based on findings obtained with the value engineering and constructability studies. Phase 3 of the project is contract award and construction; final construction date is not set.

Reclamation also completed an inspection of the normally inaccessible portion of the Caballo intake structure during mid-October 2023. To gain access, Reclamation operated the RGP reservoirs during 2023 to meet the irrigation demands while ended the season with about 5,000 ac-ft of water remaining in Caballo and contracted a 165-ton crane service for the placement of the legacy steel-

framed, timber stop logs. This two-week isolation of the intake conduit from the reservoir water provided opportunity to collect vital data in support of the Bonita Lateral project and evaluation of other O&M concerns.

Reclamation installed an acoustic flow meter within the Bonita Lateral pipe in 2023. The legacy propeller style flow meter remains in operation while the validity of ta new flow meter is confirmed. The new flowmeter allows for a digital signal to be received remotely and available for Reclamation and public display of the data once the data validation is completed. Instantaneous flow values are collected with high data quality control and assurances.

Reservoir Vegetation Management

Reclamation maintains areas previously cleared at Caballo Reservoir to limit consumption of water by woody phreatophytes like salt cedar. In 2023, approximately 1,000 acres of phreatophyte vegetation at Caballo was managed utilizing mowers and mulchers.

ESA Compliance for Operating Agreement and Storage of SJCP Water

The USFWS issued a final *Biological and Conference 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, NM* (Consultation Number 02ENNM00-2015-F-0734, RGP BO) on May 25, 2016. The non-jeopardy determination in the RGP BO is based on the mandatory accomplishment of numerous commitments by Reclamation (9 Conservation Measures, 4 Reasonable and Prudent Measures, and 9 Terms and Conditions). The USFWS provided an Incidental Take Statement for the flycatcher and cuckoo.

In accordance with the RGP BO, incidental take of flycatcher will be considered exceeded if more than 33 flycatcher territories or 24 nests (calculated as 96 eggs/nestlings) are taken because of high surface water events above the 2014 baseline. If more than 81 acres of occupied suitable or marginally suitable habitat are inundated for two to five years, take may also be exceeded. Incidental take of cuckoos will be considered exceeded if more than 5 cuckoo territories or 3 nests (calculated as 12 eggs/nestlings) are taken because of high surface water events above the 2014 baseline. If more than 606 acres of occupied suitable or marginally suitable habitat are inundated for two to five years, take may also be exceeded. Take from reservoir level inundation may be avoided if natural revegetation occurs as reservoir levels go down.

In 2023, Reclamation continued implementing the commitments set forth in the RGP BO. There was no incidental take of flycatcher or cuckoo nests/territories in 2023. Annual survey data for the RGP BO is included in the MRG BO section of this report.

Related Reclamation Programs

Native American Affairs Programs

Reclamation has numerous projects underway with Pueblos and Tribes. These projects fall under several categories including the Native American Affairs (NAA) Program, planning, water rights settlements (including assessments and implementation), cooperative ventures with other Federal agencies, Rio Grande Pueblos Irrigation Infrastructure, and other special projects funded through Congressional legislation.

NAA and other programs have provided funding to various Pueblos for water resource related issues as funding becomes available. One technical assistance project was selected for funding in 2023, which aims to improve water conservation for the Pueblo of Isleta. In addition, the U.S. Department of the Interior's Indian Water Rights Office funded various needs related to active tribal water rights assessment teams throughout New Mexico.

Contained in the Omnibus Public Land Management Act of 2009, P.L. 111-11 authorized up to $4 million in Federal appropriations to conduct a study of the 18 Rio Grande Pueblos' irrigation infrastructure, and up to $6 million per year for construction through 2019. The Study Report was submitted to Congress in June 2022. Since the expiration of the original legislation, the authorization has been extended annually. Several new Pueblo irrigation contracts and added scope and funding to several existing contracts were accomplished with 2023 funding received ($6M from Rio Grande Pueblos and $2.9M from NAA drought relief) under this authorization.

Isleta Settlement

Isleta Diversion Dam was built by the MRGCD on Pueblo of Isleta land in 1934 and rehabilitated by Reclamation in 1954. Long-standing issues from dam construction and operation on Pueblo lands were resolved in an October 21, 2016 settlement signed by Reclamation, the Pueblo of Isleta, and the MRGCD. This settlement granted the United States a 100-year easement for the dam; provided the Pueblo of Isleta with a lump sum for compensation of damages; established a team to plan and implement diversion dam modifications to better manage sediment transport into irrigation canals and provide fish passage through the dam; and allowed for bosque and riverine restoration. The settlement commitments are scheduled to be completed by 2026.

A design-build contract was awarded in February 2023 for professional services to design and construct fish passage and sediment management improvements at Isleta Diversion Dam. The same contract vehicle also provides for the design and construction of fish passage at San Acacia Diversion Dam. The project design and environmental compliance are in progress. Significant milestones in 2023 included preparation of the 30% design package and completion of a Value Engineering study. The project is on target for construction in 2025-2026.

Indian Water Rights Settlements

The Claims Resolution Act of 2010 was signed into law on December 8, 2010, authorizing the settlement of two long-running New Mexico Indian water rights cases. Title V, the Taos Pueblo Indian Water Rights Settlement Act, authorizes implementation of the Abeyta settlement (involving Taos Pueblo). Title VI, the Aamodt Litigation Settlement Act, authorizes implementation of the Aamodt settlement (involving Pojoaque, Nambé, Tesuque, and San Ildefonso Pueblos). Reclamation is working with Bureau of Indian Affairs, the Pueblos, the State of New Mexico, and other involved parties to implement the provisions of these settlements.

Taos Pueblo Indian Water Rights Settlement

Four of eight non-Pueblo parties who have projects assigned to them by the Taos Pueblo Settlement Agreement have received their grant funding and are actively working on their projects: El Prado Water and Sanitation District (EPWSD), the Town of Taos (ToT), Llano Quemado Mutual Domestic Water Consumer Association (MDWCA), and Acequia Madre del Rio Chiquito/Acequia del Monte del Rio Chiquito (Rio Chiquito). Each of these parties are at different points in implementing their projects. EPWSD and ToT are drilling wells and/or constructing well infrastructure. EPWSD is nearing completion of one of their two well projects and have nearly expended all their settlement funds; they have been seeking funding from the New Mexico State Legislature to continue construction. Llano Quemado MDWCA is currently working on securing a driller while Rio Chiquito is working on securing land for their well site.

The remaining four non-Pueblo parties (Upper Arroyo Hondo MDWCA, Upper Ranchitos MDWCA, Acequia Madre del Rio Lucero y del Arroyo Seco, and Acequia Madre del Prado) have not applied for funding nor been active in the monthly all-parties meetings. In 2022, Reclamation sent letters to each of these entities (excluding Acequia Madre del Prado) requesting a response if they were intending to commence their project; Reclamation did not receive a response from any of the parties. In 2023, the active parties discussed how to move forward with these projects but have not determined who would implement which project.

Each active party, including Taos Pueblo, is projecting that current settlement funding will not be sufficient to complete their projects as described in the Settlement Agreement. The non-federal parties are seeking legislation to address the funding shortfall.

Pojoaque Basin Regional Water System (Aamodt Settlement)

The Aamodt Settlement Agreement provides for settlement of water rights claims in the Pojoaque Basin including claims of the Pueblos of Nambé, Pojoaque, San Ildefonso, and Tesuque; Santa Fe County; and the City of Santa Fe. The Aamodt Litigation Settlement Act authorized Reclamation to plan, design, and construct a Regional Water System (RWS). The RWS will consist of a water diversion on the Rio Grande, water treatment facility, storage tanks, and transmission and distribution pipelines that will supply up to 4,000 ac-ft of water annually to Pueblo and non-Pueblo customers within the Pojoaque Basin.

Reclamation has split the RWS construction project into three phases. Phase 1 includes an intake, a water treatment plant (WTP), storage tanks, and pipelines on the northern end of the project area in San Ildefonso Pueblo and the northern part of Pojoaque Pueblo. Phase 2 includes distribution tanks and pipelines within Nambé Pueblo (Stage 1), southern Pojoaque and Tesuque Pueblos (Stage 2),

and Bishops Lodge in Santa Fe County (Stage 3). Phase 3 includes distribution piping for the Pueblos of San Ildefonso, Pojoaque, Nambé, and Tesuque, and Santa Fe County. Phase 1 is currently under construction while Phases 2 and 3 are at various levels of design.

Phase 1 construction started in 2020 and included the development of the collector wells at the intake on the Rio Grande and site preparation at the intake and WTP. In 2023, additional construction at the intake connected pipelines and electricity to the Mechanical & Electrical Building. At the WTP, a retaining wall was constructed, the foundation soils were over-excavated and compacted, the underground utilities were installed, the final grade was set, and numerous building foundations were poured. In 2024, the schedule includes continuing work at the intake and WTP and expanding to other tank sites and transmission pipelines.

In 2023, Phase 2 Stage 1's design for transmission to Nambe's storage tank was finalized and prepared for bidding. Also, the designs for Phase 2 Stage 2 (transmission through southern Pojoaque Pueblo and Tesuque Pueblo) were advanced from 60% to 90%. Consultations took place with Santa Fe County to determine priorities for constructing Phase 3 distribution pipelines in the El Rancho, Jacona, and northern Pojoaque (non-tribal) neighborhoods.

Hydrologic Models

Upper Rio Grande Water Operations Model (URGWOM)

URGWOM is a computational model developed through an interagency effort. It simulates processes and operations in the Rio Grande Basin from the headwaters in Colorado to Fort Quitman, TX, and tracks the delivery of water allocated to specific users within New Mexico. URGWOM operates on the RiverWare software platform developed at the Center for Advanced Decision Support for Water and Environmental Systems (CADSWES).

The primary purpose of URGWOM is to facilitate more efficient and effective water management – accounting, forecasting, and flood risk management operations – in the Upper Rio Grande Basin. URGWOM was developed with individual accounts running through the model to track SJC water separately from native Rio Grande water. URGWOM is used to simulate runs for the Annual Operating Plans that forecast storage and water delivery for the rest of the year, and for long-term forecasts for planning studies. The model is also currently being used for the Rio Grande Basin Study.

The URGWOM Technical Team (Team) generally meets monthly. There is also an Executive Committee that meets approximately annually. An Advisory Committee initially strengthened URGWOM's interagency nature, but no longer meets as attendees were consistently the same as those at the monthly Team meetings. The model website, which can be accessed at http://www.spa.usace.army.mil/Missions/CivilWorks/URGWOM.aspx, is updated with details on recent activities, postings of the latest documentation, and meeting notes. Reclamation is currently finishing up URGWOM training modules to allow those unfamiliar with URGWOM and RiverWare software to learn about what it is used for and how it works. These training modules will be hosted on the URGWOM website.

Reclamation is funding West Gulf RFC in a multi-year effort to recalibrate their ensemble streamflow forecast model for the Upper Rio Grande and the Pecos Basins. Reclamation is also providing funding to the National Center for Atmospheric Research (NCAR) for the improvement of their monsoon forecasting method in New Mexico as well as implementing their forecast into URGWOM runs.

I 2023, work was completed on the Rio Chama Acequias in the model to better reflect current operations. Improvements were also done to the unregulated flow and real-time applications. In addition, there were multiple other minor fixes and improvements throughout the year. As needed, updated documentation for URGWOM is tracked, developed, reviewed, and finalized by the Team.

Rio Grande Transboundary Integrated Hydrologic Model (RGTIHM)

RGTIHM is an interagency effort between the USGS and Reclamation, funded by Reclamation. The model is being developed to simulate the availability and use of surface water and groundwater in the Rincon and Mesilla Valleys, including surface water deliveries by the RGP and groundwater for irrigation and non-irrigation uses. RGTIHM represents the dominant natural and human components of the hydrologic system, thereby providing a reliable assessment of surface water and groundwater conditions and processes that can inform water users and help improve planning for future conditions and sustained operations of the RGP.

Model development includes revision of the conceptual model of the flow system, construction of a Transboundary Rio Grande Watershed Model (TRGWM) water-balance model using the Basin Characterization Model platform, and construction of an integrated hydrologic flow model using the MODFLOW One-Water Hydrologic Flow Model (MODFLOW-OWHM). The conceptual model identifies surface water and groundwater inflows and outflows, including the movement and use of water through both natural and anthropogenic processes. The groundwater flow system consists of a layered geologic sedimentary sequence combined with the effects of natural runoff and recharge, operation of the RGP, and groundwater pumping for irrigation and non-irrigation uses. Notably, operation of the RGP includes the application of surface water for irrigation, groundwater recharge from applied irrigation water, return flows through drains and wasteways, and reuse of return flows to meet irrigation demands lower in the RGP.

TRGWM and RGTIHM were developed for and calibrated to historical conditions of water and land use, and parameters were adjusted (calibrated) so that simulated values closely match observed values. The calibrated models were then used to assess the movement and use of surface water and groundwater in the Rincon Valley, Mesilla Basin, and northern part of the Conejos-Médanos Basin. Used together, RGTIHM and TRGWM provide a tool for analyzing the hydrologic system response to the historical evolution of water use in the region, including development of surface water and groundwater supplies for irrigation, municipal, industrial, and domestic uses. The models also provide a tool for evaluating the hydrologic system response to potential changes in water supplies and demands, including changes in irrigated acreage and cropping patterns, population and per capita water use, local and regional climate and hydrologic conditions, and surface water and groundwater management.

In 2023, USGS and Reclamation continued to work on RGTIHM improvements as summarized below.

RGTIHM development

- Completed work includes:
    - Appending sections to the a) Discretization File, b) General-Head Boundary package, c) Horizontal Flow Barrier package, d) Output Control, e) Riparian Evapotranspiration package, and f) Streamflow-Routing package, g) Farm Process, h) Head Observation package, i) Well package, j) Reservoir package, k) Multi-Node Well package.
    - Editing the Well package file using well locations, active and inactive dates, screened intervals, and pumping data for domestic and livestock wells obtained from the New Mexico Office of the State Engineer (NMOSE) Points of Diversion, the Texas Submitted Drillers Reports and Groundwater Databases, and NMOSE annual water use,
    - Editing the Multi-Node Well package and Farm Process files using well locations, active and inactive dates, screened intervals, and pumping data for municipal, industrial, and agricultural wells obtained from NMOSE Points of Diversion and the Texas Submitted Drillers Reports and Groundwater Databases,
    - Updating the Reservoir package using Caballo Reservoir stage obtained from Reclamation Information Sharing Environment,
    - Updating specified inflow to the Streamflow-Routing package using releases from Caballo Reservoir to the Rio Grande and Bonita Lateral,
    - Updating specified diversions from the Streamflow-Routing package using diversions from the Rio Grande to canals and laterals, and
    - Incorporating post 2014 groundwater-level measurements obtained from the USGS National Water Information System (NWIS) in the Head-Observation package and obtaining streamflow measurements from the USGS NWIS and U.S. International Boundary and Water Commission Water Data Portal that will be used to verify model performance in the extended simulation period.
- Ongoing work includes:
    - Updates to extend the model simulation period from 2015 through 2021 (most current full data set available). Automated workflows are being developed to facilitate efficient extensions of the simulation period in the future so that RGTIHM remains a relevant modeling tool to plan for future conditions and sustained operations of the RGP.
    - Estimating the crop irrigation requirement (CIR) used to simulate the demand component of irrigated agriculture in the Farm Process using actual evapotranspiration obtained from OpenET,
    - Updating specified inflow to the Streamflow-Routing package using wastewater-treatment plant effluent discharge to the Rio Grande and canals obtained from the U.S. Environmental Protection Agency, and
    - Estimating runoff and recharge from the watersheds surrounding the active boundary of RGTIHM by extending the simulation period of the Basin Characterization Model (BCM).
- Began drafting a USGS Scientific Investigations Report documenting the methods used to extend the simulation period.
- Began preparing a USGS data release that will include the updated model input and output files and automated workflows.

MF-OWHM and related software development

- Continued development and implementation of the new Surface-water Operations (SWO) Process of MODFLOW-OWHM in RGTIHM.
- Evaluate historical operations and refine SWO rules to represent these operations.
- Run hypothetical scenarios to evaluate differences between baseline operations and hypothetical operation for mid to long term planning.

Water Accounting Reports Projects

San Juan-Chama Project Water Accounting

In 2023, SJCP water accounting was accomplished using version 9.2.1 of RiverWare software, and version 9.2 of the URGWOM accounting module. All accounting data and information are stored directly in the final 2023 accounting model. The data are also sent to Reclamation's Hydrologic Database (HDB) via a Data Management Interface (DMI). Reclamation consulted with representatives of the NMISC and USACE – Albuquerque District to verify the accounting data throughout the year. This ongoing discussion minimized concerns regarding year-end data quality and accounting methods.

Oracle Hydrologic Database (HDB)

HDB is a specialized relational database for storing and recovering hydrologic data used by Reclamation in the management of river and reservoir systems. A generalized version of HDB was specifically developed for use by Reclamation with RiverWare models. HDB is an Oracle relational database application and includes connections to data sources such as Reclamation's hydrologic and meteorologic monitoring stations (HydroMet), Domestic Communications Satellite, Data Storage System, and modeling software like RiverWare. HDB was originally developed at the University of Colorado's CADSWES. Reclamation's HDB has been customized for specific office and model requirements. Reclamation depends on HDB installations for data storage and retrieval.

Development of water accounting and reporting functionalities for Reclamation's HDB installation continued during 2023. After a successful model run, water accounting data and other output are directly transferred from URGWOM via a DMI to HDB.

Reclamation continues to maintain and update our public websites. These websites have been a great asset for internal and public use in reporting, visualizing, and exporting data from Reclamation's HDB. Reclamation has also began utilizing Microsoft Power BI to create operation dashboards and plan on adding forecasting dashboards as well. The pages can be accessed under the *Reservoir Data and Operational Data* heading on this page https://www.usbr.gov/uc/albuq/water/index.html.

In 2023, Reclamation worked to back-populate historical data for the MRGP and RGP into HDB. Reclamation also began pulling Colorado Division of Water Resources' published gage data to overwrite provisional data, like the process used for USGS' gage data. Reclamation also began work to clean-up data stored in HDB.

In 2024, Reclamation plans to provide continued maintenance and data clean-up in HDB. Data from older URGWOM accounting runs are also planned to be backfilled into HDB. Improvements to current Power BI dashboards and additional Power BI dashboards are in development.

RiverWare

Numerous improvements to RiverWare were accomplished in 2023 through contracts that Reclamation and USACE have with CADSWES. Work included doing final touch-ups on the Web Map Viewer that allow users to see objects in a spatial web map and additional improvements of the Quick Start dialog that pops up when RiverWare opens to allow easy selection of models, rules, SCTs, and more. Funding was also provided to improve window management, which is a general issue working with RiverWare. In addition, improvements to the rules, scripting, and DMIs have continued. CADSWES' annual report, distributed to the RiverWare user community at their annual meeting, summarizes all 2023 changes to RiverWare.

Evapotranspiration (ET) Toolbox

ET Toolbox was an extension of Reclamation's Agricultural Water Resources Decision Support system that provided high-resolution rainfall and real-time water use predictions and estimates via a dedicated website. It also provided schematics of the MRG with the latest MRGCD, USGS, USFWS, and ABCWUA gage data.

In 2019, Reclamation began looking at collaboration with the NASA's Jet Propulsion Laboratory (JPL) to use their satellite-based ET product to replace ET Toolbox's calculated evapotranspiration. Through this collaboration, daily 30-meter ET data are being developed, along with corresponding updates to the forecast system and web interface. Security concerns have delayed the project and it is not known when the transition will occur.

In 2022, an updated 508-compliant version that transferred the schematics, gage data, and high-resolution rainfall. The new MRG Water Management Toolbox may be accessed at https://www.usbr.gov/uc/albuq/water/ETtoolboxV2/home.html. This new site does not calculate future ET or water use estimates. These estimates will be included once the work with JPL has been completed.

Aquatic Invasive Species- Zebra and Quagga Mussels

Dreissenid mussels, including the zebra mussel (*Dreissena polymorpha*) and quagga mussel (*Dreissena rostriformis bugensis*), are invasive, freshwater, bivalve mollusks. These aquatic invasive species (AIS) impair water infrastructure and it is extremely costly to remove or prevent their attachment to infrastructure. It is estimated that zebra and quagga mussels cause over $1 billion annually in damages to water infrastructure and industries in the United States. Dreissenid mussels proliferate, attach to infrastructure surfaces like dams, water intakes, pipes, and canals; and impact water storage, water delivery, irrigation, and hydropower. Dreissenid mussels can also impair recreational use and aquatic ecosystems by destroying watercraft motors, becoming a beach nuisance, altering aquatic food webs, and fostering harmful algal blooms. A single mussel can produce hundreds of thousands of eggs, which hatch into microscopic larvae called veligers. Veligers spread within a waterbody in numerous ways, mainly by floating within the water column, and can be taken up by outboard motors, pumps, or other water intake and storage on watercraft. Transport of dreissenid mussels can occur when watercraft used in an infested waterbody transport or discharge water containing veligers or adult mussels into non-infested reservoirs.

Reclamation does not have authority to manage the importation, interstate transport, exclusion, control, or eradication of aquatic invasive species in New Mexico. In New Mexico, Reclamation supports AIS prevention activities by furnishing equipment and contractual support to the New Mexico Department of Game and Fish (NMDGF). Reclamation regularly collects water samples and analyzes them by microscopy and molecular methods, providing early detection that can be used to trigger immediate containment action.

Reclamation has contracted AIS monitoring for the following:

- Inspections for watercraft entering Navajo and Elephant Butte Reservoirs
- Decontamination of watercraft considered "high risk" as defined by the NMDGF
- Coordination with law enforcement for issuance and removal of red warning tags

Reclamation's AIS watercraft inspection and decontamination (WID) efforts have increased over time from 9,346 watercraft in 2013 to 20,628 in 2023, as have the contractual costs. With limited funding, Reclamation has prioritized AIS WID services at two boat ramps (Marian del Sur and Rock Canyon) in Elephant Butte because of this reservoir's extensive recreation, fishing, irrigation, power, and water infrastructure. In 2023, 10.1 percent of incoming watercraft were high-risk inspections (were not drained and dried, etc.), and 0.8 percent of those were infested and decontaminated. In 2023, there were no detections of invasive mussels or their genetic markers in water samples collected from Elephant Butte by Reclamation's Ecological Research Laboratory.

For more information on mussels and the damage they can cause, please see Reclamation's latest issue of the Reclamation Current: February 5, 2024.

WaterSMART Program

Congress recognized the increasing stresses on water supplies in the Western U.S. with the passage of the SECURE Water Act in 2009 (P.L. 111-11). The law authorizes Federal water and science agencies to work together with state and local water managers to plan for threats to water supplies, as well as take action to secure water resources for the communities, economies, and ecosystems they support.

To implement the SECURE Water Act and ensure the Department of the Interior (DOI) is positioned to meet these challenges, the WaterSMART Program (Sustain and Manage America's Resources for Tomorrow) was established in February 2010. The Program's framework allows all bureaus of the DOI to work with States, Pueblos and Tribes, local governments, and non-governmental organizations to pursue a sustainable water supply for the Nation. This is accomplished by providing Federal leadership and assistance on the efficient use of water, integrating water and energy policies to support the maintainable use of all natural resources, and coordinating the water conservation activities of the DOI's many offices.

As the DOI's main water management agency, Reclamation plays a key role in the WaterSMART Program. Reclamation's portion of the WaterSMART Program is focused on improving water conservation, recovering declining species, increasing ecological resiliency to the impacts of climate change, preventing water-related conflicts, and helping water resource managers make informed decisions about water conservation and use. Goals are achieved through administration of grants for

scientific studies, technical assistance, and sharing scientific expertise. Reclamation will continue to work cooperatively with States, Pueblos and Tribes, and local entities as they plan for and implement actions to increase water supply through investments to modernize existing infrastructure and give attention to local water conflicts.

Bipartisan Infrastructure Law

The Bipartisan Infrastructure Law (BIL or Infrastructure Law) provides a total of $8.3 billion under Title IX (Western Water Infrastructure) to Reclamation for authorized programs and activities to be appropriated in equal increments of $1.66 billion over five years. The Infrastructure Law provided emergency funding that is available for obligation until fully expended. Allocations of the annual $1.66 billion appropriations are laid out by programs and projects in annual spend plans and addendums. Additional information can be found at: Bipartisan Infrastructure Law | Bureau of Reclamation (usbr.gov).

Traditional WaterSMART Programs and newly authorized BIL efforts are funded and managed by Reclamation's Office of Policy and Administration. More information about these programs and funding opportunity announcements can be found at: https://www.usbr.gov/watersmart/. A WaterSMART Data Visualization Tool showing project locations can be found at: https://usbr.maps.arcgis.com/apps/MapJournal/index.html?appid=043fe91887ac4ddc92a4c0f427e38ab0.

Not all programs have funding opportunities each year, so there may not be currently active projects under all programs. Ongoing, newly funded, and recently completed projects within the jurisdiction of the AAO in the Rio Grande Basin are listed in Table 15 near the end of this section.

Basin Studies

Basin Studies are collaborative studies, cost-shared with non-Federal partners, to evaluate water supply and demand and help ensure reliable water supplies by identifying strategies to address imbalances in water supply and demand. Each study includes four key elements:

- State-of-the-art projections of future supply and demand by river basin,
- An analysis of how the basin's existing water and power operations and infrastructure will perform in the face of changing water realities,
- Development of strategies to meet current and future water demands, and
- A trade-off analysis of strategies identified.

Basin Studies are critical to helping stakeholders address and plan for water supply and demand imbalances. Through these studies, Reclamation provides technical assistance and tool development, and brings together competing interests within river basins to help identify collaborative solutions. The studies are focused on areas with willing State and local partners who provide 50% of the study costs.

Santa Fe Basin Study

In 2015, AAO, in partnership with the City of Santa Fe (Santa Fe) and Santa Fe County, released the Santa Fe Basin Study, https://www.usbr.gov/watersmart/bsp/docs/finalreport/SantaFe/Santa-Fe-Basin-Final.pdf. This study evaluated projected effects of climate change, population growth, and

other stressors on the Santa Fe watershed and water supplies for the combined municipal water system of the Santa Fe and Santa Fe County.

Based on the Basin Study conclusions, Santa Fe received funding from Reclamation for a Title XVI Feasibility Study, completed in 2017 and describes alternatives for implementation of a water reuse project for Santa Fe. Santa Fe was also awarded funding from Reclamation for a Basin Study Update to determine the likely timeline for projected climate change impacts on Santa Fe's water supply over the coming century, empowering Santa Fe's water utility to plan for the remainder of its adaptation portfolio. Additionally, Santa Fe was awarded a Water Management Options Pilot Project to redevelop the system dynamics model used to simulate its water supply sources and distribution. Work continues but completion of the Basin Study Update has been postponed until the new system dynamics model (nearly completed as of this report) is available to complete the assessments.

As a result of the Basin Study and Feasibility Study, several alternatives were identified for Santa Fe to acquire additional water. Santa Fe received Title XVI funds for a proposed water reuse project in 2022. Reclamation is leading the environmental compliance process, which is expected to be completed in 2024. Under Santa Fe's preferred alternative, they would consumptively use all of their contracted SJCP water allocation by receiving credit for water returned to the Rio Grande.

Rio Grande Basin Study: Lobatos to Elephant Butte

Reclamation has partnered with the MRGCD, eight Pueblos, and numerous other basin stakeholders, including State and municipal government entities, Pueblos and Tribes, irrigation districts, acequias, and non-governmental and community organizations, to perform a Basin Study from the Lobatos stream gage near the Colorado-New Mexico border to Elephant Butte Dam in south-central New Mexico. This basin study seeks to develop projections of future water supply and demand and collectively evaluate and model potential adaptations to the projected changes. No water management decisions will be made as part of the basin study; instead, the study partners will create an interactive decision-support tool for water managers to consider, along with other constraints such as political and economic factors, as they manage water in increasingly challenging conditions.

The Study's Memorandum of Agreement (MOA) was adopted by 35 non-Federal entities and signed by Reclamation on January 24, 2023. Reclamation's signature initiated the official start to the three-year study schedule. Since the official signing of the MOA, the number of signatories has grown to 39.

The non-Federal Partners in the basin study have organized into Sectoral Committees and are working on initial reporting to inform the partnership. Sectoral Committees and the Study's Steering Committee meet monthly. Reclamation's AAO hosts All-Partner meetings quarterly. The Study's Modeling Team, led by Reclamation's AAO, has been working extensively with the University of Massachusetts–Amherst on climate and hydrologic projection sets to inform the study and its partners. The various Sectoral Committees continue to work on value assessments to aid in the study's overarching goals of analyzing supply and demand scenarios under changing climatic conditions and to assess various adaptation strategies.

Baseline Assessments and Pilots

Reclamation conducts Baseline Water Assessments to develop water supply and demand information, guidance, and tools needed to conduct planning activities across Reclamation's mission areas. Baseline Water Assessments support reservoir operations planning, appraisal and feasibility studies, basin studies, drought contingency planning, and environmental analyses.

Reservoir Operations Pilots

Through the Reservoir Operations Pilot Initiative, Reclamation uses modeling and forecasting tools to identify ways to increase flexibility in reservoir operations to support optimal water management.

Internal Applied Science Tools

Through the Internal Applied Science Tools program, Reclamation provides funding internally to Reclamation staff on a competitive basis for the development of improved modeling and forecasting tools, improved hydrologic information, GIS products, data management, and other decision support tools.

2021 SECURE Water Act Report

Updated projections of future conditions, and paleoclimate analyses to refine those projections, were developed by Reclamation and published on Reclamation's SECURE Water Act 2021 Report website: https://www.usbr.gov/climate/secure/.

Reclamation's 2021 West-Wide Climate and Hydrology Assessment and seven individual basin reports, including the Rio Grande Basin (https://www.usbr.gov/climate/secure/docs/2021secure/basinreports/RioGrandeBasinChapter.pdf), provide detailed information on climate change impacts and adaptation strategies to increase water supply reliability in the West. The 2021 SECURE Report Web Portal (https://experience.arcgis.com/experience/7461ca68b2da4620863ff27d65b8cf14/) provides a user-friendly, web-based format for delivery of information in the reports. The next report to Congress will be completed in 2026.

Table 15: AAO Managed Active WaterSMART Projects in the Rio Grande Basin[1]

Agreement No.	Program[2]	Completion Date	Recipient Name	Project Title	Federal Total Obligation Amount	Non-Federal Total Est Amount
TBD	AERP	TBD	Albuquerque Bernalillo County Water Utility Authority	Southside Wastewater Reclamation Plant Outfall Restoration Project	$3,014,481	$4,070,000
R22AP00290	ASG	12/31/2024	NM Institute of Mining and Technology	New Mexico Water Data Initiative: Improving Water Data Access for Modeling in the Middle Rio Grande	$195,050	$196,666
R24AC00030	ASG	9/30/2026	Applied Research Team, Inc.	Mapping Snow-Water Equivalent with Weather Radar	$660,216	$338,000
R19AP00267	CWMP	3/31/2023	New Mexico Jornada Resource Conservation & Development Council	Furthering Watershed Restoration Planning	$99,982	
R19AP00240	CWMP	3/31/2023	New Mexico Wilderness Alliance	Employing Citizen Science to Establish Baseline Water Quality Conditions in the Wild and Scenic Reach of the Rio Chama to Assess the Environmental Impacts of Changing Water Quality	$99,852	$10,375
R19AP00264	CWMP	3/31/2023	Santa Fe Watershed Association	Linking Shareholder Priorities with Water Management and Adaptation Strategies in the Santa Fe River Watershed	$100,000	

[1] As of January 22, 2024

[2] AERP = Aquatic Ecosystem Restoration Program
ASG = Applied Science Grants
CWMP = Cooperative Watershed Management Program
DROUGHT = Contingency Planning, Resiliency Projects, or Emergency Response Actions
EWRP = Environmental Water Resources Projects
SWEP = Small-Scale Water Efficiency Projects
Title XVI = Water Reclamation and Reuse Program, including Authorized & WIIN Act Projects, Desal Construction, and Large-scale Recycling
WCFSP = Water Conservation Field Services Program
WEEG = Water and Energy Efficiency Grants

Agreement No.	Program[2]	Completion Date	Recipient Name	Project Title	Federal Total Obligation Amount	Non-Federal Total Est Amount
R22AP00074	CWMP	12/31/2023	National Audubon Society	Isleta Reach Stewardship Association and Plan Development for the Middle Rio Grande	$99,964	
R22A900214	CWMP	6/30/2024	Colorado Rio Grande Restoration Foundation	Conejos River Partnership Project - Phase 2	$285,000	$303,640
R23AP00105	CWMP	12/31/2024	Amigos Bravos, Inc.	Improving the Ecological Function of the Rio Fernando Through Hydrology and Streambank Restoration Planning	$178,750	
R23AP00119	CWMP	12/31/2024	Santa Cruz Irrigation District	Watershed Group Development and Watershed Restoration Planning for the Rio Santa Cruz Watershed Northern New Mexico	$200,000	
R21AP10035	DROUGHT	6/1/2024	Elephant Butte Irrigation District	Watershed Scale Stormwater Monitoring and Capture	$180,670	$181,784
R19AP00115	DROUGHT	12/30/2024	Santa Fe County	Aquifer Storage and Recovery in Rancho Viejo, Santa Fe County	$286,520	$659,480
R23AP00316	DROUGHT	12/31/2026	New Mexico Acequia Association	Regions of New Mexico with Acequia Water Distribution Systems: Tools to Adapt to Water Scarcity and Guide Implementation of Strategies to Increase Acequia Community and Water Resilience	$1,464,685	$1,464,685
TBD	EWRP	TBD	Chama Peak Land Alliance	Increasing Resiliency in the San Juan-Chama Project Headwaters	$3,000,000	$1,000,000
TBD	EWRP	TBD	Colorado Rio Grande Restoration Foundation	Farmers Union Multi-Benefit Diversion Infrastructure Improvement Project	$1,274,625	
TBD	EWRP	TBD	Pueblo of Isleta	Restoring Watershed Function and Protecting Sacred Ancestral Sites on the Lower Rio Puerco, a tributary of the Rio Grande	$2,487,942	

Agreement No.	Program[2]	Completion Date	Recipient Name	Project Title	Federal Total Obligation Amount	Non-Federal Total Est Amount
R22AP00052	SWEP	6/30/2023	El Paso County Water Improvement District No. 1	Montoya Main Lateral Concrete Lining Project: Phase II	$75,000	$197,784
R21AP10004	SWEP	3/1/2024	Pueblo of Zia	Residential Metering Project, Phase 2	$73,000	$80,851
R22AP00071	SWEP	3/31/2024	City of Las Cruces	Water Conservation in the City of Las Cruces: Installing SMART Irrigation Technology for the Efficient Use of Water Supplies	$75,000	$150,000
TBD	SWEP	TBD	El Paso County Water Improvement District No. 1	Montoya Laterals System Concrete Lining Project: Phase III	$100,000	$116,386
TBD	SWEP	TBD	Elephant Butte Irrigation District	Leasburg Canal Gate Actuators and Metering Station	$94,710	$119,341
R20AP00339	Title XVI	4/30/2023	El Paso Water Utilities Public Service Board	Kay Bailey Hutchison (KBH) Desalination Plant, Phase I Part A Expansion	$2,050,000	$6,050,000
R21AP10323	Title XVI	3/31/2024	El Paso Water Utilities Public Service Board	El Paso Aquifer Storage and Recovery Using Reclaimed Water Project	$3,000,000	$9,750,000
R22AP00630	Title XVI	10/31/2026	City of Santa Fe	City of Santa Fe Reuse Pipeline	$5,750,000	$35,000,000
TBD	Title XVI	TBD	New Mexico Interstate Stream Commission	Brackish Groundwater Desalination to Increase Water Supply Resiliency and Reliability in the Lower Rio Grande Valley Region of New Mexico	$300,000	$300,000
R23AS00076	Title XVI	TBD	El Paso Water Utilities Public Service Board	Upper Valley Water Treatment Plant Reuse Study	$1,000,000	$1,000,000
R22AS00117	Title XVI	TBD	El Paso Water Utilities Public Service Board	Kay Bailey Hutchison (KBH) Desalination Plant, Phase I Part B Expansion	$2,625,000	$7,875,000
R22AS00115	Title XVI	TBD	El Paso Water Utilities Public Service Board	Advanced Water Purification Facility	$20,000,000	$60,000,000
R22A900331	Water Marketing	6/30/2025	Rio Grande Water Conservation District	Colorado's Rio Grande Basin Water Cooperative Project	$212,755	$212,757
TBD	WCFSP	TBD	El Paso County Water Improvement District No. 1	EPCWID1 System Optimization Review	$100,000	$100,000

Agreement No.	Program[2]	Completion Date	Recipient Name	Project Title	Federal Total Obligation Amount	Non-Federal Total Est Amount
R20AP00056	WEEG	3/31/2024	El Paso County Water Improvement District No. 1	Riverside Canal Concrete Lining Project (Phase III)	$1,000,000	$1,039,504
R22AP00507	WEEG	9/30/2025	El Paso County Water Improvement District No. 1	Riverside Canal Concrete Lining Project (Phase IV [4])	$1,000,000	$1,048,785
TBD	WEEG	TBD	El Paso County Water Improvement District No. 1	Advanced Flow Measurement Improvements Project	$200,000	$421,740
TBD	WEEG	TBD	El Paso County Water Improvement District No. 1	Riverside Canal Concrete Lining Project (Phase VI [6])	$2,000,000	$2,031,430
TBD	WEEG	TBD	City of Alamosa	Cattails Golf Course Irrigation Efficiency Project	$500,000	$800,000
R23AP00496	WEEG	TBD	El Paso Water Utilities Public Service Board	Installing smart meters in El Paso, Texas	$5,000,000	$8,890,000
R22AP00254	WEEG	TBD	Elephant Butte Irrigation District	Delivering Conservation: Renovating Efficient Access to Rio Grande Project Surface Water for the Mesilla Valley	$1,782,247	$3,837,213
Total Funding					$60,565,449	$147,245,421

Science & Technology Program and Other Research Projects

Reclamation's Science and Technology (S&T) Program is a Reclamation-wide competitive, merit-based applied research and development program. The program focuses on innovative solutions for water and power challenges in the Western United States for Reclamation water and facility managers and the stakeholders they serve. The program has contributed many of the tools and capabilities Reclamation and Western water managers use today.

The AAO is an active participant in Reclamation's S&T Program, and initiates and participates in research to improve the services that Reclamation provides to its stakeholders. S&T Program projects in the Rio Grande Basin that are ongoing or were completed in 2023 are listed below.

- FY 2019 Award – completed December 2023 with continued data collection into 2024, *Using Remote Sensing and Ground Measurement to Improve Evaporation Estimation and Reservoir Management* (AAO and Elephant Butte Field Division partnership with New Mexico State University). This project aims to improve reservoir evaporation monitoring and reservoir management through the comparison of evaporation estimates from in situ and remotely sensed measurements. In situ evaporation estimates for this project are measured by eddy-covariance towers at Elephant Butte and Caballo Reservoirs. The results will be compared with those from other emerging technologies (described below). Remotely sensed evaporation estimates are developed from Landsat-8 images. The analysis of the data and results are undergoing peer review and should be available in January 2024. Direct evaporation measurements at both reservoirs by the eddy-covariance method were lower than those estimated by the bulk-aerodynamic method. In contrast, evaporation by Class "A" evaporation pan was two to three times higher than both methods. Due to the interest and success of this project, data collection at both reservoirs will continue through September 2024, and potentially beyond.

- FY 2020 Award – completed, *An Experimental Monsoon Forecast for Water Management* (AAO partnership with NCAR, Boulder, CO); Bureau of Reclamation Research and Development | Research and Development Office (usbr.gov). This project builds on a previous S&T Program project characterizing extreme events in New Mexico https://www.usbr.gov/research/projects/detail.cfm?id=1782. It uses a process called "weather typing," along with statistical analyses, to begin to develop forecasts for summer monsoons in New Mexico, and in Arizona under a parallel project. This process was tested in 2021–2023 and has received "Facilitated Adoption" program funding from Reclamation's Research and Development Office for an additional three years of refinement and testing in both New Mexico and western Arizona.

- FY 2021 Award – ongoing, *Utilizing Acoustic Sensors to Detect Streambed Mobilization* (AAO partnership with USGS California Water Science Center and Christ in the Desert Monastery). This project deployed hydroacoustic sensors to determine the flows that initiate streambed mobilization on the Rio Chama. The goal is to improve management of high flow

pulses by correlating the moment of mobilization to a flow rate. The project has been extended through FY 2024 to finish data processing and write the final report.

- FY 2023 Award – ongoing, *Stochastic Streamflow Generation: A Complementary Approach for Hydroclimate Projections in Hydrologically Complex Basins* (Reclamation partnership with University of Massachusetts Amherst). This project is developing tools and resources to support informed use of climate model projections and use of weather generators in water management applications in the Upper Rio Grande Basin, including the Lower San Acacia Reach Improvements Study and the Rio Grande Basin Study: Lobatos to Elephant Butte. The goal is to develop a generalized stochastic streamflow generation approach to complement Reclamation's present practices, that is applicable across river basins and the broader water resources planning community, and consistent with decision-making frameworks such as Decision-Making under Deep Uncertainty (DMDU).

- FY 2023 Award – ongoing, *Assessing Satellite Remote Sensing Products to Improve Spatial and Temporal Resolution of Snow Water Equivalence (SWE) Measurements in the San Juan-Chama Project's Source Watersheds* (AAO partnership with University of New Mexico, University of Wyoming, University of Washington, and USGS New Mexico Water Science Center). This project builds upon a project in the headwaters of the San Juan-Chama Project, *Assessing the Utility of New Satellites to Advance State of the Art Snow Forecasting Capabilities,* funded under the Snow Water Supply Forecasting Program (see below). This S&T funding adds three more years of data collection and remote sensing to support development of a comprehensive tool to assist Reclamation in its snow monitoring in this region. Research was presented at the 2023 American Geophysical Union Annual Conference.

In addition to the S&T Program, Reclamation's Research and Development Office initiated a series of projects in 2022 aimed at developing a Snow Water Supply Forecasting Program that takes advantage of new technologies. AAO is participating in development of this program through two funded projects:

- *A Testbed for Harnessing and Benchmarking Snow Data Observations and Watershed Modeling for Water Supply Prediction* (Reclamation partnership with NCAR) – ongoing. Modeling study to test snow monitoring technologies using data from other Reclamation snow studies. This project has been extended through March 2024 to allow for the receipt and processing of several additional snow datasets to improve the overall benefit of this project to the Snow Program.

- *Assessing the Utility of New Satellites to Advance State of the Art Snow Forecasting Capabilities* (AAO partnership with the University of New Mexico, University of Washington, University of Wyoming, and USGS New Mexico Water Science Center) – ongoing. The initial intent was to test the new NISAR satellite for snow monitoring, but launch was delayed. The project instead focused on comparison of satellite stereo imagery and satellite altimetry measurements of snowpack to ground-based snowpack measurements. A report will be submitted by February 1, 2024.

Reclamation is funding the recalibration of hydrologic models used by the National Oceanic and Atmospheric Administration's West Gulf River Forecast Center, which is responsible for

development of streamflow forecasts for the Rio Grande. These hydrologic models support the development of Ensemble Streamflow Prediction forecasts, similar to those available in the Colorado River Basin, which will supplement the volumetric forecasts available from the NRCS.

Data collection was completed in 2023 on the Collison Floating Evaporation Pan (FEP) project through funding from Reclamation's Upper Colorado Basin Regional Office. This project aims to improve the estimation of reservoir evaporation monitoring through the development and calibration of an in situ floating evaporation pan. FEPs were deployed on Cochiti, Elephant Butte, and Caballo Reservoirs in the Rio Grande Basin, as well as Zuni Salt Lake and Lake Powell in the Colorado River Basin. S&T Program-funded work at Cochiti and Lake Powell was completed in 2021 and the report can be viewed at https://www.usbr.gov/research/projects/detail.cfm?id=8119. Evaporation monitoring continued at Lake Powell, Elephant Butte, and Caballo reservoirs through summer 2023. The final datasets and report were due to Reclamation by end of January 2024. Once received, an independent review of the datasets, including those generated by New Mexico State University, will be performed by Reclamation's Technical Service Center.