



— BUREAU OF —
RECLAMATION

Calendar Year 2022 Report to the Rio Grande Compact Commission

Interior Region 7: Upper Colorado Basin



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, 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 2022 Report to the Rio Grande Compact Commission

Interior Region 7: Upper Colorado Basin

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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
ASI	Annual Site Inspection
ASG	Applied Science Grants
BWHA.....	Blanca Wildlife Habitat Area
CADSWES	Center for Advanced Decision Support for Water and Environmental Systems
CBD.....	San Luis Valley Project-Closed Basin Division
CFA.....	Contributed Funds Agreements
cfs	cubic feet per second
Compact.....	Rio Grande Compact of 1938
CPUE.....	Catch-Per-Unit-Effort
CPW.....	Colorado Parks and Wildlife
CR	Comprehensive Review
cuckoo	Western Yellow-billed Cuckoo
CWCD.....	Conejos Water Conservancy District
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
EOM.....	End of Month
EPCWID.....	El Paso County Water Improvement District No. 1
ESA.....	Endangered Species Act
ET	Evapotranspiration
flycatcher.....	Southwestern willow flycatcher
HCCRD.....	Hudspeth County Conservation and Reclamation District No. 1
HDB	Hydrologic Database
HEC-RAS	Hydrologic Engineering Center River Analysis System
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
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
RGCC	Rio Grande Compact Commission
RGP	Rio Grande Project
RGP BO.....	2016 Rio Grande Project Biological Opinion
RGSM.....	Rio Grande silvery minnow
RGTIHM.....	Rio Grande Transboundary Integrated Hydrologic Model
RGWCD	Rio Grande Water Conservation District
RM.....	River Mile
RWS	Regional Water System
S&T.....	Science and Technology Program
Secretary	Secretary of the U.S. Department of the Interior
SECURE Water Act	Science and Engineering to Comprehensively Understand and Responsibly Enhance Water Act
SIR.....	Scientific Investigations Report
SJCP	San Juan-Chama Project
SLVWCD.....	San Luis Valley Water Conservation District
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
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
WCFSF	Water Conservation Field Services Program
WEEG.....	WaterSMART Water and Energy Efficiency Grant
WIIN Act.....	Water Infrastructure Improvements for the Nation

Introduction

The Albuquerque Area Office of the Bureau of Reclamation (Reclamation) is responsible for operation, maintenance, and oversight of four projects on the mainstem of the Rio Grande (Figure 1) and its upper basin tributaries. These projects are the San Luis Valley Project, the San Juan-Chama Project, the Middle Rio Grande Project, and the Rio Grande Project.

The San Luis Valley Project consists of the Conejos and Closed Basin Divisions. The Conejos Division, which includes Platoro Dam and Reservoir, supplies water for approximately 81,000 acres within the Conejos Water Conservancy District. The Closed Basin Division is 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).

The San Juan-Chama Project 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 for storage in Heron Reservoir as a component of the Colorado River Storage Project. It supplies water for municipal, domestic, industrial, recreation, fish and wildlife purposes, and supplemental water for irrigation. Another part of the project 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 Middle Rio Grande Project consists of El Vado Dam and Reservoir and irrigation and drainage facilities in the Middle Rio Grande Valley. It also includes river channel maintenance from Velarde, New Mexico, south to Caballo Reservoir, and the Low Flow Conveyance Channel south of San Acacia, New Mexico. Irrigation water provided to the Middle Rio Grande Conservancy District supplies water to 50,000 – 70,000 acres of land.

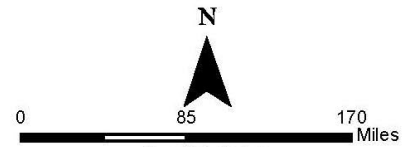
The Rio Grande Project includes Elephant Butte and Caballo Reservoirs and Percha, Leasburg, and Mesilla Diversion Dams. It stretches from the lower Rio Grande Valley of southern New Mexico to Fort Quitman south of El Paso, Texas. The Rio Grande Project provides an agricultural water supply for approximately 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 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.



Data Attribution: USBR, DWR, NHD, USCB, GDFW, and Esri Basemaps

Map Notes: Sensitive Information, Only Major Facilities Included

Albuquerque Area Office Boundary



Coordinate System:
NAD 1983 UTM Zone 13N

Bureau of Reclamation, Upper Colorado Basin, Albuquerque Area Office

Figure 1: Map of Reclamation's Albuquerque Area Office Projects

San Luis Valley Project, Colorado

There are two divisions within the San Luis Valley Project (Figure 2), the Conejos and Closed Basin Divisions.

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

The Closed Basin Division (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 to help stabilize it. Russell Lakes Wildlife Management Area is a mitigation feature of the project but receives no salvaged water. Reclamation operates the wells under the guidance of the San Luis Valley's CBD Operating Committee (Operating Committee). The Rio Grande Water Conservation District assists Reclamation with salvage well maintenance and well rehabilitation and other operation and maintenance (O&M) work through a cooperative agreement.

Conejos Division

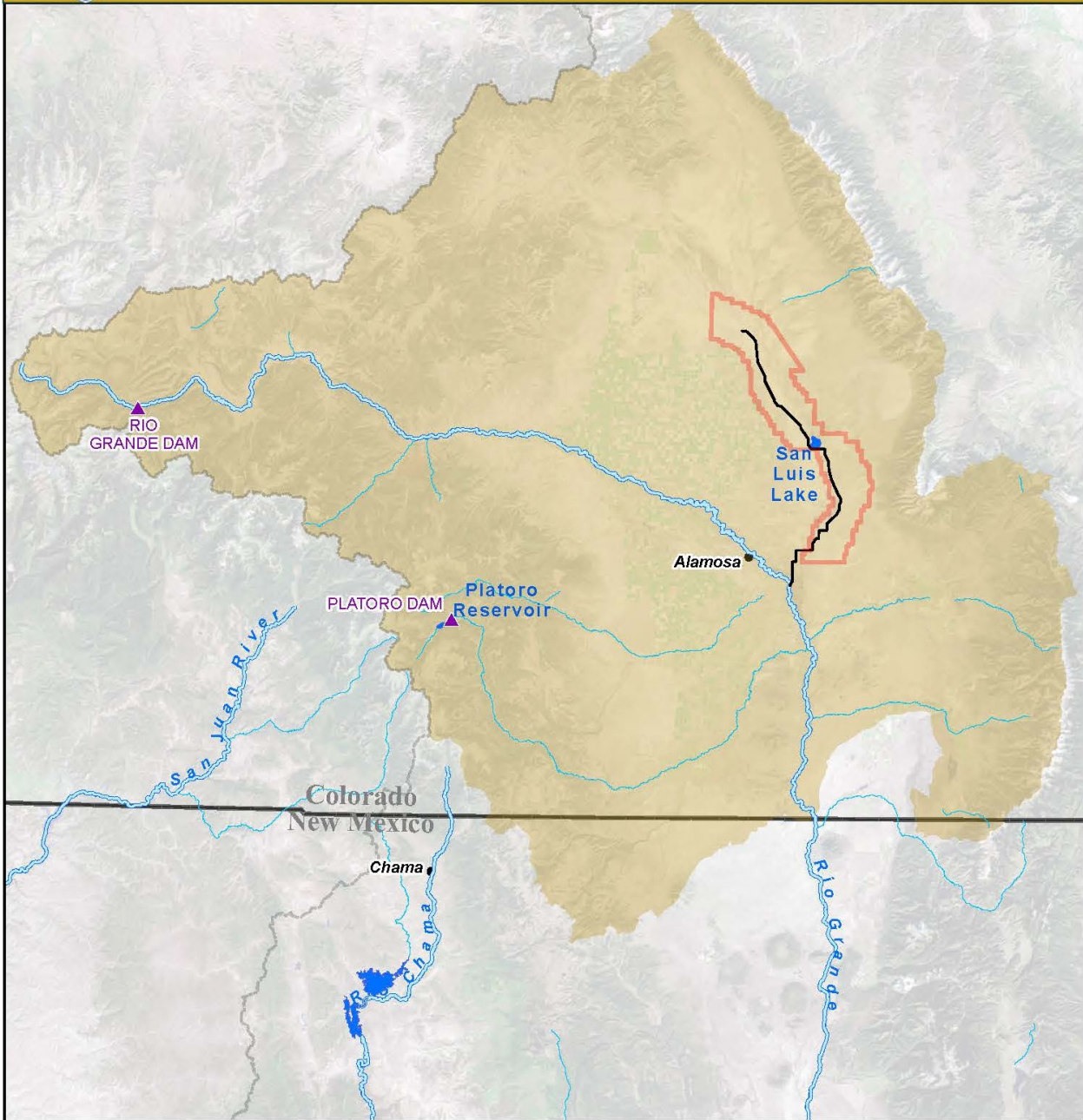
Platoro Operations







Platoro Reservoir started 2022 with a midnight storage volume of 14,290 acre-feet (ac-ft) and water surface elevation of 9,972.19 feet. Article VII¹ restrictions were in effect on January 1 and remained in effect for the rest of the year. The December 31, 2022, reservoir storage volume was 13,899 ac-ft (9,971.39 feet). The minimum storage was on December 26 and 27, at 13,865 ac-ft (9,971.32 feet) and the maximum storage was on May 30, when the reservoir peaked at 26,264 ac-ft (9,993.12 feet).

2023 Platoro Reservoir Outlook

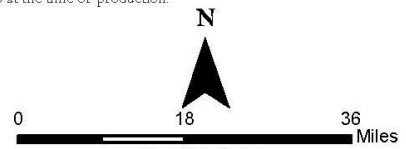
The March 2023 Natural Resources Conservation Service (NRCS) most probable forecast for Platoro Reservoir inflow is for 56,000 ac-ft (110 percent of median). It is probable that Article VII restrictions on Platoro will be lifted for a period of time in 2023.

¹ See the Article VII section under Rio Grande Project



-  San Luis Valley Project
-  Dam
-  Waterbody
-  Closed Basin Canal
-  River
-  Closed Basin Project Area

Map Notes: No warranty is made by the Bureau of Reclamation as to the accuracy, reliability, or completeness of the data herein. This data was produced using the best available resources at the time of production.



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NAD 1983 UTM Zone 13N

Bureau of Reclamation, Upper Colorado Basin, Albuquerque Area Office

Figure 2: 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 O&M issues. Four of the eight Category 2 O&M recommendations were completed in 2022. Recoating the interior of the conduit pipe exhibiting coating degradation, first observed in 2017 and stemming from high velocity discharges, has been deferred to the spring of 2023. The Annual Site Inspections were completed in July 2022 and there were no new O&M recommendations. The Facility Reliability Rating was completed in September 2022 with Platoro Dam receiving a score of 94 which equates to an overall rating of “Good.”

In August 2022, Reclamation conducted instrumentation training for Platoro Dam personnel and an emergency management Tabletop Exercise for Platoro Dam.

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 and to support aquifer sustainability. 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, BWA, and ANWR. In 2022, the CBD delivered 11,673 ac-ft. Of that, total creditable Compact water delivered to the Rio Grande was 8,276 ac-ft. This included 8,110 ac-ft delivered at the CBD canal outlet, plus a 119 ac-ft exchange of Treasure Pass water and a 47 ac-ft exchange with Colorado Parks and Wildlife delivered to the BWA. The ANWR was owed a total mitigation amount of 2,597 ac-ft. Of this total, 2,292 ac-ft was delivered to the ANWR, while 305 ac-ft was delivered to the BWA through an exchange between USFWS and Bureau of Land Management. Table 1 reports total production and Compact deliveries in 2022 and the four preceding years. Table 2 shows total water accounting by delivery location and month.

Table 1: CBD Deliveries 2018-2022²

Year	Total CBD Production	Delivered at CBD Canal Outlet	Delivered by Exchange ³	Total Creditable Delivery
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
2018	10,209	6,558	250	6,808

² Units are ac-ft

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

Table 2: CBD Water Accounting⁴

	BWHA			Parshall Flume		ANWR				Rio Grande Delivery			Total CBD Production
	CH03 Sta. 730+00	CH04 Sta. 798+60	Total ⁵	Total Passing	Creditable	CH01 Chicago Turnout	CH02 Mum Turnout	Pumping Plant	Total	Flume less ANWR	Creditable	Non-Creditable	
January	0	0	0	1,019	1,019	0	0	0	0	1,019	1,019	0	1,019
February	33	0	33	881	881	0	0	0	0	881	881	0	914
March	75	69	144	881	881	261	247	0	508	373	373	0	1,025
April	0	0	0	965	965	16	25	0	41	924	924	0	965
May	0	0	0	946	946	0	0	0	0	946	946	0	946
June	96	124	220	757	757	0	0	0	0	757	757	0	977
July	185	197	382	613	613	0	0	0	0	613	613	0	995
August	158	157	315	643	643	211	185	0	396	247	247	0	958
September	46	83	129	724	724	258	198	0	456	268	268	0	853
October	48	0	48	891	891	364	254	0	618	273	273	0	939
November	0	0	0	1,025	1,025	112	161	0	273	752	752	0	1,025
December	0	0	0	1,057	1,057	0	0	0	0	1,057	1,057	0	1,057
Annual	641	630	1,271	10,402	10,402	1,222	1,070	0	2,292	8,110	8,110	0	11,673

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 1,269 samples collected during 2022. All 2022 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 2022, four new pumps were installed, and 19 salvage wells were rehabilitated.

⁴ Units are ac-ft

⁵ Delivery to BWHA includes a 119 ac-ft Treasure Pass exchange, 47 ac-ft Colorado Parks and Wildlife exchange, and 305 ac-ft mitigation water transfer from ANWR.

San Juan-Chama Project, Colorado – New Mexico

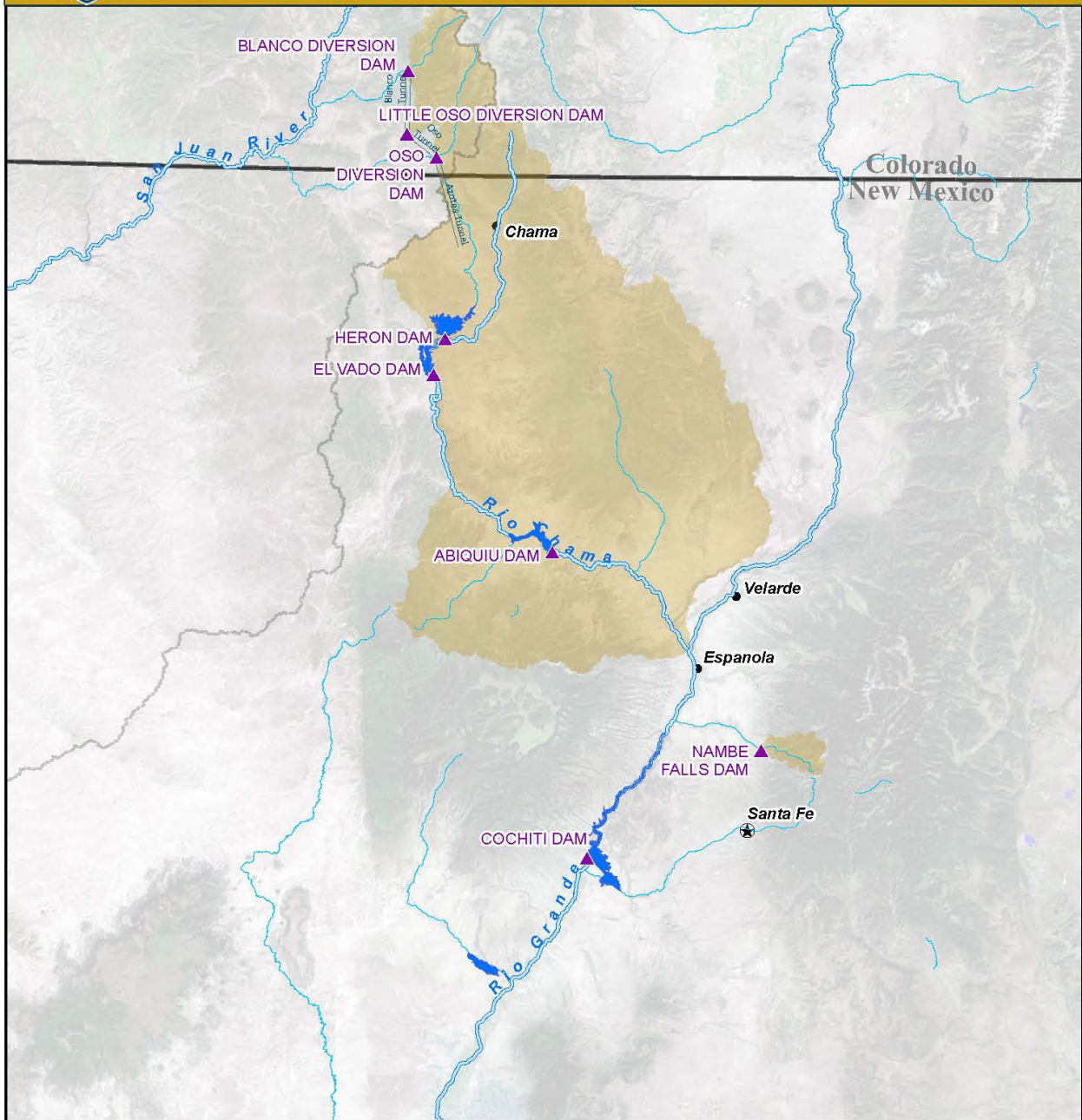
The San Juan-Chama Project (SJCP) diverts water at three diversion dams from the upper tributaries of the San Juan River in Colorado through the Azotea Tunnel to Heron Reservoir in New Mexico for use in the Rio Grande Basin of New Mexico and provides water for municipal, domestic, and industrial use (Figure 3). 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. Reclamation used Crystal Reports software from 2013 to 2021 to generate accounting reports. For 2022, Microsoft Excel was used to create the water accounting report. The Excel workbook mines 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). SJCP accounting for 2022 is provided in the separate *2022 Water Accounting Report*.

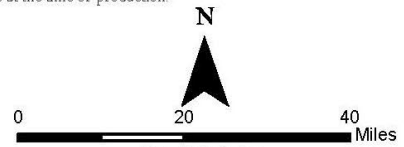
Heron Dam and Reservoir Operations

Diversions into the Azotea Tunnel began on March 3 and continued until October 25 during 2022. The total volume diverted was 67,934 ac-ft. The running 10-year average of Azotea Tunnel diversions increased slightly this year, from 79,145 ac-ft for the period 2012 through 2021, to 81,211 ac-ft for the period 2013 through 2022 (Table 3).



- San Juan-Chama Project
- River
- Dam or Diversion
- Pipeline
- Waterbody

Map Notes: No warranty is made by the Bureau of Reclamation as to the accuracy, reliability, or completeness of the data herein. This data was produced using the best available resources at the time of production.



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Bureau of Reclamation, Upper Colorado Basin, Albuquerque Area Office

Figure 3: Area Map of the San Juan-Chama Project

Table 3: SJCP Diversions Through Azotea Tunnel⁶

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	10-Year Total
January	0	0	28	109	0	0	0	0	0	0	137
February	0	227	974	1,917	1,488	0	0	9	0	0	4,615
March	1,036	1,984	6,890	6,489	16,839	1,598	1,036	1,644	816	2,172	40,504
April	7,068	13,808	8,163	13,687	32,628	12,869	24,049	10,605	13,446	17,079	153,430
May	16,844	20,251	24,470	27,940	45,326	15,616	33,926	26,972	24,778	29,871	265,994
June	8,387	18,851	38,438	35,427	46,227	2,636	56,925	7,866	17,907	6,550	239,214
July	511	1,550	8,581	3,535	10,617	152	26,285	876	2,439	4,556	59,102
August	3,115	788	889	3,681	4,809	7	5,841	159	627	4,707	24,623
September	4,930	902	126	1,271	1,806	0	208	83	116	848	10,291
October	2,761	1,334	811	253	2,413	1,216	0	0	0	2,151	10,936
November	1,049	335	862	0	279	283	0	0	0	0	2,808
December	0	59	0	334	0	90	0	0	0	0	483
Annual	45,760	60,030	90,566	94,309	162,522	34,377	148,270	48,214	60,129	67,934	812,111

Heron Reservoir began the year at elevation 7,077.71 feet (40,261 ac-ft). The maximum elevation/storage was reached on June 2 at 7,107.34 feet (84,874 ac-ft). Heron Reservoir ended the year at elevation 7,078.56 feet (41,195 ac-ft). The low point of the year was 7077.70 feet (40,250 ac-ft), from January 4 to 19.

There was insufficient storage in the project pool on January 1 to make an initial allocation to the SJCP contractors. The first allocation of 17,000 ac-ft was made in May, and subsequent allocations were made in June, July, August, September, and November. A robust monsoon season allowed for an allocation to be made as late as November. The total volume allocated was 62,000 ac-ft, or 64 percent of a full allocation.

The SJCP contractors' 2022 and waived 2021 allocations were delivered as shown in Table 4, for a total delivery of 62,874 ac-ft. The remaining 2022 allocations are being held in Heron according to waivers, which grant an extension of the delivery date into 2023. It should

⁶ Units in ac-ft

be noted that many 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 2022.

Table 4: SJCP Water Releases by Contractor from Heron Reservoir⁷

SJCP Contractor	January	February	March	April	May	June	July	August	September	October	November	December	Annual
MRGCD	0	0	0	0	225	9,117	1,617	0	0	0	1,259	1,568	13,784
Santa Fe	0	0	0	0	0	0	0	0	8,320	0	0	201	8,521
Santa Fe County	0	0	0	0	0	0	0	0	0	0	243	0	243
Cochiti	0	0	0	0	0	0	0	0	422	1,752	459	134	2,767
Albuquerque	0	0	0	0	0	2,289	7,871	9,397	12,008	0	0	0	31,565
Pojoaque Unit	0	0	0	0	0	0	0	0	0	0	663	0	663
Taos	0	0	0	0	0	0	0	0	0	0	50	0	50
Los Alamos	0	0	0	0	0	0	0	0	0	0	0	531	531
Española	0	0	0	0	0	0	0	0	0	0	0	55	55
Taos Ski Valley	0	0	0	0	0	0	0	0	0	0	0	9	9
Los Lunas	0	0	0	0	0	0	120	0	30	0	124	0	274
Bernalillo	0	0	0	0	0	0	100	0	96	0	57	0	253
Belen	0	0	0	0	0	0	100	0	0	0	59	0	159
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	1,494	1,126	1,331	0	0	0	0	0	3,948
El Prado	0	0	0	0	0	0	0	0	0	0	0	0	0
Taos Pueblo	0	0	0	0	0	0	0	0	0	0	0	0	0
Aamodt	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	1,716	12,532	11,139	9,449	20,876	1,752	2,977	2,433	62,874

⁷ Units in ac-ft

Table 5: SJCP Monthly Water Operations at Heron Reservoir⁸

	Inflow		Outflow		SJCP Loss	End of Month (EOM) Content		
	Rio Grande	SJCP	Rio Grande	SJCP		Rio Grande	SJCP	Total
Dec. 2021	-	-	-	-	-	298	39,941	40,239
January	82	0	17	0	0	13	40,291	40,304
February	115	0	16	0	0	112	40,291	40,403
March	966	2,172	19	0	0	1,059	42,463	43,522
April	1,534	17,073	1,498	0	2,029	1,094	57,473	58,601
May	50	29,811	337	1,716	1,658	807	83,911	84,751
June	51	6,537	513	12,532	85	346	77,830	78,209
July	115	4,547	49	11,139	-25	412	71,262	71,708
August	494	4,698	46	9,449	0	860	66,511	67,404
September	30	849	544	20,876	303	346	46,184	46,560
October	73	2,148	66	1,752	0	352	46,580	46,962
November	23	0	23	2,977	325	352	43,278	43,660
December	385	0	387	2,463	0	350	40,845	41,195
Sub-Total	3,948	67,809	3,545	62,874	-	-	-	-
Adjustment ⁹	-	-	-	-	-	-350	-	-
Annual	71,757		66,419		4,380	0	41,195	41,195

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 2022 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 feet is reached. Once that elevation is attained, the outlet gates are regulated weekly to stabilize the reservoir at 6,825.60 feet, or the elevation it is at when it reaches 100 percent ice cover. An uncontrolled spill begins at the top of the spillway crest, an elevation of 6,826.60 feet. During irrigation season (May – October), water is stored and released on demand to meet downstream requirements.

Nambé Falls Reservoir began 2022 at an elevation of 6,823.70 feet (1,573 ac-ft). The reservoir filled on March 13 and remained full and spilling until April 29 when irrigation releases began. The maximum elevation was 6,827.14 feet (1,760 ac-ft) which occurred on August 21. There were two 9-

⁸ Units in ac-ft

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

day releases made at approximately 30 cfs in May. Monsoon season then began in earnest in July which supplied adequate flows for the rest of the season. A peak outflow of 68 cfs occurred on August 25. The minimum elevation of 6,817.66 feet (1,273 ac-ft) was reached on May 28 after the second irrigation release. The reservoir ended 2022 at elevation 6,825.29 feet (1,657 ac-ft).

The Nambé Falls depletion for the year was 735 ac-ft at Otowi (748 ac-ft from Heron). A release of 663 ac-ft from Heron Reservoir was made leaving a deficit of 85 ac-ft. Last year there was a deficit of 711 ac-ft of water that needed to be released for depletions. Since there was no extra water available to be released in 2022 to cover this deficit, 796 ac-ft extra will need to be released in 2023 and/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 2022. A summary of 2022 Nambé Falls Reservoir operations is provided in Table 7.

Table 6: SJCP Water at Otowi¹⁰

	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
January	0	0	5,897	5,897	-3,365	88	130	23	2,337
February	0	0	5,166	5,166	-2,072	85	29	63	3,043
March	0	0	4,023	4,023	390	84	76	18	4,272
April	0	0	229	229	2,470	27	39	19	2,653
May	1,716	0	0	1,716	3,605	67	159	26	5,121
June	12,532	0	0	12,532	1,199	261	317	77	13,231
July	11,139	0	80	11,219	-7,768	154	208	23	3,111
August	9,449	0	615	10,064	-9,035	120	50	22	881
September	20,876	0	0	20,876	-18,513	251	10	23	2,125
October	1,752	0	0	1,752	546	40	59	20	2,220
November	2,977	1,259	0	1,719	2,315	55	30	22	3,971
December	2,463	1,020	0	1,443	1,688	44	97	131	3,121
Annual	62,874	2,279	16,010	76,606	-28,510	1,276	1,204	469	46,086

¹⁰ Units in ac-ft

Table 7: SJCP Monthly Water Operations at Nambé Falls Reservoir¹

	Inflow	Outflow Bypassed	Outflow Storage Release Operational	Outflow Storage Release Irrigation	Reservoir Losses	Total Outflow + Losses	EOM Content
Dec. 2021	-	-	-	-	-	-	1,091
January	184	54	0	0	1	56	1,694
February	159	119	43	0	13	175	1,678
March	250	172	0	14	13	199	1,729
April	546	496	0	76	26	598	1,677
May	744	568	0	533	31	1,132	1,289
June	563	241	0	11	20	272	1,580
July	1,259	1,044	0	26	16	1,086	1,753
August	1,798	1,743	0	52	11	1,806	1,745
September	1,543	1,526	0	50	9	1,585	1,703
October	887	828	0	74	0	902	1,687
November	582	550	0	40	6	596	1,673
December	446	348	113	0	2	463	1,657
Annual	8,961	7,689	157	876	148	8,870	

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 2022 data.

2023 San Juan-Chama Project Outlook

On January 1, 2023, the allocable SJCP water in Heron Reservoir was zero (0) ac-ft. 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. Therefore, contractors were notified on January 15, 2023, of the zero ac-ft initial allocation.

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 will be made monthly beginning in April. They will continue until December 15, unless a full allocation is made earlier. The March NRCS most probable forecast for the Rio Blanco and the Navajo River at the diversions are for 53,000 and 64,000 ac-ft respectively. Based on the March 2023 projected flows, there is a chance that the contractors will receive a near-full or full allocation for 2023.

¹ Units are in ac-ft

Facility Review and Safety of Dams Program

Nambé Falls Dam

There are no significant dam safety-related O&M issues associated with Nambé Falls Dam. The Annual Site Inspection was completed in August 2022. The inspection resulted in three Category 3 O&M recommendations. There is currently one incomplete Safety of Dams recommendation and eight incomplete Category 2 O&M recommendations for Nambé Falls Dam.

To address the Safety of Dams recommendation, Reclamation initiated a seismic hazard study in 2021 with completion anticipated in 2023. In December 2022, to address one of the O&M recommendations, PVID hired a contractor to inspect and remove accumulated sediment and debris on top of and around the intake structure. The contractor removed a small amount of woody debris and air lifted out as much sediment as possible. They also noted that the top hatch to the intake was missing and manufactured and installed a temporary cover to keep larger vegetation from entering the intake. Reclamation will inspect the temporary cover during the next dive exam. Work continues on the other O&M recommendations including updated dam break analyses and revised downstream inundation maps. The Nambé Falls Dam Facility Reliability Rating was completed in September 2022 with the dam receiving a score of 91 which equates to an overall rating of “Good.”

In March 2022, Reclamation conducted a virtual emergency management Tabletop Exercise for Nambé Falls Dam. The newly hired dam tender completed required training in April 2022 and Reclamation conducted instrumentation training at Nambé Falls Dam in August 2022.

Heron Dam

There are no significant dam safety related O&M issues associated with Heron Dam and Dike. An Emergency Management Annual Orientation Seminar was conducted in September 2022. The Annual Site Inspection was completed in July 2022. The Facility Reliability Rating was completed in September 2022 with Heron Dam receiving a score of 94, which equates to an overall rating of “Good.”

Middle Rio Grande Project, New Mexico

The Middle Rio Grande Project (MRGP) consists of El Vado Dam and Reservoir, three diversion dams- Angostura, Isleta, San Acacia, over 1,000 miles of canals, laterals, and drains, 260 miles of the Rio Grande channel, and 57 miles of Low Flow Conveyance Channel (LFCC) and Reclamation's River Maintenance program from Velarde, NM to Caballo Reservoir (Figure 4). The MRGP delivers water for irrigation, maintains valley drainage, and provides flood protection. Under contract with Reclamation, the MRGCD operates and maintains the three diversion dams. Upon completion of title transfer in 2022, the additional portions of the irrigation and drainage system of the MRGP are owned, operated, and maintained by MRGCD. Reclamation owns and administers the storage permit, lands, and rights-of-way activities of El Vado area.

El Vado Dam and Reservoir Operations

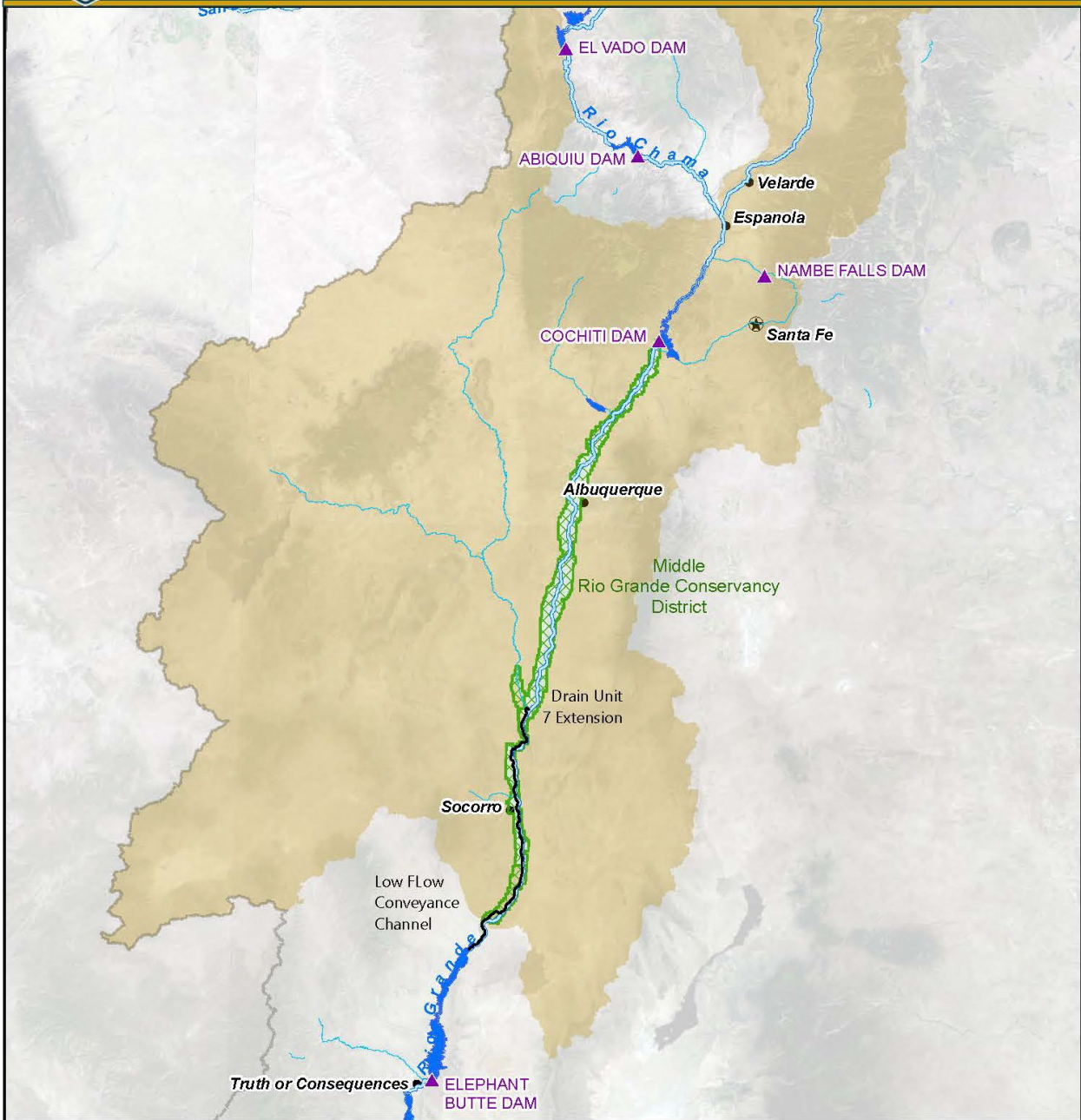
El Vado Reservoir began 2022 at an elevation of 6,809.64 feet (16,015 ac-ft) and ended the year at 6,785.95 feet (2,262 ac-ft). The low point of the year occurred on July 1 with the reservoir hitting an elevation of 6,783.68 feet (1,474 ac-ft). The peak was on April 27 at an elevation of 6,814.07 feet (19,674 ac-ft). All storage at the end of the year was MRGCD's SJCP water. Table 8 provides a summary of monthly operations and water accounting for El Vado Reservoir.

El Vado started 2022 with no native Rio Grande water and only SJCP water in storage. Article VII¹ Compact restrictions on storage of native water were in effect for the entire year, so Reclamation only retained native water for the needs on Prior and Paramount (P&P) lands. Due to elevation restrictions for the El Vado Dam construction² (6,785 feet +/- 1.5 feet), most of the P&P water was moved to Abiquiu in May where it was held until released for delivery before the end of the year. Reclamation retained 1,500-2,000 ac-ft of the P&P water in El Vado. Weekend rafting releases of about 600 cfs were made from native flows and SJCP water released from Heron Reservoir and passed through El Vado through the summer while staying within the elevation restriction.

MRGCD started 2022 with no SJCP water or native water in storage at El Vado Reservoir. Reclamation did not store any native water for MRGCD during the year. MRGCD operated using native flows of the Rio Chama and the mainstem Rio Grande and 11,505 ac-ft of their 2022 SJCP allocation. They moved their remaining 2,279 ac-ft of their 2022 SJCP allocation to El Vado in November.

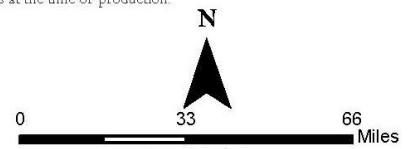
¹ See Article VII Section under Rio Grande Project

² See El Vado Dam Construction Section below



- Middle Rio Grande Project
- Dam or Diversion
- Waterbody
- River
- Canal
- Irrigation/Conservancy District

Map Notes: No warranty is made by the Bureau of Reclamation as to the accuracy, reliability, or completeness of the data herein. This data was produced using the best available resources at the time of production.



Bureau of Reclamation, Upper Colorado Basin, Albuquerque Area Office

Figure 4: Map of Middle Rio Grande Project

Table 8: Reservoir Operations for El Vado Dam¹

	Inflow		Outflow		Losses		EOM Content		
	Rio Grande	SJCP	Rio Grande	SJCP	Rio Grande	SJCP	Rio Grande	SJCP	Total
Dec. 2021	2,769	1,432	8,896	2,875	94	-15	0	16,101	16,101
January	2,189	0	91	5,897	0	0	2,098	10,204	12,302
February	2,182	0	88	5,166	0	0	4,192	5,038	9,230
March	6,132	0	1,163	4,023	34	0	9,127	1,015	10,142
April	52,030	0	42,863	229	72	7	18,221	779	19,000
May	39,767	1,716	56,737	1,716	-84	20	1,335	758	2,093
June	6,615	12,532	7,030	12,532	6	30	914	728	1,642
July	9,102	11,139	8,595	11,219	-97	32	1,517	617	2,134
August	12,100	9,449	11,815	10,064	120	2	1,682	0	1,682
September	5,596	20,876	5,395	20,876	26	0	1,856	0	1,856
October	5,512	1,752	5,107	1,752	18	0	2,243	0	2,243
November	3,863	2,977	4,972	1,719	14	1	1,120	1,258	2,378
December	3,920	2,433	5,046	1,413	10	1	-15	2,277	2,262
Annual	149,008	62,874	148,902	76,606	119	93	-	-	-

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 information mentioned above may differ from those found using final 2022 data.

Prior and Paramount Operations

Reclamation retains native water in El Vado Reservoir for use on the P&P acreage of the six MRG Pueblos when natural Rio Grande flows are not sufficient to meet irrigation demand. The Bureau of Indian Affairs’ call for P&P in 2022 was 20,000 ac-ft. USACE issued a deviation to store native water in Abiquiu during El Vado construction. Retention of native water for P&P started in January at El Vado. Most of the P&P water in El Vado was moved to Abiquiu in May. USACE retained additional native water for P&P to achieve the 20,000 ac-ft call by May 24. There was no call for release from the P&P water over the course of the irrigation season indicating the irrigation demand from the P&P lands was met with available natural flows. Evaporation losses to the P&P water from April 30 to December 12 were 1,624 ac-ft. The remaining 18,644 ac-ft was released to Elephant Butte Reservoir between November 15 and December 12.

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 the Article VII storage restrictions are in effect. New Mexico allocates this water through a series of Emergency Drought Water (EDW) agreements with Reclamation,

¹ Units in ac-ft

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 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 2022.

Compact Debit Water

Under Article VI of the Compact, native water in El Vado Reservoir for 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, therefore no Compact Debit water was stored or retained in El Vado during 2022.

2023 Middle Rio Grande Project Outlook

The March 2023 NRCS spring runoff forecast for the Rio Grande at Otowi is 575,000 ac-ft (102 percent of median) and March to July El Vado Reservoir inflow of 215,000 ac-ft (116 percent of median). In 2022, the actual volume at Otowi, excluding SJCP flows and adjusted for upstream storage, was 290,500 ac-ft and March to July inflow to El Vado was 114,422 ac-ft. While the 2023 runoff forecast is well above last year observed volumes, conditions can change quickly and observed flow could be well below the March forecast. Reclamation therefore uses the full range of runoff forecasts to plan for the irrigation season.

El Vado Dam Facility Review and Safety of Dams Program

The Annual Site Inspection was completed in July 2022 and an embankment point survey was completed in May 2022.

The El Vado Dam Facility Reliability Rating was completed in September 2022 with the dam receiving a score of 56 resulting in an overall rating of “Poor.” The “Poor” rating is due to one incomplete Safety of Dams recommendation which results in a 2022 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 current El Vado construction, updated in the 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 outstanding Safety of Dams recommendation refers to preparing final designs for preferred alternatives to address risk associated with the failure of the service spillway, an uncontrolled release via the emergency spillway, and internal erosion through the embankment. Additionally, through the Safety of Dams process a change in operation was issued that restricted the reservoir elevation to 6,785 feet until the El Vado construction project addresses the Safety of Dams recommendation. The reservoir was operated at the restricted elevation from April to December 2022 with no major issues.

In September 2021, the El Vado Seepage Reduction Modification Project, Phase 1, was awarded to Carpi USA, Inc., for \$31.2 M 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.

Carpi mobilized in the spring of 2022 and completed repairs to the steel face plate and began grouting beneath the face plate. Currently, the Government and Contractor are working through several modifications based on quantity and site condition changes. The project is on budget, but it is expected that the baseline schedule will add six to 12 months due to grouting methods and materials changes in late 2022. Carpi is scheduled to begin re-mobilizing in March 2023 and re-commence field work in early April 2023.

The El Vado Spillway Replacement, Phase 2, is going through final design changes. The solicitation should be posted late in 2023. Phase 2 may include repairs to or replacement of the El Vado stilling basin. When Phase 2 begins in the spring of 2024, it is anticipated that NM Highway 112 will be closed for realignment and construction of new bridge over the service spillway entrance.

Related Reservoir Operations

Abiquiu Dam and Reservoir

Abiquiu Dam and Reservoir is a U.S. Army Corps of Engineers' (USACE) facility. P.L. 97-140 authorizes storage up to 200,000 ac-ft of SJCP water in Abiquiu Reservoir. SJCP water in storage in 2022 peaked on October 4 at 104,597 ac-ft. Total storage in the reservoir peaked at 124,855 ac-ft (6,204.08 ft) on September 23. There was no flood storage in 2022. Abiquiu ended 2022 with 99,422 ac-ft of SJCP water in storage. Table 9 provides a summary of monthly operations and water accounting for Abiquiu Reservoir. The P&P water was retained in Abiquiu once the El Vado elevation restrictions were implemented. USACE issued a deviation to allow native water retention.

Table 9: Reservoir Operations for Abiquiu Dam¹

	Inflow		Outflow		Losses		EOM Content			
	Rio Grande	SJCP	Rio Grande	SJCP	Rio Grande	SJCP	Sediment	Rio Grande	SJCP	Total
Dec. 2021	11,826	2,908	17,872	2,498	8	118	2,235	0	75,669	77,904
January	942	5,722	1,048	2,357	0	140	0	-1,600	78,895	78,275
February	1,334	5,117	285	3,044	0	148	0	-554	80,819	81,248
March	3,161	4,061	911	4,450	25	573	0	1,662	79,856	82,510
April	44,740	325	42,749	2,795	77	1,104	58	3,558	76,282	80,907
May	58,994	1,499	43,236	5,103	418	1,568	136	18,873	71,109	91,153
June	6,753	12,503	6,593	13,702	334	978	142	18,681	68,932	88,809
July	9,321	10,700	7,940	2,932	162	109	151	19,896	76,591	97,695
August	17,935	9,345	19,364	310	94	-302	166	18,354	85,928	105,524
September	6,346	20,455	6,800	1,942	113	285	179	17,781	104,156	123,197
October	5,836	1,864	5,511	2,410	97	374	180	-	103,236	122,505
November	-5,508	12,682	5,990	14,997	58	132	180	-	100,789	108,503
December	-1,493	8,470	5,527	10,158	4	-351	180	-	99,452	100,112
Annual	148,361	92,713	145,954	64,200	1,382	4,758	-	-	-	-

Cochiti Dam and Reservoir

Cochiti Dam and Reservoir is another USACE facility. It is located downstream from the confluence of the Rio Chama and the Rio Grande. 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 more 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 2022, 1,848 ac-ft was released from Abiquiu Reservoir and 1,825 ac-ft arrived in Cochiti Reservoir to fill the recreation pool and maintain flows on the Rio Chama. The year ended with a deficit of 3,903 ac-ft needed to reach 1,200 surface acres. Table 10 is a summary of monthly operations and water accounting for Cochiti.

¹ Units in ac-ft

Table 10: Reservoir Operations Cochiti Dam

Cochiti Reservoir Operations	Authorized SJCP Pool		Wetlands		SJCP Pool					Hold Pool
	Area (acres)	Content Capacity (ac-ft)	EOM Elevation (feet)	EOM Area (acres)	EOM Content (ac-ft)	EOM Area (acres)	Losses (ac-ft)	Demand (ac-ft)	Delivery (ac-ft)	SJCP Pool + Sediment
Dec. 2021	1,200	44,137	5,354	0	41,028	984	75	3,109	205	41,307
January	1,200	44,137	5,354	0	41,128	995	63	3,010	166	41,411
February	1,200	44,137	5,354	0	42,000	1,051	65	2,137	937	42,288
March	1,200	44,137	5,354	0	42,206	1,060	213	1,931	419	42,500
April	1,200	44,137	5,354	0	41,808	1,044	399	2,330	0	42,141
May	1,200	44,137	5,354	0	41,308	1,012	500	2,829	0	41,694
June	1,200	44,137	5,354	0	41,044	985	264	3,094	0	41,434
July	1,200	44,137	5,354	0	40,706	948	337	3,431	0	41,113
August	1,200	44,137	5,354	0	40,483	927	223	3,654	0	40,925
September	1,200	44,137	5,354	0	40,266	913	312	3,872	95	40,723
October	1,200	44,137	5,354	0	40,309	915	40	3,828	84	40,774
November	1,200	44,137	5,354	0	40,172	910	137	3,965	0	40,649
December	1,200	44,137	5,354	0	40,234	912	62	3,903	124	40,723
Annual	-	-	-	-	-	-	2,615	-	1,825	-

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 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.

River Maintenance

Reclamation has authorization for maintenance of the Rio Grande from Velarde, NM, south to the headwaters of Caballo Reservoir. Responsibilities include maintenance of the river channel, floodplain, MRGP drains, and the LFCC. 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 annual assessment of sites and reaches conditions after the spring snowmelt 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 continuing to work on improving 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 a Letter of Permission.

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 Montaña Bridge, and Isleta downstream to Elephant Butte.

The ongoing Lower San Acacia Reach Initiatives (LSARI) effort is evaluating alternatives in the high priority San Acacia Reach to improve water conveyance and meet ecological goals. A report entitled "Lower Reach Plan" was completed in 2018 and led to a value planning study in 2021. The original document provides a strategic overview of reach projects and efforts underway for the river and LFCC from Isleta Diversion Dam to the Elephant Butte Reservoir pool. During 2022, alternatives were identified, a technical team was established, and an environmental impact statement was started. Reclamation anticipates completing a feasibility-level study and conducting the public scoping and field surveys in 2023. The final environmental impact statement and construction planning are anticipated for 2025 with phased construction 2025 through 2028.

Determination of River Maintenance Needs

In 2014, Reclamation completed its "Determination of River Maintenance Needs" process. The workshop followed a developed 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. A total of 86 sites and 11 reaches were evaluated. Monitoring during

the spring runoff and monsoon season in 2018 and work progress were considered in the 2019 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 Actions¹.

River Maintenance Sites

Reclamation is pursuing work at 17 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.

San Felipe (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. 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 designed by a contractor hired by the Pueblo and were constructed by Reclamation in 2014. Through a P.L. 93-638 contract, the Pueblo of Santa Ana planted vegetation at this site in early 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 (Figure 5). An interim adaptive maintenance project was completed in January 2016 to provide additional protection of the levee system while a longer-term solution could be investigated. The site experienced additional bank

¹ See the Programmatic Water Operations and River Maintenance ESA Compliance Section

erosion during the 2016 and 2017 runoff, but the existing weir field and temporary controls placed in 2016 minimized the extent of the lateral bank migration.



Figure 5: Looking downstream at Santa Ana RM 205.8 east bankline bendway weirs and repairs (Reclamation)

An investigation to evaluate the specific geomorphic and hydraulic conditions that led to the unexpected bank erosion during the 2015 runoff was completed in October 2018. Reclamation is currently performing adaptive maintenance work as part of a permanent repair project. These repairs include 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 bendway, 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 and is expected to continue through March 2023. Figure 6 shows progress of the construction on the longitudinal stone toe protection.



Figure 6: Looking downstream at placement of riprap for longitudinal stone toe protection on the eastern bankline; scour hole is visible in the distance (Reclamation)

Angostura to Montañó Reach Planning (Existing)

In 2014, Reclamation identified the reach of the Rio Grande from RM 201 to Montañó 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 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-GeomorphicanHydraulicAnalysis.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. Post-project geomorphic monitoring such as cross

section data collection, aerial flights, and longitudinal profile data collection on the Rio Grande have been performed since 2008 as part of the adaptive maintenance activities.

In 2016, there was new erosion along the east bankline at the site. With the approval of the Pueblo's Tribal Council, Reclamation strengthened the bankline at the bendway weirs in March and April 2017.

Subsequent adaptive maintenance work at this site consists of two phases. Phase I involved rehabilitating the side channels constructed on the western floodplain as part of the original 2008 project and constructing a new side channel to facilitate water and sediment transport from an arroyo on the western floodplain (Figure 7). Phase II will include two new side channels (Figure 8) just downstream of the project in an area that is also eroding. Construction on Phase I was completed in April 2021. Construction on Phase II is expected to start in fall 2023.



Figure 7: Construction of new side channels on the western floodplain of the Sandia Priority Site (Reclamation)

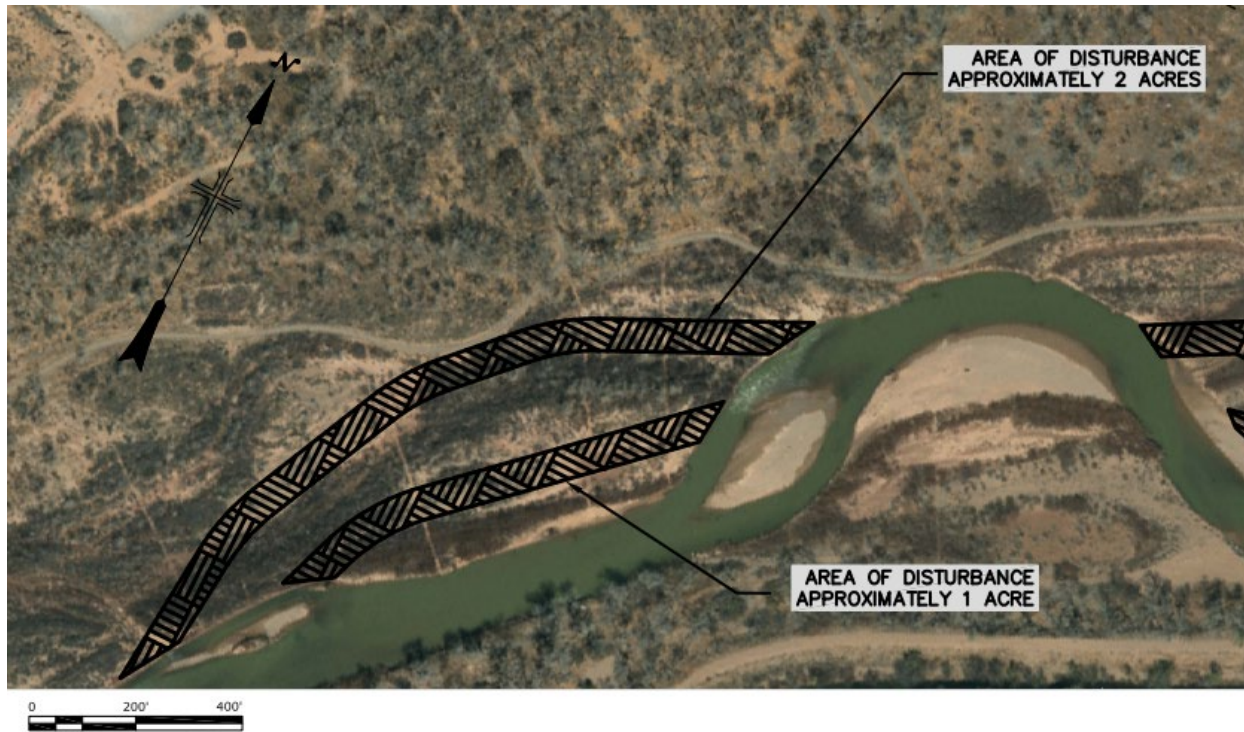


Figure 8: Plan view of the designed Sandia Priority Site Phase II side channels

Corrales Siphon (Adaptive)

The Corrales Siphon at RM 199.7 is in Corrales, NM, just north of Albuquerque and about 700 feet 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.

Reclamation and MRGCD collaborated on a short-term project that placed riprap in the scour hole downstream of the exposed siphon. Approximately 1,800 cubic yards of riprap were placed upstream and downstream of the siphon along the west bankline.

The scour hole and exposed part of the siphon have moved away from the west bank toward the center and east bank of the river channel. In fall 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 9).



Figure 9: Looking east at the Corrales Siphon and the 2020 riprap protection placed downstream of the siphon (Reclamation)

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 irrigation season. 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.

River Mile 199 (New)

In spring 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 feet from the west levee toe. The Angostura to Montaña 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.

In 2019, Reclamation began alternative formulation and analysis to address bank erosion near the Corrales levee system. 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. In 2021, the bank stabilization with channel raising plus cutoff channels alternative was selected (Figure 10).

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 with plans for completion of 90% design work in June 2023, followed by performing environmental compliance. Construction is targeted for fall 2024. Project has experienced some delay due to staffing shortage.

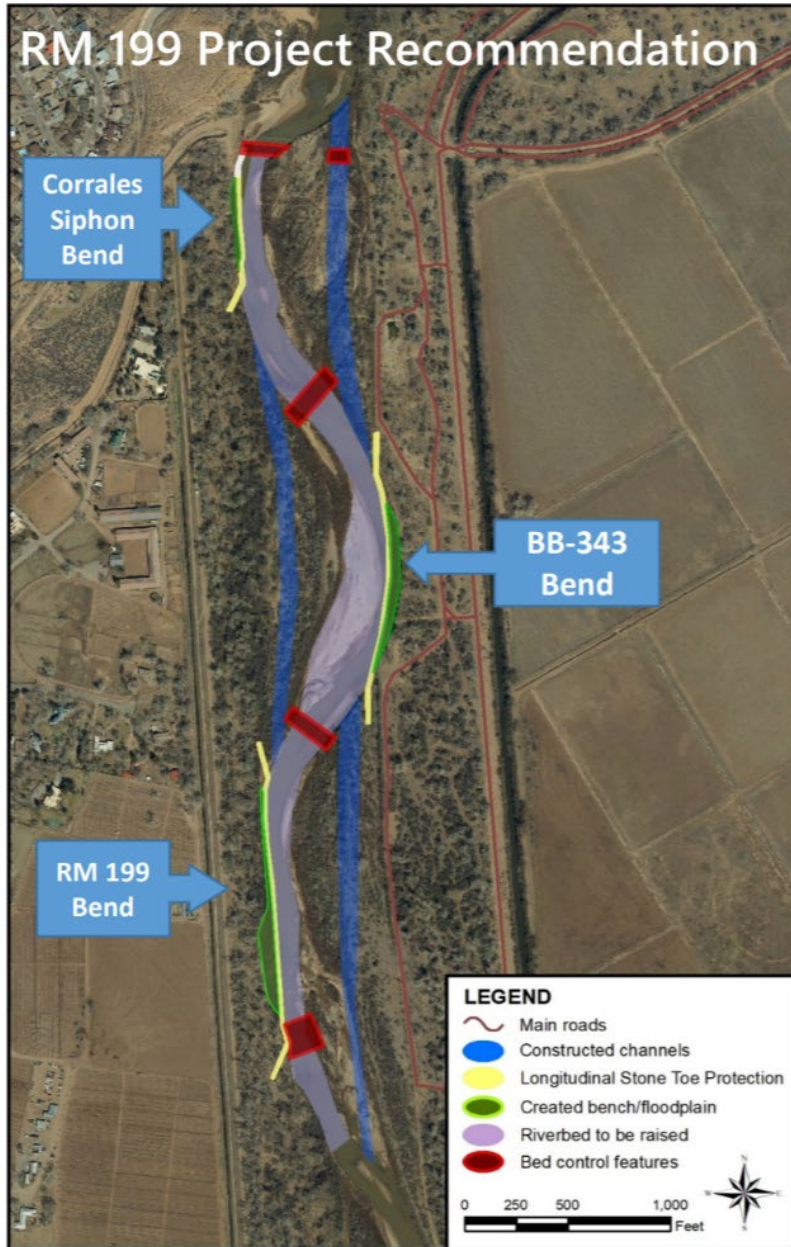


Figure 10: Plan view showing the design layout of the RM 199 maintenance project

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 (please see the next section for more details).

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 conveyance. Reclamation completed project designs in the fall of 2022 (Figure 11). The project is currently going through environmental approvals funded by the NMISC. Clean Water Act approvals from the USACE and the New Mexico Environment Department for Section 404 and 401 permitting, respectively, have caused delays. Construction of Los Lunas RM 163 is tentatively targeted for fall 2023.

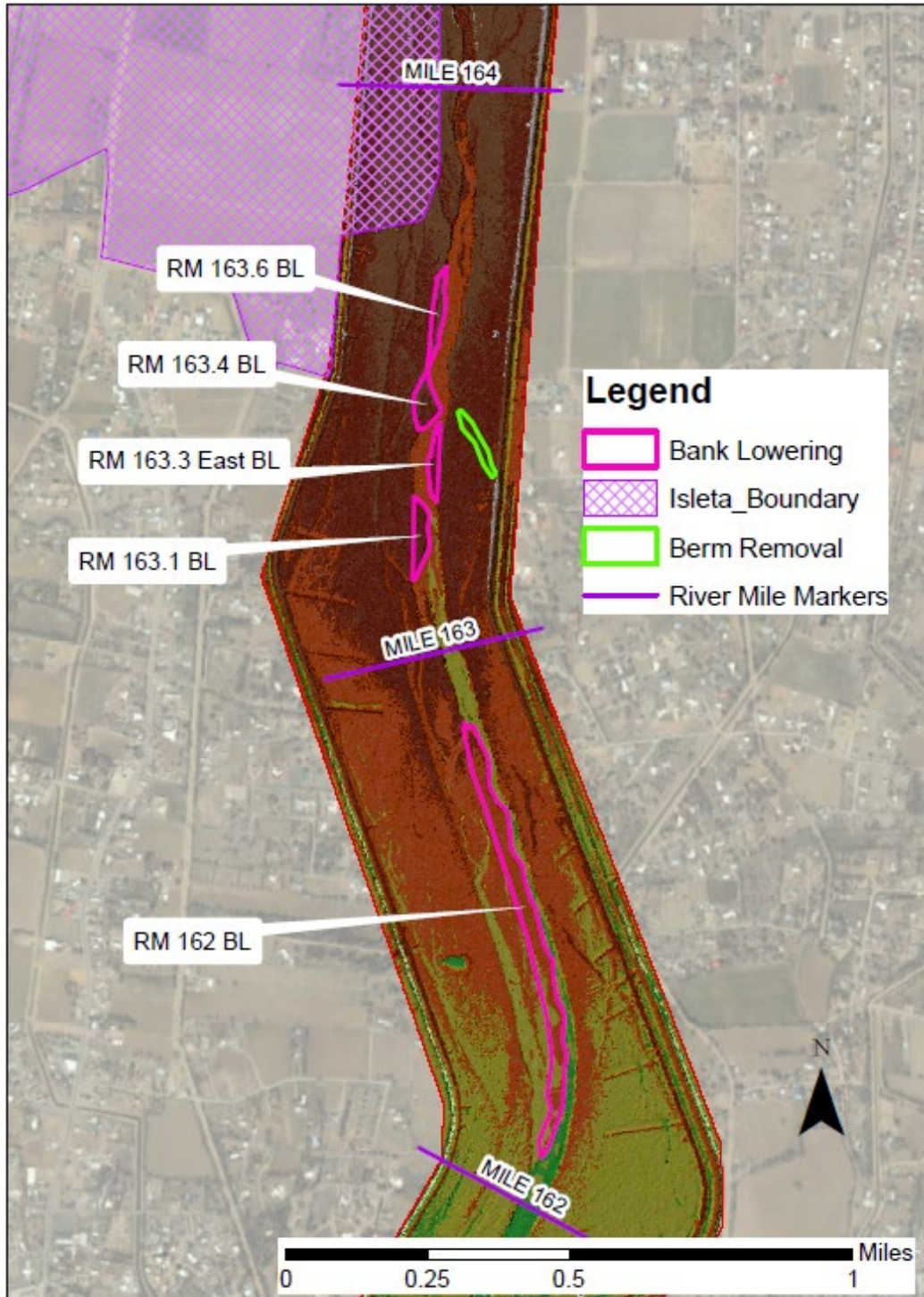


Figure 11: Plan view showing the design bank lowering (BL) berm removal features of the RM 163 maintenance project immediately upstream of U.S. Highway 6 bridge

Highway 380 to Elephant Butte Reservoir Reach Planning (Existing)

Planning efforts are currently underway to identify 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 Bosque Del Apache National Wildlife Refuge (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.

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 12). Like the downstream phase of this project, 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. The project's wetland delineation report is currently being finalized. Findings identified no wetlands along the planned project realignment. In 2023, the design documentation should move to the 90% level. Environmental compliance should also be completed so that construction may begin in fall 2024.

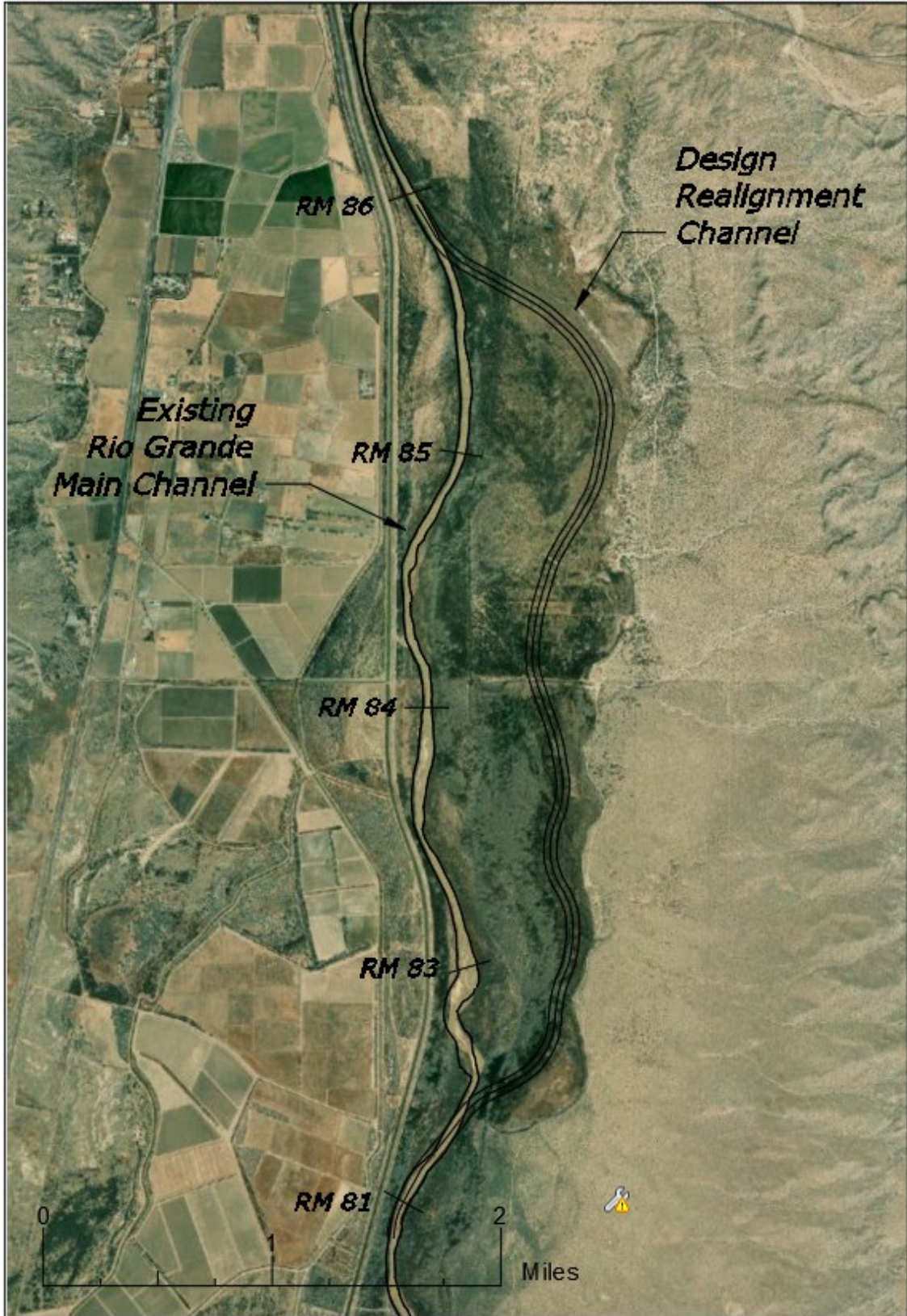


Figure 12: Plan view showing proposed Bosque del Apache River Realignment project.

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 will move two river channel segments to the east, about 4.5 miles (Upstream Phase) and 2.5 miles in length (Downstream Phase), and then reconnect them with the current channel.

In 2016, Reclamation decided to first construct the Downstream Phase to learn from the observed channel response of the smaller realignment section before beginning work on the longer Upstream Phase realignment. The southern realignment was termed the BDA Pilot Realignment Project.

Designs were completed on the BDA Pilot Realignment Project in 2017. Mowing began in January 2018. During the extended 2019 spring runoff, a plug again formed in the main river channel at the same location as in 2017. This plug completely blocked flow from the main channel, and water was forced into the area mowed for the project. The necessary CWA compliance was obtained from USACE in summer 2019. 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. Due to the low spring runoff in 2021 and 2022 (55 percent and 52 percent of median at the Otowi Gage, respectively), there has not been extended high flows to further advance the river slope adjustment from the new downstream connection. At the time of this report, knick-point sediment excavation to facilitate the channel's adjustment and conveyance is underway. This adaptive management work will be completed in early 2023 and ready for any incoming spring runoff flows.

A Reclamation-led hydraulic data collection effort through the realignment corridor has been completed annually in March 2020, 2021, and 2022. This monitoring is scheduled again for March 2023. Site revegetation began in January 2021 with the planting of the northern willow grid within the old river channel. Ongoing project monitoring will continue with invasive species vegetation control performed by BDA field crews over the next several years while, regular channel monitoring by Reclamation in coordination with NMISC, and RGSM studies conducted with funding by both the State and Federal stakeholders.

Project monitoring by Reclamation and NMISC staff 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 13). 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 ISC. Channel maintenance at what is now being called the “knickpoint” site (Figure 14) on the lower realignment project is ongoing and is expected to be completed by March 2023.



Figure 13: View of realigned Rio Grande channel on the BDA from the west bank following summer monsoonal flows (Reclamation)



Figure 14: Channel maintenance work at the knickpoint site on the BDA Lower Realignment Project (Reclamation)

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 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.

In 2022, spring runoff was below average for the Rio Grande resulting in no expected changes to the channel capacity from the previous year. Reclamation completed channel excavation for approximately two and one-half miles through the BDA in September 2020. It is expected that downstream water conveyance will improve through this river section and that the excavation will minimize the risk of sediment plug formation in the channel at this location.

NMISC's contractor removed debris from the lower channel that deposited as reservoir storage levels dropped in the summer of 2022. Their focus was north of the Rio Grande at the Narrows with the NMISC contractor completing this effort in December 2022. Reclamation construction crews did not perform any Delta Channel maintenance work this year.

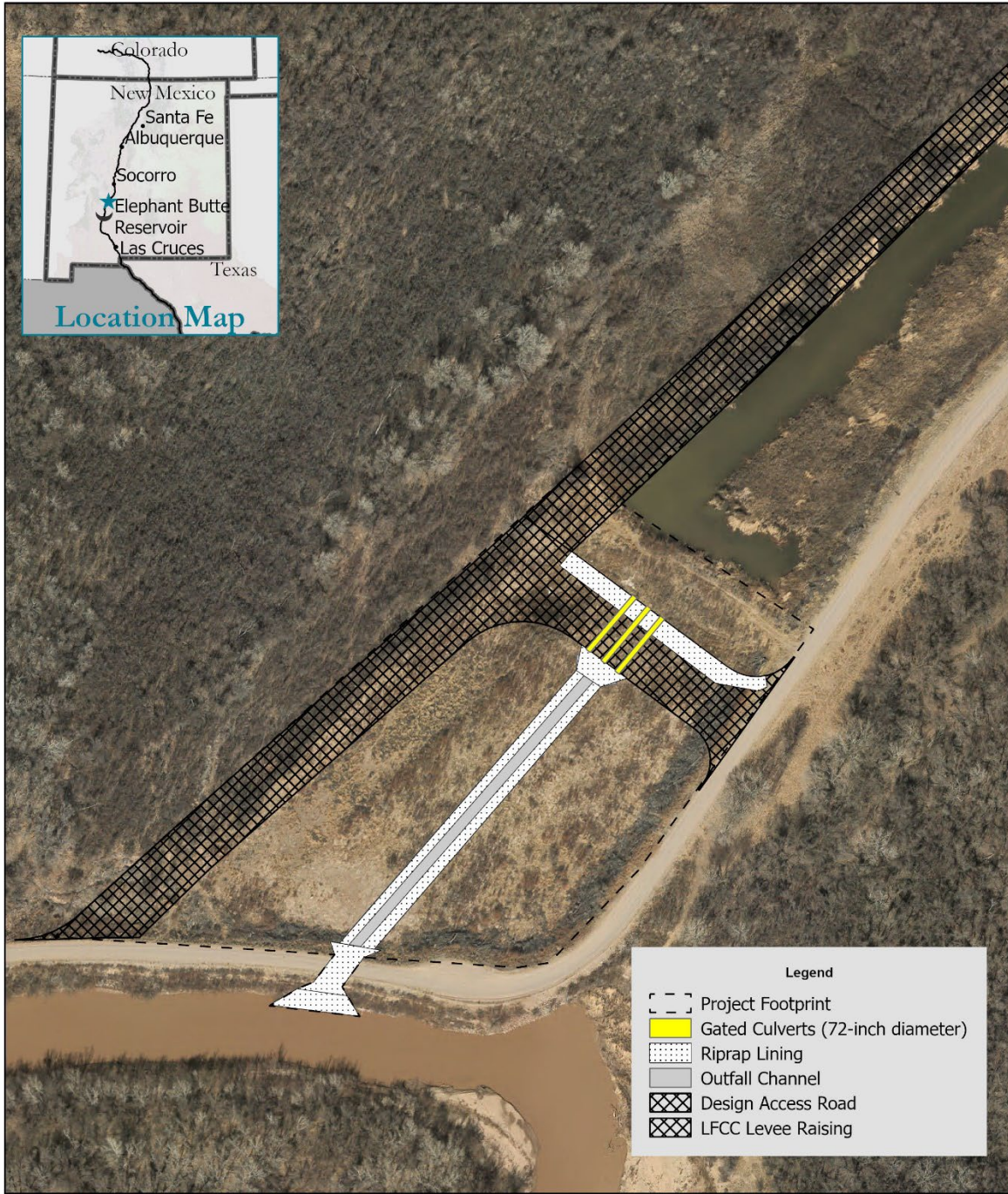
Fort Craig Bend and River Mile 60 (Existing)

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 habitat for 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 Fort Craig pump site. Recent observations show that the windrow has not launched into the channel even though the bank toe has additional scour.

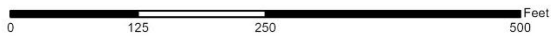
Additional repair work may be needed at the RM 60 bend in 2023. Currently the Fort Craig bend appears to be stable. The multi-disciplinary interagency LSARI team has developed alternatives to reduce maintenance frequency, increase water salvage, and enhance habitat throughout the San Acacia Reach. The alternatives are being evaluated via a feasibility-level study and through the LSARI effort.

River Mile 60 (New)

Reclamation is working with MRGCD and NMISC to re-establish a more direct outfall to the river channel near the terminus of the LFCC at RM 60 or the Elephant Butte headwaters. This outfall returns irrigation return and valley drainage flows and should help with downstream deliveries to the reservoir pool and the State of New Mexico's water delivery under the Rio Grande Compact. Construction is planned for 2023. Figure 15 shows the project components. Following construction of the outfall, plans are in place for doing Adaptive Management and experimental operations for optimizing outfall operations for both water delivery and sustaining western riparian and wetland habitats.



Produced by the Bureau of Reclamation
Upper Colorado Region
Albuquerque Area Office



River Mile 60 Proposed Outfall Project Footprint Area: 7.4 ac



Date: 20191017
Printed: 20230131
Document Name: RM60 Layouts

Figure 15: RM 60 Proposed Project Outfall

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. Work identified for 2022 involves sediment removal at the mouths of three major tributaries (Mescal, Cuchillo Negro, and Hondo). Sediment removed from seven maintenance sites in the Truth or Consequences totaled 19,000 cubic yards in the 2021-2022 maintenance season.

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. USACE has informed Reclamation that the current single 5-year Regional General Permit for this work will have to be replaced by multiple annual permits, up to four permits every year.

Delta Channel Maintenance with the State of New Mexico

In 2022, 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.

USACE issued a new Letter of Permission valid for five years which 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 temporary 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 46 and RM 49 near Red Rock staging area. M Reclamation provided necessary engineering services, environmental compliance, and construction inspection associated with Delta Channel Maintenance in accordance with the agreement.

2022 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 1800 historic rangelines established for monitoring sediment aggradation/degradation along the floodway and levee system. Plans are underway 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.

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.

Endangered Species

Incidental take of RGSM is authorized for the Proposed Action if October density is greater than or equal to 1.0 fish per 100 m² for 10 of the 15 years of the MRG BO's duration, October density is less than 1.0 fish per 100 m² for no more than five of the 15 years, and October density is less than 0.3 fish per 100 m² 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.

RGSM density, measured as Catch-Per-Unit-Effort (CPUE, number of RGSM per 100 m²), in October 2022 was 0.08 RGSM/100 m² which was lower than the October 2021 CPUE of 0.27 RGSM/100 m². Based on 30 sampling sites, RGSM CPUE in October 2022 was 0.18 RGSM/100 m² which is higher than the 20 sites estimate of 0.08 RGSM/100 m². Reclamation continues to evaluate whether the low estimated CPUE in 2022 occurred due to the Proposed Action or, more likely, the reduced natural flow availability 2022.

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.

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 two flycatcher nest territories in 2022 due to construction activities for two of Reclamation's projects in 2022. The Rio Grande Delta Channel project between RM 48 and RM 50 involved vegetation and sediment removal for levee maintenance and resulted in incidental take of 5 flycatcher nest territories, approximately 13 acres of moderately suitable habitat and 30 acres of suitable habitat for the flycatcher, and about 19 acres of suitable habitat for the cuckoo. The controlled outfall project from the LFCC into the Rio Grande at RM 60 included vegetation removal and road maintenance and resulted in the incidental take of approximately 1.6 acres of moderately suitable habitat for the flycatcher, and 2.5 acres of suitable habitat for the cuckoo. There was no incidental take of cuckoo territories in 2022 from on the ground project activities.

In 2022, Reclamation and the MRG BO Partners continued implementing the commitments set forth in the BO. Several large-scale projects, including LFCC and 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 2022:

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

The 2022 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 rapidly drawing a seine through the water column to capture fish has been conducted monthly from April to November at 20 standard monitoring sites along the river (Dudley et al. 2022a). For comparison among years, seasons, and sites, the catch of RGSM and other fishes is standardized to a density or CPUE. Since 2017, 10 additional sites are surveyed during October and CPUE is reported for both the 20 standard sites and 30 sites (standard and additional).

Based on monitoring data from the 20 standard sites, RGSM were present at three of 20 sites with an overall CPUE of 0.08 RGSM/100 m² during October 2022 (Dudley et al. 2022b). At these 20 standard sites, the October 2022 CPUE was lower than the October 2021 CPUE of 0.27 RGSM/100 m². Based on all October surveys since 1993, the overall CPUE averaged 6.96 RGSM/100 m² and ranged from 0.00 to 37.86 RGSM/100 m².

Based on the 30 sampling sites, RGSM CPUE in October 2022 was 0.18 RGSM/100 m². This estimate was more than double the 20 standard site CPUE of 0.08 RGSM/100m². The species was present at 10 of those 30 sites in October 2022.

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. 2022a). 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 (1993–2020; Dudley et al. 2022a). 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. Thus, 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. 2022a).

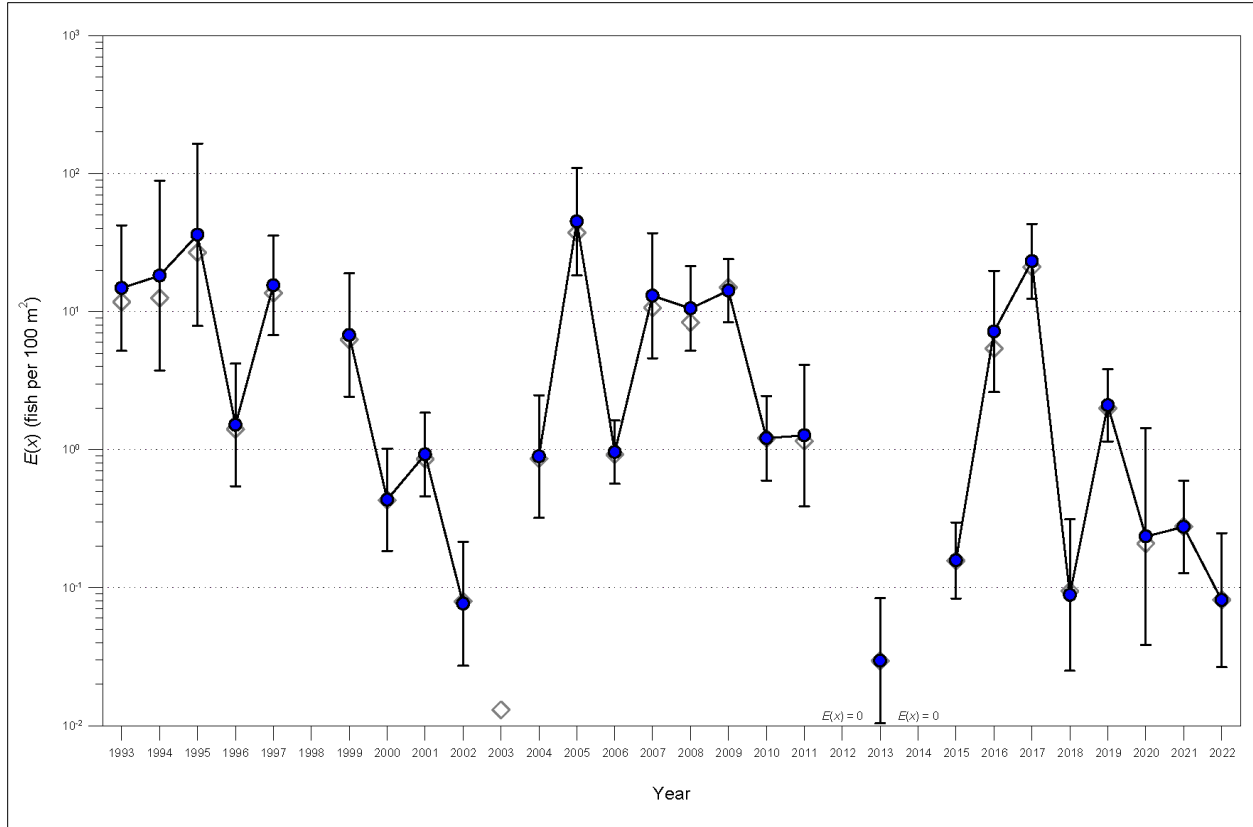


Figure 16: RGSM estimated CPUE ($E(x)$) using standard site (20 sites) October data for 1993-2022. Solid circles indicate estimated CPUE, bars represent 95 percent confidence intervals, and hollow diamonds represent simple methods-of-moments estimates (Dudley et al. 2022a, and 2023 Dudley Written Communication).

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Dudley, R.K., S.P. Platania, and G.C. White. 2022a. Rio Grande Silvery Minnow Population Monitoring during 2020. Annual Contract 140R4019P0048 Report to Bureau of Reclamation, American Southwest Ichthyological Researchers, Albuquerque, NM.

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

Southwestern Willow Flycatcher

The Southwestern Willow 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).

During the summer of 2022, Reclamation conducted surveys and nest monitoring of flycatchers in 13 distinct reaches along approximately 267 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 2022, a total of 1,124 resident flycatchers were documented. These flycatchers established 612 territories, of which 512 had pairs. This represents a 22 percent increase in territory numbers from 2021. As in previous years, the San Marcial Reach was by far the most productive, containing 654 resident flycatchers and 352 territories, of which 302 were pairs – a 40 percent increase in territories from 2021 (although only selected sites were surveyed in 2020 and 2021).

Table 11: Southwestern Willow Flycatcher Territories 2013-2022¹

Location ²	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013
Frijoles	N/S ³	N/S	N/S	N/S	0	0	0	0	0	1
Belen	95	85	25	N/S	20	17	20	17	18	23
Sevilleta	17	N/S	N/S	N/S	12	4	5	8	4	4
San Acacia	0	N/S	N/S	0	0	0	0	0	0	0
Escondida	5	2	3	9	4	8	5	7	4	8
BDA	35	39	35	24	24	16	14	11	23	27
Tiffany	N/S	N/S	N/S	0	0	0	5	1	8	4
San Marcial	352	252	200	293	277	257	302	300	307	266
MRGP Subtotals	504	378	263	326	337	302	351	344	364	333
Caballo Reservoir	12	18	11	9	7	8	9	14	15	4
Caballo to El Paso, TX	96	107	109	91	77	60	41	31	26	34
RGP Subtotals	108	125	120	100	84	68	50	45	41	38
Total	612	503	383	426	421	370	401	389	405	371

A total of 679 nests were discovered and roughly 80 percent were sufficiently monitored to determine success rates, productivity, and brown-headed cowbird (*Molothrus ater*) parasitism. The San Marcial Reach was most productive at 398 nests.

¹ Breeding season only

² Table does not include detections outside of the active floodplain at BDA

³ N/S = not surveyed

Other studies continued or updated in 2022 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, the overall 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.

Nest success in the Middle Rio Grande has remained between 38 and 48 percent for the past five years following a study period low of 25 percent in 2017 (Figure 17).

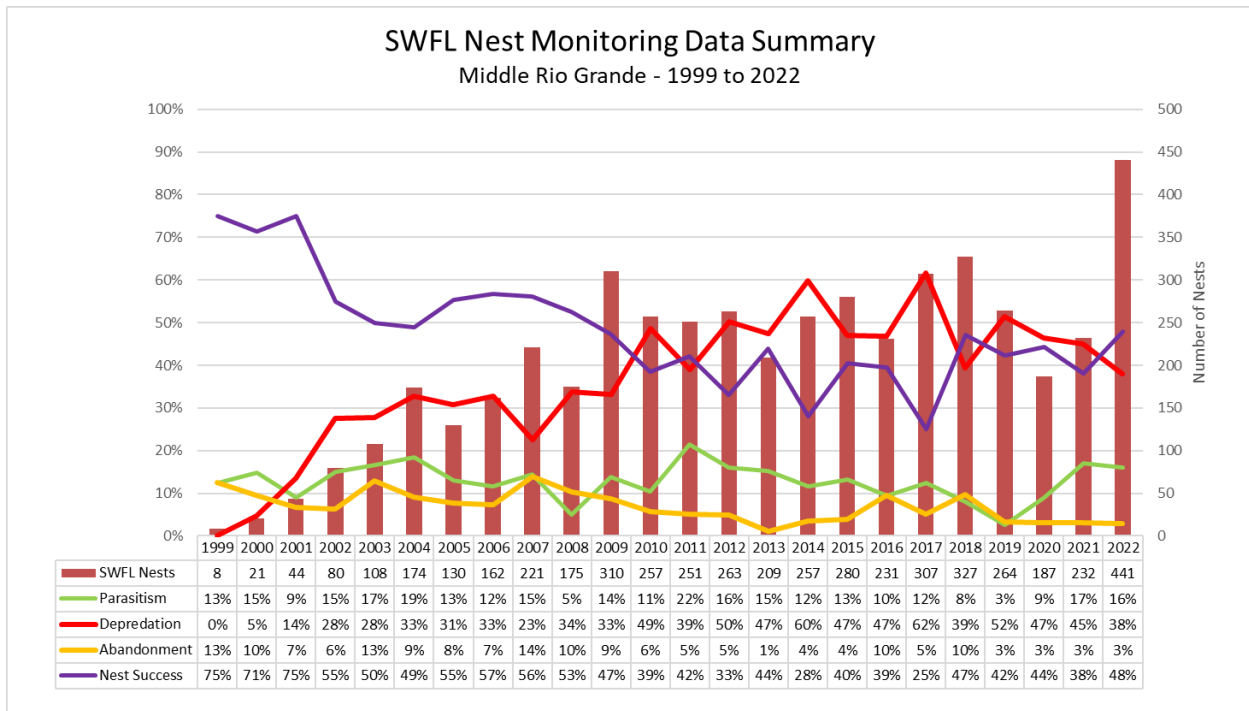


Figure 17: Summary of Flycatcher nesting in the MRGP from 1999 to 2022

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 48 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 Lower Rio Grande, particularly in sites downstream of Caballo Dam, has been higher in recent years, averaging 54 percent between 2016 and 2022. Flycatchers in the Caballo Delta have not been as successful, averaging 47 percent nest success during the same period (Figure 18, 19).

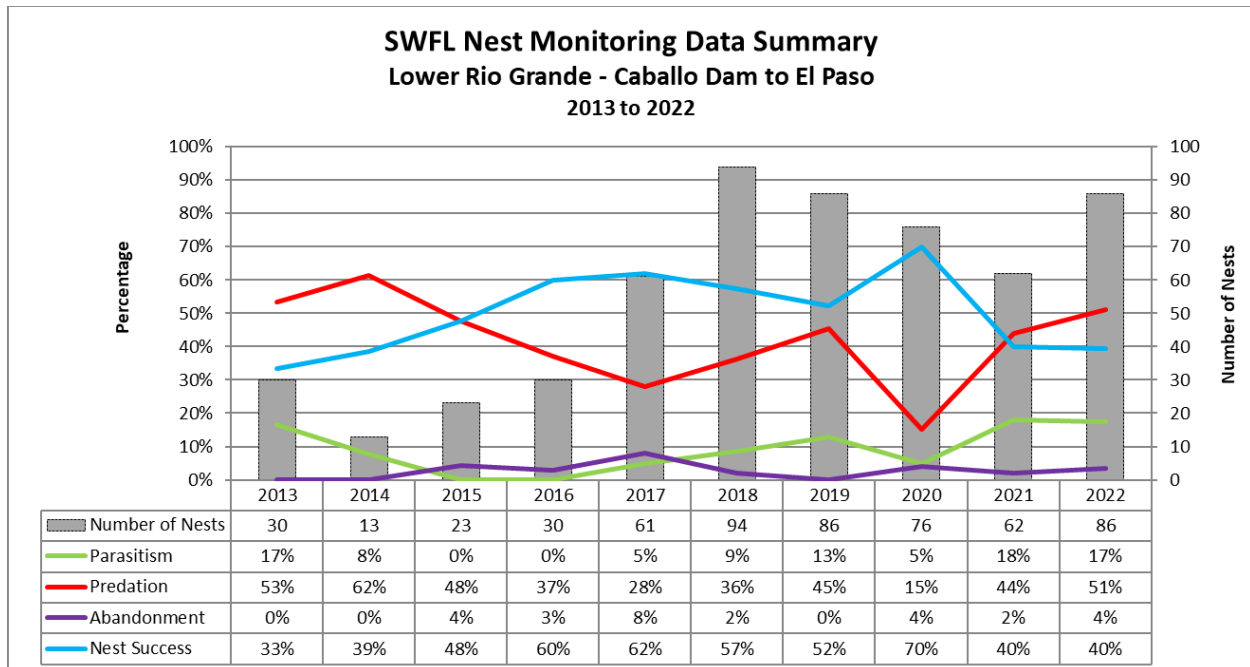


Figure 18: Flycatcher nest variables, Caballo Dam to El Paso, TX, 2013-2022

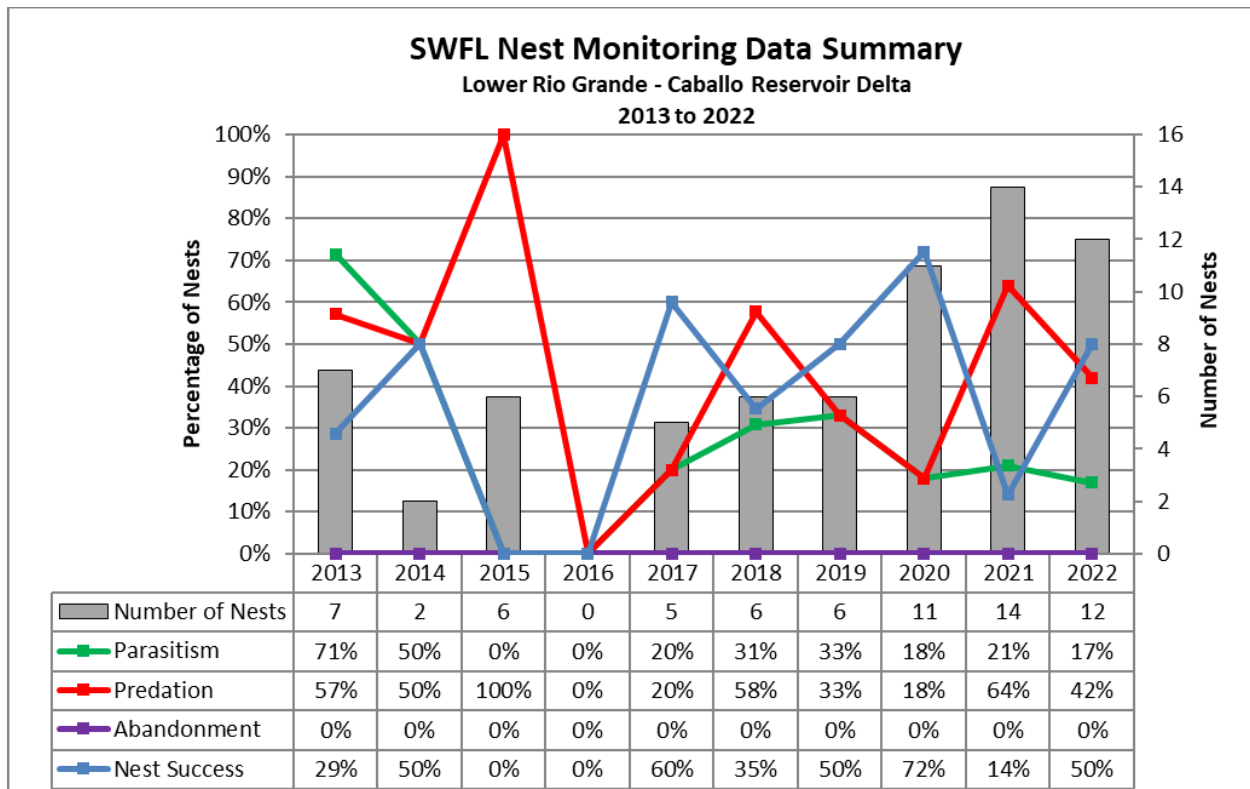


Figure 19: Flycatcher nest variables, Caballo Reservoir delta, 2013-2022

During 2017 and 2019, 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 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 Yellow-billed 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).

During 2022, Reclamation conducted cuckoo surveys in 13 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 RGOA BO. In 2022, there were an estimated 157 breeding territories, all assumed to be pairs, derived from 621 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 2013-2022¹

Location ²	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013
Belen	40/11	22/5	15/3	N/S	41/10	34/4	54/12	39/10	24/5	20/6
Sevilleta	50/11	N/S ³	N/S	N/S	41/10	12/4	32/10	18/5	9/2	19/6
San Acacia	24/6	N/S	N/S	28/8	47/14	50/13	23/8	27/8	15/4	20/5
Escondida	3/1	13/2	16/5	51/11	55/10	44/11	58/16	62/16	27/7	80/23
BDA	46/14	70/15	49/11	59/14	46/13	43/10	32/11	40/12	34/12	29/8
Tiffany	N/S	N/S	N/S	0	0	2/0	9/0	2/0	2/0	4/1
San Marcial	317/79	198/45	68/17	190/42	193/49	227/56	220/59	215/59	190/61	219/70
MRG Subtotal	480/122	303/67	148/36	328/75	423/106	412/98	428/116	403/110	301/91	391/119
Caballo	100/25	90/18	72/16	47/11	58/13	64/16	62/15	48/15	28/8	N/S
Percha	11/2	13/2	22/4	13/2	7/1	8/2	3/1	1/0	0/0	N/S
Hatch	11/3	10/2	21/4	11/2	17/6	11/1	6/2	4/1	0/0	N/S
Radium Springs	7/2	8/1	19/5	9/3	25/7	10/4	16/6	10/4	8/2	N/S
Las Cruces	5/1	0	0	12/2	10/3	9/3	N/S	N/S	N/S	N/S
Mesilla	0	0	1/0	5/1	9/2	0	N/S	N/S	N/S	N/S
RGP Subtotal	141/35	121/23	135/29	101/21	126/32	93/23	87/24	63/20	36/10	N/S
Total	621/157	424/90	283/65	429/96	549/138	505/121	515/140	466/130	337/101	391/119

New Mexico Meadow Jumping Mouse

The New Mexico Meadow 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

¹ Breeding season only

² Table does not include detections outside of the active floodplain at BDA

³ N/S = Not Surveyed

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 2022. 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 on February 6, 2023, a 90-day stay was granted for settlement negotiations.

Middle Rio Grande Endangered Species Collaborative Program

In response to ESA species listings in the Middle Rio Grande, ESA-related litigation, and the 2003 BO, 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 2022, 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 as authorized by the Omnibus Appropriations Act of 2009 (P.L. 111-8). 2022 accomplishments include the following.

- Minnow Action Team meetings in March 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 Workshop
- Management of Vegetated Islands and Bank-Attached Bars Workshop
- Collaboratory – a two-day forum which featured presentations on strategic planning, the Portal, balancing water needs, agricultural implications, and future conditions of the MRG
- Finalization 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.
- Formation of several 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. One of the critical efforts to maintain densities is the coordination of water operations, and RiverEyes facilitates coordination among agencies, helps to prevent unexpected drying, and prepare for and initiate RGSM salvage.

For the 2022 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 late May through early October. Channel drying began in the Angostura Reach on July 22 and reconnected on July 26. Drying was first observed in the Isleta Reach on June 16, and the last day was September 26. In the San Acacia Reach, the first day of drying was June 5, while the last day was September 24. The total number of river miles affected by drying at some point during river drying during 2022 was 61.1 miles: 36.1 miles in the San Acacia Reach, 14.3 miles in the Isleta Reach, and 10.7 miles in the Angostura Reach (within the City of Albuquerque). The maximum extent of drying on a single day was 60 miles on July 26.

The 2022 season had a strong monsoon and there were therefore numerous re-wetting events. The Angostura Reach had one drying event that lasted five days, the area near Peralta Wasteway had five drying events totaling 28 days, the Abeytas Heading area was dry for three days in one event, the San Acacia area had five drying events totaling 41 days, above the Low Flow Conveyance Channel Outlet was dry for two days in one event.

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 2022, a total of 6,337 ac-ft of supplemental water was released for endangered species purposes. Of that volume, 2,204 ac-ft was water that Reclamation leased from 2022 SJCP contractor allocations. Reclamation also released 4,133 ac-ft of environmental conservation water leased in 2021 from ABCWUA's SJCP water stored in Abiquiu. In 2021, 851 ac-ft were released and evaporation losses on the environmental conservation water in 2022 were 16 ac-ft, accounting for all 5,000 ac-ft from the 2021 lease.

The release of supplemental water began on May 25 at 125 cfs. The release was intended to support a small pulse that MRGCD hoped to create past Isleta Diversion Dam by reducing diversions to keep more water in the river. It was intended to stimulate a RGSM spawn for egg collection. The maximum rate of release in 2022 was 175 cfs on May 27 and 28 to support this operation.

The release was slowly reduced to 50 cfs on June 10, some of which was bypassed at San Acacia Diversion Dam. River drying began in the San Acacia Reach on June 5. The release was stopped on June 17 when widespread rain in the basin that day and the following week reconnected the river from Cochiti Dam to Elephant Butte Reservoir on June 22.

The supplemental release resumed on July 8 at 15 cfs as rain and streamflow decreased. It was increased to 30 cfs on July 21 as flow dropped further. It was stopped on July 27 after widespread rain. The river reconnected from Cochiti Dam to Elephant Butte Reservoir on August 1.

September did not have as much rain as the previous three months, and the supplemental release was restarted at 50 cfs on September 5 and, depending on river conditions, fluctuated between 30 and 50 cfs until September 21. Due to widespread rain beginning that day, that was the final release in 2022. The river reconnected from Cochiti Dam to Elephant Butte Reservoir on September 26 and remained connected through the remainder of the year.

Reclamation's supplemental water account ended 2022 with 3,360 ac-ft in storage in Heron and 1,656 ac-ft in Abiquiu, all leased from 2022 SJCP contractor allocations. In 2023, 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 SJCP allocation.

Other Sources of Supplemental Water

In addition to the water released by Reclamation, three other sources of water were used to support the needs of the ESA-listed species in 2022. They were pre-1907 native water rights leased by Reclamation, SJCP water leased by Audubon Southwest, and the Environmental Water Leasing Program (EWLP), a fallowing program within the MRGCD largely funded by Reclamation. Water from all three sources was released to the river via MRGCD wasteway outfalls. Various types of releases were therefore coordinated closely. Potential points of release for this water were the bypass at Isleta Diversion Dam and the following outfalls: Alejandro Wasteway, 240 Wasteway, Los Chavez Wasteway, New Belen Wasteway, Lower Peralta #2 Drain, and San Francisco Drain.

As shown in Table 13, approximately 2,828 ac-ft was released to the river by MRGCD at locations in the Isleta Reach. Most of the release came from the EWLP.

Table 13: 2022 Isleta Reach Outfall Deliveries

Isleta Reach Outfall Delivery Dates, 2022	Delivered Water Volume, ac-ft	Water Source
April 27 – May 5	70.66	Native water acquired, permitted, and used for offset
May 23 – June 3	68.95	Native water acquired, permitted, and used for offset
June 15 – September 11	137	SJCP (Audubon New Mexico); sporadic during period
June 11 – October 31	2,551	Native water acquired by EWLP; sporadic during period
TOTAL	2,828	

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 water rights offset releases were from the 240 Wasteway outfall from April 27 to May 5 and May 23 to June 3.

Audubon New Mexico began 2022 with 152 ac-ft of SJCP water acquired in previous years in storage in Abiquiu Reservoir. In 2022, they added leases of SJCP water as follows: 100 ac-ft with the City of Belen, 150 ac-ft with the Village of Los Lunas, and 100 ac-ft with the Town of Bernalillo, from 2022 allocations to these SJCP contractors in Heron Reservoir. After 2022 releases of 137 ac-ft, Audubon Southwest ended 2022 with 346 ac-ft in storage in Abiquiu Reservoir. Transit losses moving water from Heron to Abiquiu were 3.85 ac-ft and evaporative losses while in storage in Abiquiu in 2022 were 16.1 ac-ft.

Deliveries of Audubon water were made to the three wasteway outfalls in the Isleta Reach, although most was released at the Alejandro wasteway. Releases from Abiquiu for the Alejandro wasteway began on June 15 and were mostly released as a block at the end of the week in which wasteway releases were made. There were numerous shut-offs when monsoon flows reconnected the Isleta Reach. Releases ended on September 11.

There were 2,554 acres enrolled in the EWLP. 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 – not including supplemental water and ABCWUA’s release, covers MRGCD’s daily demand). MRGCD, Audubon, and Reclamation then coordinated on where EWLP water would be released. The high storm inflow in 2022 generated a credit of 7,015 ac-ft for the season, of which only 2,551 ac-ft were released. The remaining 4,464 ac-ft of EWLP credits were not released and do not carryover, but instead act as system conservation by reducing total irrigation demand.

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 after Reclamation ceased LFCC-to-river pumping in 2020. It is now owned and operated by MRGCD and is capable of pumping to both the river and irrigation facilities. In 2022, MRGCD pumped 230 ac-ft from the Neil Cupp site to the river from June 2 to 7 at approximately 20 cfs to maintain river connectivity as flow into the reach declined.

Rio Grande Project, New Mexico – Texas

Reclamation's Albuquerque Area Office and the Elephant Butte Field Division are jointly responsible for the operations of the Rio Grande Project (Figure 20). 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 Elephant Butte Irrigation District, El Paso County Water Improvement District No. 1, 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 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.

Upon completion of title transfer in 1996, the irrigation and drainage system of the Rio Grande Project has been 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, including Percha, Leasburg, and Mesilla. Reclamation also retains the title and O&M responsibilities for Elephant Butte and Caballo Dams and the Elephant Butte Powerplant.

In September 2003, Reclamation completed work to remove Riverside Diversion Dam and the adjacent coffer dam, both in Texas. Prior to removal, Riverside Diversion Dam had been inoperable since 1987 when flooding on the Rio Grande caused the structure to fail.

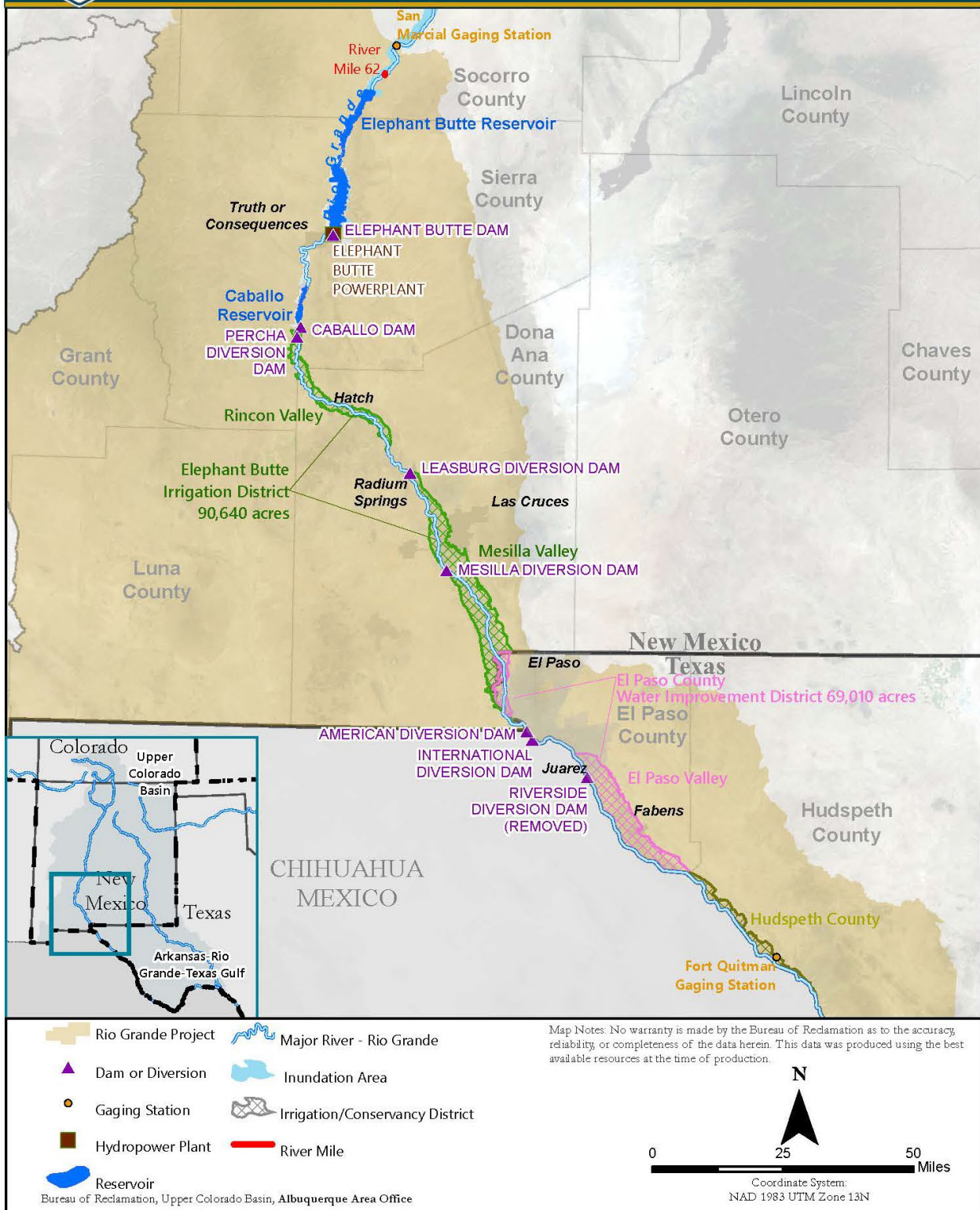


Figure 20: Area Map of the Rio Grande Project

Rio Grande Project Operations

Combined total storage for Elephant Butte and Caballo Reservoirs for 2022 began with 184,364 ac-ft, 8 percent of total capacity, and ended with 276,952 ac-ft (12 percent). Maximum combined total storage was 298,095 ac-ft (13 percent) and minimum was 90,585 ac-ft (4 percent) on May 27 and August 18, respectively. Reclamation communicated with stakeholders to provide information and projections of reservoir elevations throughout the irrigation season.

Compact Accounting in RGP Storage

In 2022, the three Compact states reached consensus on the Compact accounting method that was under dispute since 2011. The Rio Grande Compact Commission (RGCC) determines final Compact accounting annually. It is anticipated that the RGCC will update and finalize the accounting for 2011 through 2022 at the 2023 RGCC meeting. As of this report, the RGCC has not provided updated accounting for 2021 and this report references the accounting data and methods known at the time.

Reclamation performs daily accounting of SJCP, Compact Credit water, and native Rio Grande water on 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 the URGWOM, an account with a non-zero value is assessed gains and losses, so end-of-year debits are given a value of zero.

Usable Water

Rio Grande Project supply available for release 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 2022, the usable water in RGP storage (Elephant Butte and Caballo Reservoirs combined) was 183,512 ac-ft on January 1 and 275,963 ac-ft on December 31. Usable water in storage reached a high of 296,984 ac-ft on May 27 and a low of 89,546 ac-ft on August 18.

Article VII Restrictions

Article VII of the Compact stipulates that when Usable water in Rio Grande Project storage 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. Usable water in Project storage was below 400,000 ac-ft for all of 2022.

Compact Credit Water

Compact credit water for Colorado and New Mexico is stored as wet water in Elephant Butte Reservoir and not included as Usable Water. New Mexico began 2022 with a debit (122,300 ac-ft under method 1 and 121,100 ac-ft under method 2). Colorado began 2022 with a debit (8,800 ac-ft under method 1 and 3,800 ac-ft under method 2).

Elephant Butte Dam, Reservoir and Powerplant

In 2022, the minimum daily storage at Elephant Butte Reservoir was 73,855 ac-ft (elevation 4291.19 feet) on August 18. The maximum daily storage was 265,222 ac-ft (elevation 4320.76 feet) for three consecutive days on May 10-12, 2022.

Reclamation began intermittent releases at Elephant Butte Dam in April 2022 to perform, test, and complete several O&M projects at the facility. These minimal O&M-related releases totaled about 39 ac-ft. Releases for irrigation demand began on May 3 and continued through August 19. During this period, a release of 281,427 ac-ft was recorded by the USGS Rio Grande below Elephant Butte Gage. The 2022 annual volume measured was 281,815 ac-ft.

The total gross hydropower generation for 2022 was 18,656,250 kilowatt-hours (kWhr). Net hydropower generation was 18,492,082 kWhr, which is 43 percent of the 10-year average (2012 through 2021) 32,298,321 kWhr. The Elephant Butte powerplant record showed releases of 237,647 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.

Caballo Dam and Reservoir

Caballo Reservoir started 2022 at 15,155 ac-ft (4134.34 feet) and ended the year at 50,902 ac-ft (4146.77 feet). During 2022, the maximum storage was 50,902 ac-ft (4316.26 feet) on December 31. The minimum storage occurred on two consecutive days on January 1-2, at 15,155 ac-ft (elevation 4134.34 feet).

The irrigation release period extended from June 1 through August 20, 2022, releasing 268,331 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 historic sites. The calendar year 2022 volume measured at the gage was 268,974 ac-ft.

The diversion from Caballo Dam for Bonita Lateral irrigation was 926 ac-ft from January through December.

Warren Act Deliveries

Drainage waters from the RGP lands provide supplemental irrigation water for approximately 18,342 acres of the Hudspeth County Conservation and Reclamation District No. 1 (HCCRD). Total flows out of the project 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. Under the Warren Act contracts, HCCRD is charged for drainage water from the RGP between March 1 and September 30. For 2022, 16,009 ac-ft was diverted under the contract period and 25827 ac-ft for the calendar year.

Rio Grande Project Water Accounting

2022 Water Accounting

In December 2021, Reclamation allocated zero (0) ac-ft as the initial allocation to Mexico for 2022. The provision of the 1906 Convention for extraordinary drought was applied and Reclamation

provided Mexico with monthly updated allocations through July. The last in-season allocation to Mexico, 14,827 ac-ft (24 percent of a full allocation), was made in July 2022. Mexico's allocation is calculated from the anticipated release of usable 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. The actual release for the 2022 irrigation season was less than the anticipated release in July. When this occurs, an over delivery to Mexico is calculated in the Rio Grande Project water accounting. This is further explained below in this section of the report.

The U.S. Districts, EBID, and EPCWID were provided an initial allocation in May 2022 after the 2021 water accounting had been finalized. The 2021 allocation balance was used to compute their 2022 allocations. Reclamation provided the U.S. Districts with updated allocations monthly as usable water in storage increased. The last in-season allocation was on July 7 due to below average inflows and usable water.

Releases from Caballo for irrigation deliveries began on June 1 and ended on August 20. EBID and EPCWID began the season with coordinated orders and diversions. Mexico delayed their initial order by one week and their diversions began on June 7. EBID ended their surface water diversions on June 28 with Mexico following on August 9. EPCWID ended release season on August 31.

The total Caballo release for Rio Grande Project water accounting was 268,290 ac-ft, which was used to calculate the diversion ratio, a quantitative measure of delivery performance. This is 41 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 2022, the calculated diversion ratio was 0.77.

The measured delivery to Mexico was 14,843 ac-ft. The calculated charges to EBID were 82,339 ac-ft. EPCWID's calculated charges were 111,483 ac-ft. EBID and EPCWID were charged 739 and 562 ac-ft for the over delivery to Mexico, respectively, based on the proportion of the EOY 2022 allocation balances. The allocation balances at the beginning of 2023 were for 58,447 ac-ft for EBID and 71,860 ac-ft for EPCWID, respectively. See Table 14 for a summary of the 2022 water accounting.

Table 14: 2022 Rio Grande Project Water Accounting¹

	Final Allocation	Final Charges	Caballo Release for Irrigation	Calculated Diversion Ratio	Adjustment for Over Delivery to Mexico	Account Balance for 2023
EBID	141,525	82,339	-	-	-739	58,447
EPCWID	183,905	111,483	-	-	-562	71,860
Mexico	14,827 ²	14,843	-	-	-	-
Total	340,257	208,665	268,290	0.770	-	-

2023 Rio Grande Project Outlook

Reclamation determined the initial 2023 allocation to Mexico of 7,374 ac-ft using data from December 1, 2022, Reclamation will evaluate and update as necessary the allocation to Mexico based on the RGP water available. Reclamation will provide the initial 2023 allocation to the U.S. Districts in April or May closer to the start of the release season, anticipated to begin in early June.

Based on the March NRCS streamflow forecasts for the Upper Rio Grande and Rio Chama Basins, the current climatic conditions, and current hydrologic conditions, Reclamation anticipates a shortened irrigation season beginning around June 1 and similar to 2019.

RGP River Gage Operation and Maintenance

The EBID and EPCWID operated and maintained gages for flow measurements at canal headings, river stations, and lateral headings during 2022. Reclamation operated and maintained the Rio Grande below Caballo gaging station, and coordinated and maintained central control of releases, river operations, and water accounting. To accomplish the water allotment 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 districts for their areas of responsibility, Reclamation calculated and summarized the monthly and end-of-year RGP water supply use and accounting for 2022.

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 Rio Grande Project) 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 Rio Grande Project 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

¹ Volumes in ac-ft

² 13,542 ac-ft was calculated for RGP accounting purposes, allocation under the 1906 Convention remains 14,827 ac-ft

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 Rio Grande Project. However, 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 Rio Grande Project 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.

The first phase of the trial was held as a remote hearing in the fall of 2021. At the conclusion of the first phase, the parties renewed mediation efforts and in January 2022, the parties along with the appointed mediator, Judge Arthur Boylan, recommended a delay in the second phase of the trial, scheduled to commence in March 2022, to allow for further mediation. On January 24, 2022, based on the recommendation of the parties, Special Master Melloy ordered the case stayed. The parties continued to mediate through September 2022. On September 21, 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. On November 14, 2022, Colorado, New Mexico and Texas filed a joint motion to enter into a Consent Decree without the United States. The Special Mater held a hearing on the proposed Consent Decree in January 2023 and the parties anticipate a ruling in the next few months.

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 three incomplete Category 2 O&M recommendations for Elephant Butte Dam.

In fall 2022, Reclamation removed 30,474 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. There was a large accumulation of sediment due to the 2022 monsoon season flows.

Reclamation installed two pressure transducers at Elephant Butte. One was installed in the Rio Grande below Elephant Butte near Reclamation's offices to study the effects of backwater driven by vegetative growth in the channel downstream. The other was installed on the upstream face of the dam to study and provide backup reservoir elevation data, independent of the plumbing infrastructure that connects the official recording data (Stage-Discharge Recorder) instrumentation.

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 pending review for completion.

The Bonita Lateral irrigation pipe was inspected in September 2021 and an Ultrasonic Thickness inspection in March 2021. This completed phase 1 of a multiphase project to repair or replace approximately 1,000 feet of the irrigation pipe from the head gate to the outlet gate. Phase 2, a feasibility study based on the inspection reports to determine possible repair methods, is underway. Phase 3 is contract award and construction; the current schedule to award is dependent on the feasibility study.

Reclamation also completed three safety improvements to the manned cableway downstream of the Caballo Dam is used for routine stream gaging of irrigation releases.

Reservoir Vegetation Management

Reclamation maintained areas previously cleared at Caballo Reservoir to limit consumption of water by woody phreatophytes like salt cedar. In 2022, approximately 400 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 as a result of high surface water events above the 2014 baseline data. 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 as a result 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.

In 2021, Reclamation continued implementing the commitments set forth in the RGP BO. There was no incidental take of flycatcher or cuckoo nests/territories in 2022. 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, 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. Six Pueblo drought mitigation projects were funded in 2022, all benefitting Pueblo irrigation infrastructure and enhancing tribal drought resilience. In addition, the Secretary'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. Funds received in 2022 added additional scope and funding to several existing Pueblo irrigation contracts.

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 when Reclamation, the Pueblo of Isleta, and the MRGCD signed a global settlement on October 21, 2016. This global settlement granted the United States easement for the next 100 years, provided the Pueblo of Isleta with a lump sum damage compensation, and 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, as well as bosque and riverine restoration. The Settlement commitments are scheduled to be completed by 2026.

In 2022, the settlement team focused on a design-build procurement action which will obtain professional services to design and implement fish passage and sediment management improvements at Isleta Diversion Dam. Through the same contracting action, the selected contractor will also design and implement fish passage at San Acacia Diversion Dam. Solicitation and selection were completed in 2022 and the design-build contract was awarded February 2023.

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

Pursuant to Title V of the Claims Resolution Act, Reclamation is working on implementing their responsibilities under the Taos Pueblo Indian Water Rights Settlement. Under the terms of the Settlement, Taos Pueblo has a recognized right to 11,927.71 ac-ft per year of depletion, of which 7,249.05 ac-ft per year would be available for immediate use. The Pueblo has agreed to forbear using 4,678.66 ac-ft per year to allow non-Indian water uses to continue. Over time, the Pueblo would reduce the amount of the forborne water rights through purchase of surface water rights from willing sellers.

In addition, the Pueblo and other settlement parties received SJCP allocations. Reclamation entered into contracts for SJCP water with the Pueblo for 2,200 ac-ft per year; the Town of Taos for up to 366 ac-ft per year (in addition, Reclamation typically leases the Town of Taos' non-Settlement allocation of 400 ac-ft); and El Prado Water and Sanitation District for 40 ac-ft per year.

The Settlement Act authorizes and directs Reclamation to provide financial assistance in the form of grants on a non-reimbursable basis to plan, permit, design, engineer, and construct Mutual-Benefit Projects. These efforts will minimize adverse effects on the Pueblo's water resources by moving future non-Indian ground water pumping away from the Pueblo's Buffalo Pasture, a culturally sensitive wetland. Implementation of the Settlement is currently in the final, on-the-ground phase, and Reclamation is awarding grants to project entities as they move forward with their Mutual-Benefit Projects.

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 Secretary and all other governmental parties signed the Settlement Agreement as well as the Cost-Sharing and System Integration Agreement on March 14, 2013.

The Aamodt Litigation Settlement Act authorized Reclamation to plan, design, and construct a Regional Water System (RWS). The RWS would consist of a water diversion, raw water transmission pipeline, and water treatment facility at San Ildefonso Pueblo on the Rio Grande, as well as storage tanks and transmission and distribution pipelines that would supply up to 4,000 ac-ft of water annually to Pueblo and non-Pueblo customers within the Pojoaque Basin.

The Final Environmental Impact Statement was published in the Federal Register in January 2018. The Record of Decision was signed on September 11, 2019. Reclamation completed designs for Phase 1 at the 100 percent level in August 2019 that included intakes, a water treatment plant, storage tanks, and pipelines on the northern end of the project area in San Ildefonso Pueblo and the northern part of Pojoaque Pueblo. A supplemental Environmental Assessment was completed in January 2020. Phase 2 designs include a conveyance system for treated water to existing and proposed distribution tanks within the Nambé, southern Pojoaque, and Tesuque Pueblos, and

Bishops Lodge in Santa Fe County. The Nambé portion of Phase 2 was completed to the 90 percent level in December 2021. The 30 percent level designs for Phase 3 are complete and include distribution piping for the Pueblos of San Ildefonso, Pojoaque, Nambé, and Tesuque, and Santa Fe County. Associated cost estimates are well above the amount authorized for the project. In accordance with the Act, the Secretary initiated negotiations with the parties for an agreement regarding non-Federal contributions to ensure the RWS can be constructed.

An agreement pursuant to Section 611(g) of Title VI of the Claims Resolution Act of 2010 was signed by settlement parties in 2019, addressing the scope, funding shortfall, and extension of project construction completion from June 2024 to June 2028. The Cost-Sharing and System Integration Agreement and the Contributed Funds Agreement (CFA) was signed by Santa Fe County and Reclamation in 2020. An Amended and Restated State CFA was signed by Reclamation in the fall of 2020.

Federal funding was obligated to the design-build contractor for a limited construction contract at the intake area on the Pueblo of San Ildefonso in September 2019. The contractor mobilized in June 2020. The Omnibus Bill which became law December 27, 2020, included the increase in the project funding and time extension to and allowed the remainder of Phase 1 Construction to continue. The Limited Construction portion award amount was \$12,509,979 and was expected to be completed in April of 2021. Due to the COVID-19 pandemic, completion was delayed to January 2022. The next portion of Phase 1 construction is expected to begin in March 2022 and includes the installation of the raw water intake pumps for Collector Wells 1 and 3, completion of the intake area Mechanical & Electrical Building, and starting construction of the water treatment plant.

In 2022, about 3 ac-ft were withdrawn from the completed wells for construction purposes, such as dust abatement and compaction.

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 delivery of water allocated to specific users within New Mexico. URGWOM operates on a RiverWare software platform. RiverWare was 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 is used for accounting of SJCP water and forecasting daily storage and delivery. The model is used to simulate processes for Annual Operating Plans, that forecast the remainder of the year, and for long-term forecasts for planning studies. The model is 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 URGWOM website is updated with details on recent activities, postings of the latest documentation, and meeting notes. It can be accessed at <http://www.spa.usace.army.mil/Missions/CivilWorks/URGWOM.aspx>. Reclamation is currently working on URGWOM Training modules to assist those unfamiliar with URGWOM and RiverWare software to gain some understanding of what it does and how it works. This will be hosted on the URGWOM website.

In 2022, deep groundwater aquifer objects were implemented in the Middle and Lower Rio Grande portions of URGWOM, making URGWOM's shallow groundwater aquifer objects no longer dependent on input from the USGS's Modular Three-Dimensional Finite-Difference Groundwater Flow Model (MODFLOW). As needed, updated documentation for URGWOM is tracked, developed, reviewed, and finalized by the Team. In consultation with the Team, Reclamation is studying how to incorporate the National Weather Service River Forecast Center's (RFC) ensemble forecast, in conjunction with the currently utilized NRCS forecast, into URGWOM forecast runs.

Reclamation is funding the West Gulf RFC, with the assistance of a contractor, to recalibrate the ensemble forecasts for the Rio Grande Basin. Reclamation is also working with and funding the National Center for Atmospheric Research (NCAR) to implement a newly developed monsoon forecasting technique into the RFC's ensemble forecasts for better prediction of monsoon activity when incorporated into URGWOM forecasting runs. Work was completed that improved the simulation of Reclamation's supplemental water releases as they reach the diversion dams in the Middle Rio Grande Valley. There were also many other minor fixes and updates throughout the year.

The USGS began shutting down the *myUSGS Confluence* website, the repository for URGWOM development files, documentation, model updates, Tech Team Meeting notes, and other information, in late 2021. The website was to shut down in January 2022 but will be used until the end of 2022. The Team agreed to use Reclamation's Sharepoint application as the new URGWOM repository. This year the Team finished moving all files from *myUSGS Confluence* to Reclamation's Sharepoint repository and is utilizing it to store URGWOM related files and to track issues and changes in URGWOM.

Rio Grande Transboundary Integrated Hydrologic Model (RGTIHM)

RGTIHM is being developed through an interagency effort between the USGS and Reclamation, who is funding it. The model is intended 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, 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 ones. The calibrated model was 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. 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 2022, the USGS:

- Published Scientific Investigations Report (SIR) 2022-5045 documenting edits to and recalibration of the version of the RGTIHM published on April 7, 2020 (<https://doi.org/10.3133/sir20225045>)
- Released the archive for the model documented in the SIR as well as the version of RGTIHM published on April 7, 2020 (<https://doi.org/10.5066/P99PLDXV>)
- Initiated a new interagency agreement with Reclamation to include 2015 through 2021 in the simulation period

Water Accounting Reports Projects

San Juan-Chama Project Water Accounting

In 2022, SJCP water accounting was accomplished using version 8.5.2 of RiverWare software, and version 8.5 of the URGWOM accounting module. All accounting data and information are stored directly in the final version of the 2022 accounting model. Data are also sent to Reclamation's HDB via a DMI. Reclamation consulted with representatives of the NMISC and USACE – Albuquerque District to verify 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 2022. 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 updates 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. The pages can be accessed under the *Reservoir Data* heading on this page <https://www.usbr.gov/uc/water/index.html>.

Planned work for 2023 includes continued maintenance of HDB, as well as continuing to back-populate historical data for the Middle Rio Grande and Rio Grande Projects into HDB. Reclamation is investigating the ability to pull in Colorado Division of Water Resources' published gage data to overwrite provisional data, similar to the process used for USGS' gage data. Improvements to the newly developed websites that utilize HDB are also planned.

RiverWare

Numerous improvements to RiverWare were accomplished during 2022 through contracts that Reclamation and USACE have with CADSWES. Work included developing the initial release of the Web Map Viewer to allow users to see objects in a spatial web map and the initial release of the Quick Start dialog that pops up when one opens RiverWare to allow easy selection of models, rules, SCTs, and more. 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 2022 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 National Aeronautics and Space Administration's (NASA) 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, ET Toolbox was shut down due to 508 compliance issues. Reclamation created 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 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 them or prevent their attachment to infrastructure. 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. The Fish and Wildlife Coordination Act, as amended by section 7001 of Public Law 116-9, provides authority for Reclamation to “enter into any contract or cooperative agreement with another Federal agency, an eligible State, a Federally recognized Indian tribe, a political subdivision of an eligible State, or a private individual or entity to assist with the control and management of an invasive species.”

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 17,931 in 2022, as have the contractual costs. With limited funding, Reclamation has prioritized AIS WID services at two marinas in Elephant Butte because of this reservoir’s extensive recreation, fishing, irrigation, power, and water infrastructure. In 2022, 30 percent of incoming watercraft were high risk inspections (were not drained and dried, etc.), and 0.1 percent of those were infested and decontaminated. In 2022, there were no detections of invasive mussels or their genetic markers in water samples collected from Elephant Butte by Reclamation’s Ecological Research Laboratory.

WaterSMART Program

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.

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 and helping water resource managers make wise decisions about water use. Goals are achieved through administration of grants, 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 (Infrastructure Law) provides a total of \$8.3 billion under Title IX (Western Water Infrastructure) to the Bureau of Reclamation for authorized programs and activities. Funding is provided as emergency funding and is available for obligation until expended. In FY 2022 and FY 2023, establishing the exact allocation of the initial \$1.66 billion by project will take shape over the coming months. Additional information can be found at: <https://www.usbr.gov/bil/2022-spendplan.html>.

Programs funded and managed by Reclamation's Office of Policy and Administration include:

- WaterSMART Grants
 - Water and Energy Efficiency Grants
 - Small-Scale Water Efficiency Projects
 - Water Marketing Strategy Grants
 - Environmental Water Resources Projects
 - Aquatic Ecosystem Restoration Program
 - Cooperative Watershed Management Program
 - Water Conservation Field Services Program
- Drought Response Program
 - Drought Contingency Planning
 - Drought Resiliency Projects
 - Emergency Response Actions
- Title XVI Water Recycling and Reuse Program
 - Authorized Title XVI Projects
 - WIIN Eligible Projects
- Large-Scale Water Recycling Program

- Desalination Projects (WIIN Act)
- Basin Studies
- Baseline Assessments and Pilots
- Reservoir Operations Pilots
- Applied Science Grants
 - Internal Applied Science Tools
- 2021 SECURE Water Act Report to Congress

More information about these programs, completed project reports, 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>.

General information about Reclamation’s WaterSMART Program is provided below. 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.

WaterSMART Grants

Water and Energy Efficiency Grants

Through Water and Energy Efficiency Grants (WEEG), Reclamation provides 50/50 cost-share funding to irrigation and water districts, Pueblos and Tribes, States, and other entities with water or power delivery authority. Projects conserve and use water more efficiently, increase the production of hydropower, mitigate conflict in areas at a high risk of future water conflict, and accomplish other benefits that contribute to water supply reliability in the Western United States. Projects are selected through a competitive process and the focus is on projects that can be completed within two or three years.

Small-Scale Water Efficiency Projects

Through the Small-Scale Water Efficiency Projects (SWEF), Reclamation provides 50/50 cost-share funding to irrigation and water districts, Pueblos and Tribes, States, and other entities with water or power delivery authority for small water efficiency improvements that have been identified through previous planning efforts. Projects eligible for funding include installation of flow measurement devices or automation in a specific part of a water delivery system, lining a section of a canal to address seepage, or other similar projects that are limited in scope.

Water Marketing Strategy Grants

Through the Water Marketing Strategy Grants, Reclamation provides assistance to States, Pueblos and Tribes, and local governments to conduct planning activities to develop water marketing strategies that establish or expand water markets or water marketing activities between willing participants in compliance with State and Federal laws.

Environmental Water Resources Projects

WaterSMART Environmental Water Resources Projects is a category of funding to support projects focused on environmental benefits that have been developed as part of a collaborative process to help carry out an established strategy to increase the reliability of water resources.

Unlike other WaterSMART programs, Environmental Water Resources Projects require only 25 percent cost share. Applicants are invited to leverage their money and resources by cost sharing with Reclamation on water conservation and efficiency projects that result in quantifiable and sustained water savings and benefit ecological values or watershed health; water management or infrastructure improvements to benefit ecological values or watershed health; and watershed restoration projects benefitting ecological values or watershed health that have a nexus to water resources or water resources management.

New for FY 2023: Section 40907 of the Bipartisan Infrastructure Law (BIL), P.L. 117-58, signed in late 2021, includes additional authority for Reclamation to provide funding for multi-benefit projects that improve watershed health. Section 40907 is being implemented through WaterSMART Environmental Water Resources Projects, and additional details will be contained in the funding opportunity anticipated for early 2023.

Aquatic Ecosystem Restoration Program

The new WaterSMART Aquatic Ecosystem Restoration Program will provide cost-shared funding to States, Pueblos and Tribes, and other entities as they study, design, and construct aquatic ecosystem restoration projects that are collaboratively developed, have widespread regional benefits, and result in the improvement of the health of fisheries, wildlife, and aquatic habitat.

Eligible restoration activities include, but are not limited to

- Removal or modification of barriers to fish passage
- Restoration of connectivity
- Restoration of aquatic habitat
- Improvement of water availability, quality, and temperature.
- Other related activities

Cooperative Watershed Management Program

The Cooperative Watershed Management Program (CWMP) contributes to the WaterSMART strategy by providing funding to watershed groups to encourage diverse stakeholders to form local solutions to address their water management needs. Funding is provided on a competitive basis for the following.

- **Watershed Group Development and Watershed Restoration Planning**
In 2012, Reclamation began providing funding for watershed group development, watershed restoration planning, and watershed management project design (Phase I). A watershed group is a self-sustaining, non-regulatory, consensus-based group that is composed of a diverse array of stakeholders, which may include, but is not limited to, private property owners; non-profit organizations; Federal, State, or local agencies; and Pueblos and Tribes. As part of Phase I activities, applicants may use funding to develop bylaws, a mission statement, perform stakeholder outreach, develop a watershed restoration plan, and design a watershed management project. For Phase I projects, Reclamation awards a successful

applicant up to \$100,000 per year for a period of up to two years with no non-Federal cost-share required.

- **Implementation of Watershed Management Projects**

In 2017, Reclamation started to provide cost-shared financial assistance to watershed groups to implement watershed management projects. These on-the-ground projects, collaboratively developed by members of a watershed group, address critical water supply needs and water quality concerns, helping water users meet competing demands and avoid conflicts over water. Reclamation currently provides funding to watershed groups for the implementation of watershed management projects through the Environmental Water Resources Projects funding opportunity.

Water Conservation Field Services Program

The Water Conservation Field Services Program (WCFSP) was established by Reclamation in 1996 to proactively encourage water conservation in the operations of recipients of water from Federal water projects and to assist agricultural and urban water districts in preparing and implementing water conservation plans in accordance with the Reclamation Reform Act of 1982. Funding is used to make cost-shared financial assistance available on a competitive basis at Reclamation's area and regional office levels, as well as for technical assistance from Reclamation staff. Funding may be used to develop water conservation plans, identify water management improvements through System Optimization Reviews, design water management improvements, and improve application of water conservation technologies through demonstration activities.

Drought Response Program

Reclamation's Drought Response Program supports a proactive approach to drought by assisting water managers to develop and update comprehensive drought plans and implement projects that will build long-term resiliency to drought. Program areas are described below.

Drought Contingency Planning

Reclamation will provide financial assistance on a competitive basis for applicants to develop a drought contingency plan or to update an existing plan to meet the required elements described in the Drought Response Framework. Most drought contingency planning processes are structured to address three questions:

- How will we recognize the next drought in its early stages?
- How will drought affect us?
- How can we protect ourselves from the next drought?

The planning process helps planners answer these three questions and encourages an open and inclusive planning effort that employs a proactive approach to building long-term resiliency to drought.

Drought Resiliency Projects

Drought Resiliency can be defined as the capacity of a community to cope with and respond to drought. Under this element of the program, Reclamation will provide funding for projects that will help communities prepare for and respond to drought. Typically, these types of projects are referred

to as "mitigation actions" in a drought contingency plan. Reclamation funds projects that build resiliency to drought by:

- Increasing the reliability of water supplies
- Improving water management
- Providing benefits for fish and wildlife and the environment

Emergency Response Actions

Reclamation continues to undertake emergency response actions under the Drought Response Program to minimize losses and damages resulting from drought, relying on the authorities in Title I of the Drought Act. Emergency response actions are crisis-driven actions in response to unanticipated circumstances. Eligible emergency response actions are limited to temporary construction activities and other actions authorized under Title I that do not involve construction of permanent facilities, including water purchases and use of Reclamation facilities to convey and store water.

Title XVI Water Recycling and Reuse Projects

Title XVI of P.L. 102-575, as amended (Title XVI), provides authority for Reclamation's water recycling and reuse program. Through the Title XVI Program, Reclamation identifies and investigates opportunities to reclaim and reuse wastewaters and impaired ground and surface water in the 17 Western States and Hawaii. Title XVI includes funding for the planning, design, and construction of water recycling and reuse projects in partnership with local government entities.

Authorized Title XVI Projects

Projects authorized under this authority are listed at:
<https://www.usbr.gov/watersmart/title/authorized.html>.

WIIN Eligible Projects

Projects eligible to compete for Title XVI Program funding under section 4009(c) of the Water Infrastructure Improvements for the Nation (WIIN) Act are listed at:
<https://www.usbr.gov/watersmart/title/wiin.html>.

Large-Scale Water Recycling Program

Section 40905 of the BIL provides authority for Reclamation's Large-Scale Water Recycling Program. The program provides \$450 million over five years to projects in Reclamation states that have a total project cost greater than or equal to \$500 million, at 25% Federal cost share, with no per-project maximum. Large-scale recycled water projects will play an important role in helping communities develop local, drought-resistant sources of water supply by turning currently unusable water sources into a new source of water supply that is less vulnerable to drought and climate change.

Projects will become eligible to compete for funding under the Large-Scale Water Recycling Program once Reclamation has reviewed a feasibility study submitted by the non-Federal project sponsor and has informed Congress that the project meets Reclamation's requirements. Temporary guidelines for the preparation of feasibility studies are established by Temporary Reclamation

Manual Release WTR TRMR-128, https://www.usbr.gov/recman/temporary_releases/wtrtrmr-128.pdf.

WTR-TRMR-128 communicates to project sponsors the additional information they must provide to Reclamation, beyond existing Title XVI Program requirements. The additional requirements are available as a TRMR so that potential project sponsors can begin working on feasibility studies. Over the next year, this TRMR will be incorporated as permanent revisions to the existing Reclamation Manual Directive and Standards "Title XVI Water Reclamation and Reuse Program and Desalination Construction Program Feasibility Study Review Process" (WTR 11-01). There will be an opportunity for public comment during the permanent revision process.

Desalination Projects

The WIIN Act provides new authority to Reclamation to develop a desalination construction program that will provide a path for ocean or brackish water desalination projects to receive Federal funding. Eligible projects are listed at: <https://www.usbr.gov/watersmart/desalination/eligible.html>.

In 2022, the AAO supported the development and implementation of three WIIN-eligible Title XVI projects and one WIIN Act Desalination project.

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,
- A trade-off analysis of strategies identified.

Basin studies in the Upper Rio Grande Basin build on the hydrologic projections developed by Reclamation as part of the Upper Rio Grande Impact Assessment (Llewellyn et al., 2013).

Santa Fe Basin Study

In 2015, Reclamation's AAO, in partnership with the City of Santa Fe and Santa Fe County, released the Santa Fe Basin Study: Adaptations to Projected Changes in Water Supply and Demand (Llewellyn et al., 2015; <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 City and County.

Based on the conclusions of this Basin Study, the City of Santa Fe received funding from Reclamation for a Title XVI Feasibility Study, which was completed in 2017. The completed study describes alternatives for implementation of a water reuse project for the City.

In 2016, the City of Santa Fe was also awarded funding from Reclamation for a Basin Study Update. In this project, Reclamation and Santa Fe collaborated to determine the likely timeline for projected

impacts of climate change on Santa Fe’s water supply over the coming century, empowering the Santa Fe water utility to plan for implementation of the remainder of its adaptation portfolio. In 2018, the City was awarded a Water Management Options Pilot Project to redevelop the system dynamics model used to simulate its water supply sources and distribution. Work on this update has continued through 2022 and the City has nearly completed this model redevelopment. Completion of the Basin Study Update has been postponed until the new system dynamics model is available to complete the assessments.

As a result of the Basin Study and Feasibility Study, several alternatives were defined for the City to acquire additional water. The City 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 the City’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, seven Pueblos, and numerous other basin stakeholders to perform a Basin Study from the Lobatos stream gage near the Colorado-New Mexico border to Elephant Butte Dam. This study follows from the Middle Rio Grande Basin Study – Plan of Study and seeks to include a broad and diverse consortium of basin stakeholders, including State and municipal government entities, Pueblos and Tribes, irrigation districts, acequias, and non-governmental and community organizations. The 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 is being funded as a 50/50 cost split between Reclamation and all other partners combined.

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. Signatories are listed below.

1. American Rivers
2. Amigos Bravos
3. Audubon Southwest
4. Bosque Ecosystem Monitoring Program
5. Bernalillo County
6. Center for Social Sustainable Ecosystems
7. Coronado Soil and Water Conservation District
8. Embudo Valley Regional Acequia Association
9. Friends of the Bosque del Apache National Wildlife Refuge
10. Las Acequias de Placitas
11. Middle Rio Grande Conservancy District
12. Middle Rio Grande Water Advocates
13. National Wildlife Federation
14. New Mexico Environmental Law Center
15. New Mexico Healthy Soil Working Group
16. New Mexico Interstate Stream Commission
17. New Mexico Wild
18. Pueblo of Cochiti
19. Pueblo of Isleta
20. Pueblo of Laguna
21. Pueblo of Sandia
22. Pueblo of Santa Ana
23. Pueblo of Santo Domingo
24. Pueblo of Taos
25. Rio Grande Restoration
26. Save Our Bosque Task Force
27. Sierra Club – Rio Grande Chapter

- | | |
|--|--------------------------------|
| 28. South Valley Regional Association of
Acequias | 32. Water Culture Institute |
| 29. The Nature Conservancy | 33. Western Resource Advocates |
| 30. The Wilderness Society | 34. Wild Earth Guardians |
| 31. Trout Unlimited | 35. World Wildlife Fund |

The partners and Reclamation have been developing projection sets and 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. Examples of ongoing activities include:

- Conducting Impact Assessments to develop key data on west-wide risks and impacts to water supply and demand that inform Reclamation operations and planning studies and provide a foundation for project specific applications.
- Conducting Site-Specific Pilots to support the application of information developed through Basin Assessments in specific locations. Reclamation initiated the Site-Specific Pilots in 2015 to identify possible improvements to western reservoir operations using forecasting and other ways to enhance operations flexibility. Outcomes from the Pilots will be used to develop guidance for optimizing reservoir operations west-wide.
- Collaborating with other Federal agencies to develop tools with shared benefits. For example, Reclamation and the USGS are working together to expand application of the USGS National Brackish Groundwater Assessment database to develop a web-based data viewer and decision support tool for planners to evaluate the potential use of brackish groundwater supplies.

New 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/>.

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.

Reclamation completed an analysis of water operations on the Rio Chama, located in northwestern New Mexico, as a Reservoir Operations Pilot project. This project evaluated the legal constraints to river and reservoir operations on the Rio Chama, and the economic implications of reservoir operations and potential changes to them. Existing data and information on the effects of reservoir operations on the ecology, geomorphology, hydropower generation, and recreation potential of the designated Wild and Scenic reach of the Rio Chama was compiled. The report can be found at <https://www.usbr.gov/watersmart/pilots/docs/riochama/Rio-Chama-Transmittal-Report.pdf>.

Applied Science Grants

Through Applied Science Grants, Reclamation provides funding to external non-Federal entities and internal project teams for the development of tools and information to support water management for multiple uses. Eligible projects include the development of modeling and forecasting tools, hydrologic data platforms, and new data sets.

Applied Science Tools

Reclamation's Water Resources and Planning Office provides funding to Reclamation staff on a competitive basis for the development of improved modeling and forecasting tools, improved hydrologic information, GIS products, and data management, and other decision support tools.

Using applied science information and tools allows Reclamation, partners, and stakeholders to rely on the best available science to address uncertainty in decision making to improve water management. Reclamation also relies on applied science to carry out activities that are central to our mission and are in cooperation with our stakeholders and partners.

All proposed projects must have a nexus to Reclamation's mission, priorities, and activities, including fulfilling water supply contracts, operating reservoirs for multiple purposes, and complying with environmental requirements.

2021 SECURE Water Act Report

In 2021, the Bureau of Reclamation released final technical reports supporting the Water Reliability in the West - 2021 SECURE Water Act Report. Reclamation's 2021 West-Wide Climate and Hydrology Assessment (<https://www.usbr.gov/climate/secure/docs/2021secure/2021SECUREReport.pdf>) and seven individual basin reports provide detailed information on climate change impacts and adaptation strategies to increase water supply reliability in the West. A new 2021 SECURE Report Web Portal (<https://experience.arcgis.com/experience/7461ca68b2da4620863ff27d65b8cf14/>) is also available to provide 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: Active WaterSMART Project in the Rio Grande Basin Managed by the AAO¹

Agreement No.	Program ²	Completion Date	Recipient Name	Project Title	Federal Total Obligation Amount	Non-Federal Total Est Amount
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
R21AP10045	ASG	6/30/2022 (Complete)	NM Office of the State Engineer/ Interstate Stream Commission	Developing a Projection Tool for Otowi Index Supply and Elephant Butte Index Supply	\$141,272	\$147,038
	CWMP	TBD	Amigos Bravos, Inc.	Improving the Ecological Function of the Rio Fernando Through Hydrology and Streambank Restoration Planning	\$178,750	\$0
R19AP00276	CWMP	10/30/2022 (Complete)	Chama Peak Land Alliance	Enhancing the Capacity of the San Juan - Chama Watershed Partnership	\$100,000	\$0
R22A900214	CWMP	6/30/2024	Colorado Rio Grande Restoration Foundation	Conejos River Partnership Project - Phase 2	\$285,000	\$303,640
R22AP00074	CWMP	12/31/2023	National Audubon Society	Isleta Reach Stewardship Association and Plan Development for the Middle Rio Grande	\$99,964	\$0

¹ As of February 3, 2023

² ASG = Applied Science Grants

CWMP = Cooperative Watershed Management Program

DROUGHT = Contingency Planning, Resiliency Projects, or Emergency Response Actions

WEEG = Water and Energy Efficiency Grant

SWEP = Small-Scale Water Efficiency Project

WCFSP = Water Conservation Field Services Program

Title XVI = Water Reclamation and Reuse Program

WIIN Act = Water Infrastructure Improvements for the Nation

Agreement No.	Program ²	Completion Date	Recipient Name	Project Title	Federal Total Obligation Amount	Non-Federal Total Est Amount
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
	CWMP	TBD	Santa Cruz Irrigation District	Watershed Group Development and Watershed Restoration Planning for the Rio Santa Cruz Watershed Northern New Mexico	\$200,000	\$0
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	\$0
R18AP00114	CWMP	6/30/2022 (Complete)	Cimarron Watershed Alliance, Inc. (Canadian River Basin)	Restoration Planning for Improved Water Quality and Quantity in the Cimarron Watershed	\$99,994	\$1,521
R19AP00267	CWMP	9/30/2022 (Complete)	New Mexico Jornada Resource Conservation & Development Council	Furthering Watershed Restoration Planning	\$99,982	\$0
	DROUGHT	TBD	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
R21AP10035	DROUGHT	12/31/2022 (extension requested)	Elephant Butte Irrigation District	Watershed Scale Stormwater Monitoring and Capture	\$180,670	\$181,784
R19AP00115	DROUGHT	12/30/2023	Santa Fe County	Aquifer Storage and Recovery in Rancho Viejo, Santa Fe County	\$286,520	\$659,480
R21AP10076	DROUGHT	5/31/2022 (Complete)	Village of Tijeras	Well No. # Drilling, Testing, and Construction (Drought Well)	\$748,980	\$748,980

Agreement No.	Program ²	Completion Date	Recipient Name	Project Title	Federal Total Obligation Amount	Non-Federal Total Est Amount
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
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
	SWEP	TBD	El Paso County Water Improvement District No. 1	Montoya Laterals System Concrete Lining Project: Phase III	\$100,000	\$116,386
	SWEP	TBD	Elephant Butte Irrigation District	Leasburg Canal Gate Actuators and Metering Station	\$94,710	\$119,341
R19AP00280	SWEP	9/30/2022 (Complete)	Ponderosa Mutual Domestic Water Consumers Association	Meter Upgrade Project	\$24,000	\$29,531
R21AP10004	SWEP	3/1/2024	Pueblo of Zia	Residential Metering Project, Phase 2	\$73,000	\$80,851
R21AP10139	SWEP	3/31/2022 (Complete)	El Paso County Water Improvement District No. 1	Ysla Lateral Concrete Lining Project, Phase 3	\$75,000	\$122,294
R21AP10111	SWEP	6/30/2022 (Complete)	County of Bernalillo	Well Meter Upgrade Project	\$28,156	\$28,156
R17AP00223	SWEP	9/30/2022 (Complete)	City of El Paso, TX	Water Conservation in the City of El Paso Parks	\$75,00	\$75,000
R22AP00360	Title XVI	10/31/2026	City of Santa Fe	City of Santa Fe Pipeline Project	\$5,750,000	\$35,000,000
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
	Title XVI	TBD	El Paso Water Utilities Public Service Board	Advanced Water Purification Facility	\$20,000,000	
R22A900331	Water Marketing	6/30/2025	Rio Grande Water Conservation District	Colorado's Rio Grande Basin Water Cooperative Project	\$212,755	\$212,757
	WCFSF	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
R22AP005007	WEEG	TBD	El Paso County Water Improvement District No. 1	Riverside Canal Concrete Lining Project (Phase IV)	\$1,000,000	
	WEEG	TBD	El Paso County Water Improvement District No. 1	Advanced Flow Measurement Improvements Project	\$200,000	\$421,740
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
R19AP00150	WEEG	6/30/2022 (Complete)	El Paso County Water Improvement District No. 1	La Union East Canal Concrete Lining Project	\$300,000	\$625,298
R18AP00197	WEEG	6/30/2022 (Complete)	Elephant Butte Irrigation District	Picacho W-H-E-N Project	\$997,182	\$1,152,288
R20AP00339	WIIN Act	10/31/2022 (Complete)	El Paso Water Utilities Public Service Board	Kay Bailey Hutchison (KBH) Desalination Plant, Phase I Part A Expansion	\$2,050,000	\$6,050,000
Total Funding					\$41,292,769	\$62,897,312

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 2022 are listed below.

- FY 2019 Award – ongoing, *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 through eddy covariance towers at Elephant Butte and Caballo Reservoirs. The results will be compared with those from the Collison Floating Evaporation Pans. Remotely sensed evaporation estimates are developed from Landsat-8 images. The project is on track to be completed by September 30, 2023.
- FY 2019 Award – completed, *Software Tool Development to Generate Stochastic Hydraulic Simulations using HEC-RAS* (AAO partnership with USACE and the Hydrologic Research Center of San Diego, CA). Main modules include Monte-Carlo sample generation and ingestion, implementation of samples by modifying HEC-RAS input files, post-processing, statistical analysis, and visualization. They have been fully tested and include a case study for the SJCP.
- FY 2020 Award – ongoing, *Characterizing the Predictability and Sensitivity of Streamflow to Monsoon Season Precipitation* (AAO partnership with NCAR, Boulder, CO). 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. The initial results show forecasts starting in May provided more accuracy than climatology. This process was tested in 2021 and 2022 and provides a qualitative measure that can guide Reclamation's streamflow forecasts after May. Although this work will not predict specific monsoon events, it will provide information on the likely strength of the monsoon season, allowing for better water supply planning than was previously possible.
- FY 2021 Award – ongoing, *Utilizing Acoustic Sensors to Detect Streambed Mobilization* (AAO in partnership with the USGS California Water Science Center and the 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. Data processing is underway.

- FY 2023 Award – *Stochastic Streamflow Generation: A Complementary Approach for Hydroclimate Projections in Hydrologically Complex Basins* (Reclamation in partnership with University of Massachusetts Amherst). This project will develop tools and resources to support informed use of climate model projections and use of weather generators in water management applications. 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 that is consistent with decision-making frameworks such as Decision-Making under Deep Uncertainty (DMDU).
- FY 2023 Award – *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 in partnership with University of New Mexico, University of Wyoming, University of Washington, and USGS Water Science Center). This project builds upon the previously funded 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*, that was funded under the Snow Monitoring Program. This S&T funding will add an additional three years of data collection and work on the development of a comprehensive tool to assist Reclamation in its snow monitoring.

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 monitoring program that takes advantage of new monitoring technologies. AAO is participating in development of this snow monitoring program through two funded projects:

- *A Testbed for Harnessing and Benchmarking Snow Data Observations and Watershed Modeling for Water Supply Prediction* (Reclamation in partnership with NCAR) – ongoing. Modeling study to test snow monitoring technologies using data from other Reclamation snow studies.
- *Assessing the Utility of New Satellites to Advance State of the Art Snow Forecasting Capabilities* (AAO in partnership with the University of New Mexico, University of Washington, University of Wyoming, and USGS Water Science Center) – ongoing. Study involves remote sensing paired with field monitoring in the headwaters of the SJCP.

Reclamation is partnering with NASA’s Jet Propulsion Lab on a project to update the technology used to produce evapotranspiration estimates in the Middle Rio Grande Basin. This is described in more detail in the *ET Toolbox* section above. The project is expected to provide daily ET estimates and forecasts at 30-meter spatial resolution derived from the Moderate Resolution Imaging Spectroradiometer on the Terra and Aqua satellites and Landsat imagery. MRGCD will host the JPL tool and data on their servers.

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.

Research continues on the Collison Floating Evaporation Pan through funding from the 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. Floating evaporation pans have been deployed on Cochiti, Elephant Butte, and Caballo Reservoirs, 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 results are being integrated and compared with those generated by New Mexico State University. Data collection should be completed by September 30, 2023, at Lake Powell, and Elephant Butte and Caballo Reservoirs. Project close-out should be completed by the end of 2023.

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