

RECLAMATION

Managing Water in the West

Calendar Year 2015 Report to the Rio Grande Compact Commission

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March 2016

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List of Acronyms and Abbreviations

ac-ft	acre-feet
AIS	Aquatic Invasive Species
ARRC	Aquatic Resources and Recovery Center
ABCWUA	Albuquerque Bernalillo County Water Utility Authority
AOP	Annual Operations Plan
AWARDS	Agricultural Water Resources Decision Support
BA	Biological Assessment
BDANWR	Bosque del Apache National Wildlife Refuge
BiOp	Biological Opinion
CPUE	catch per unit effort
BLM	Bureau of Land Management
CADSWES	Center for Advanced Decision Support for Water and Environmental Systems
CAS	Corrective Action Study
cfs	Cubic Feet per Second
CMIP5	Coupled Model Intercomparison Project Phase 5
CR	Comprehensive Review
CWCD	Conejos Water Conservancy District
CWMP	Cooperative Watershed Management Program
CY	Calendar Year
DOMSAT	Domestic Communications Satellite
DSS	Data Storage System
EBID	Elephant Butte Irrigation District
EPCWID	El Paso County Water Improvement District No. 1
EDW	Emergency Drought Water
ESA	Endangered Species Act
EIS	Environmental Impact Statement
ET	Evapotranspiration
FERC	Federal Energy Regulatory Commission
flycatcher	Southwestern willow flycatcher
FY	Fiscal Year
FW	Floodway
HCCRD	Hudspeth County Conservation and Reclamation District No. 1
HDB	Bureau of Reclamation's Hydrologic Database
IBWC	International Boundary and Water Commission
kWhr	kilowatt-hour
LCC	Landscape Conservation Cooperative
LOPP	Lease of Power Privilege
LACPP	Los Alamos County Power Plant
LFCC	Low Flow Conveyance Channel
MAT	Minnow Action Team
MRGCD	Middle Rio Grande Conservancy District
MRCOG	Mid-Region Council of Governments

MRMPO.....	Mid-Region Metropolitan Planning Organization
NEPA	National Environmental Policy Act
NMDGF	New Mexico Department of Game and Fish
NMISC.....	New Mexico Interstate Stream Commission
NMOSE.....	New Mexico Office of the State Engineer
O&M.....	Operations and Maintenance
PCR.....	Polymerase Chain Reaction
PFR	Periodic Facility Review
P.L.....	Public Law
RDLES	Reclamation Detection Laboratory for Exotic Species
RGP.....	Rio Grande Project
RWS	Regional Water System
SL.....	standard length
SJ-C.....	San-Juan Chama
URGSiM	Upper Rio Grande Simulation model
URGWOM.....	Upper Rio Grande Water Operations Model
YOY	young of year

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 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* (Figure 1).

The *San Luis Valley Project* consists of the Conejos and Closed Basin Divisions. The Conejos Division, which includes Platoro Dam and Reservoir, provides water for approximately 86,000 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.

The *San Juan – Chama (SJ-C) Project* consists of a system of storage dams, diversion structures, tunnels, and channels for transbasin movement of water from the San Juan River Basin to the Rio Grande Basin as a component of the Colorado River Storage Project. The SJ-C Project provides water for municipal, domestic, industrial, recreation, fish and wildlife purposes, and supplemental water for irrigation. Another component of the project is the Pojoaque Irrigation Unit including Nambé Falls Dam. The Pojoaque Irrigation Unit provides water for approximately 2,800 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. The project also includes river channel maintenance from Velarde, New Mexico, southward to Caballo Reservoir, and the Low Flow Conveyance Channel (LFCC) south of San Acacia, New Mexico. Irrigation water is provided to the Middle Rio Grande Conservancy District (MRGCD) which supplies water to 50,000 to 70,000 acres of land.

The *Rio Grande Project* includes Elephant Butte and Caballo Reservoirs and Percha, Leasburg, and Mesilla Diversion Dams. The Project stretches from the lower Rio Grande Valley of southern New Mexico to just 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 in New Mexico and the El Paso County Water Improvement District No. 1 in Texas. Water is also provided for diversion to Mexico by the International Boundary and Water Commission - United States Section according to the terms of the Convention of 1906 between the United States and Mexico. Drainage waters from the Rio Grande Project lands provide a supplemental supply for approximately 18,000 acres of land within the Hudspeth County Conservation and Reclamation District No. 1 in Texas. Elephant Butte Dam also generates electrical power for communities and industries in southern New Mexico. Reclamation transferred title to the canal and drainage facilities to the districts in a 1996 quit claim deed.

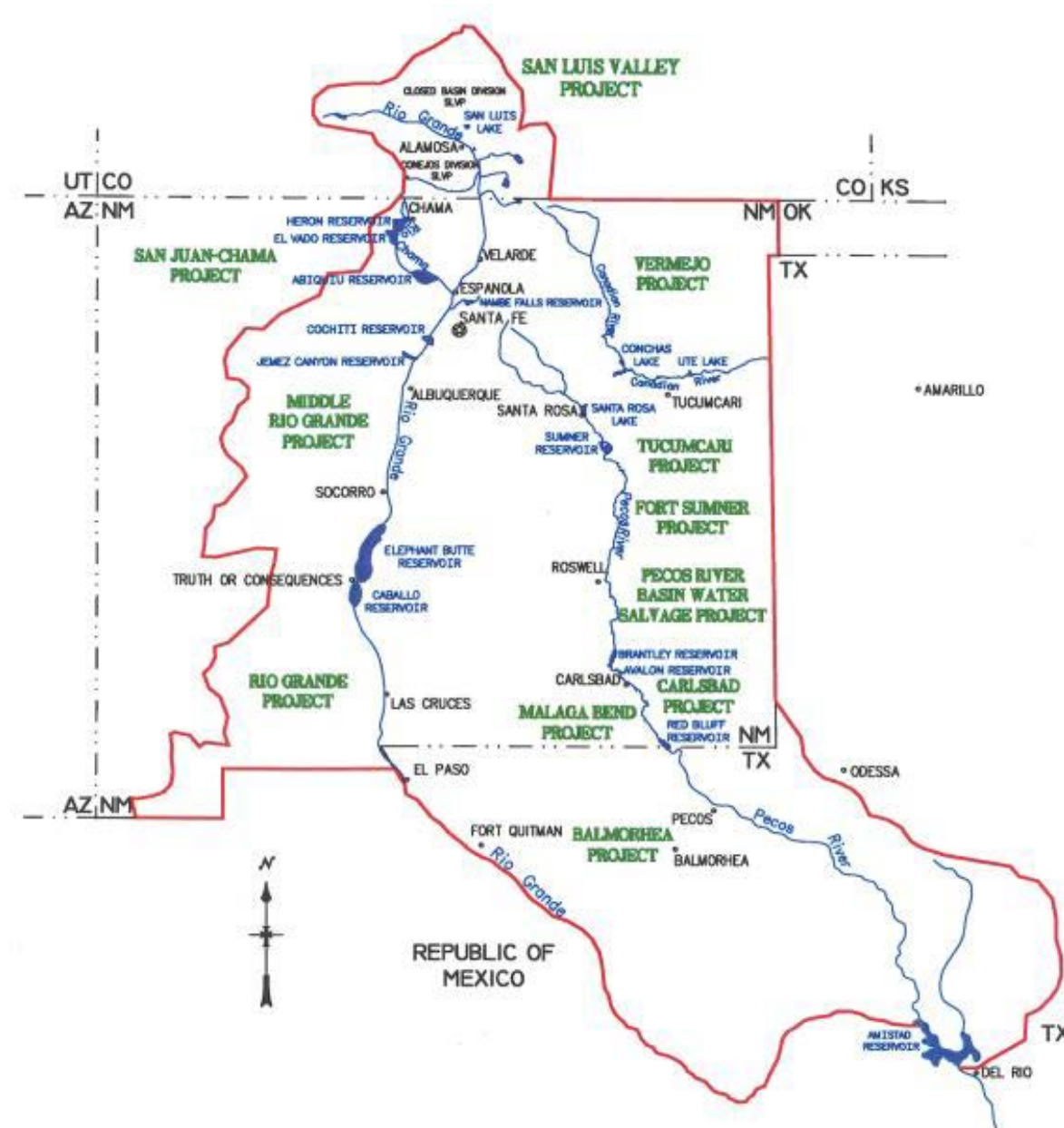


Figure 1: Project Map of Reclamation's Albuquerque Area Office

San Luis Valley Project, Colorado

Conejos Division, Platoro Reservoir

The Conejos Water Conservancy District (CWCD) operates Platoro Reservoir, which provides storage for approximately 86,000 acres associated with the San Luis Valley Project (Figure 2). The CWCD’s office is located in Manassa, Colorado.

Platoro Reservoir started the year on January 1, 2015, with a water surface elevation of 9,964.23 feet and a storage volume of 10,563 acre-feet (ac-ft). The December 31, 2015, reservoir elevation was 9,970.20 feet, with a storage volume of 13,324 ac-ft. The minimum storage during calendar year 2015 occurred on January 1, 2015. Maximum storage occurred on June 22, 2015, when the reservoir peaked at elevation 9,994.36 feet (27,111 ac-ft). There was 1,320 ac-ft of Rio Grande Compact water stored during water year 2015. All of this water was released by the end of the water year.

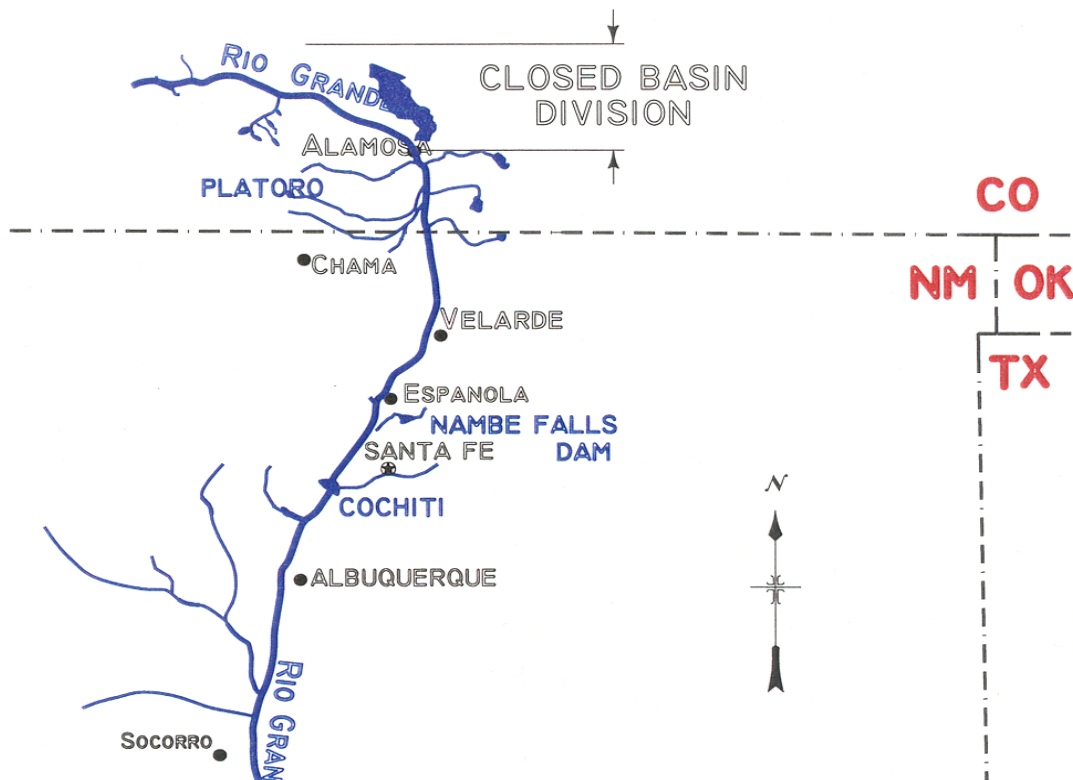


Figure 2: Area Map of San Luis Valley Project

Platoro Dam Facility Review and Safety of Dams Programs

Outside of aging infrastructure, there are no significant dam safety related Operations and Maintenance (O&M) issues associated with Platoro Dam and Dike. At the end of Fiscal Year (FY) 2015, there were four incomplete Category 2 O&M recommendations for Platoro Dam. One Category 2 O&M recommendation was completed in FY 2015.

The Facility Review Rating was updated in October 2015. The rating for Platoro decreased from a total score of 96 to a score of 89. Platoro currently has an overall rating of “Good.”

Closed Basin Division

The Alamosa Field Division of the Albuquerque Area Office operates and oversees the maintenance of a water salvage project constructed in the Closed Basin area of the San Luis Valley, Colorado (Figure 2). The purpose is to salvage unconfined groundwater from the Closed Basin that would otherwise be lost to evaporation and evapotranspiration. The salvaged water is pumped from up to 170 salvage wells and delivered through a conveyance channel to the Rio Grande to assist Colorado in meeting its commitment under the Rio Grande Compact. The project also delivers mitigation water to the Alamosa National Wildlife Refuge and Blanca Wildlife Habitat Area, and helps stabilize San Luis Lake. Reclamation continues to work under the guidance of the Closed Basin Division Operating Committee in management of Closed Basin operations and water deliveries. The Rio Grande Water Conservation District (RGWCD) provides the civil maintenance on the Closed Basin Project, while the Bureau of Reclamation operates and maintains the project. The last Review of Operations and Maintenance (RO&M) examination was conducted in October of 2011. The next RO&M examination is scheduled for 2016.

Operations

Deliveries by the Closed Basin Division in Calendar Year (CY) 2015 included deliveries to the Rio Grande, Blanca Wildlife Habitat Area and Alamosa National Wildlife Refuge.

A total of 11,684 acre-ft (ac-ft) of project water was delivered in CY2015. Total deliveries of Compact water to the Rio Grande for CY2015 were 8,059 ac-ft. The Rio Grande Compact also specifies that water delivered to the river cannot exceed, based on a ten day average, 350 parts per million total dissolved solids. Table 1 compares 2015 Closed Basin Project total production and compact deliveries in 2015, to quantities in the five preceding calendar years. Total water deliveries to the Bureau of Land Management’s (BLM) Blanca Wildlife Habitat Area were 1,037 ac-ft. This included 800 ac-ft for annual mitigation and an exchange of 237 ac-ft of Colorado Parks and Wildlife water. A total of 2,588 ac-ft of mitigation water was delivered to the Alamosa National Wildlife Refuge, which is not considered a delivery to the Rio Grande.

Table 1: Closed Basin Project Deliveries 2010-2015

Closed Basin Project Deliveries Compared to Deliveries from Prior Rio Grande Compact Commission Reports		
Year	Total Production (ac-ft)	Delivered to Rio Grande (ac-ft)
2015	11,684	8,059
2014	11,213	7,598
2013	11,401	7,979
2012	12,877	9,409
2011	15,167	11,579
2010	17,098	12,849

Natural inflows to San Luis Lake (SLL) are measured by the SLL inlet flume or estimated at the spillway and culverts. Inflow to SLL during CY2015 totaled 4,330 ac-ft. Closed Basin Division water accounting for the 2015 calendar year is summarized in Table 2.

Table 2: San Luis Valley Project - Closed Basin Division Water Accounting (units are acre-feet)

MONTH	BLANCA WILDLIFE HABITAT AREA (BWHA)			PARSHALL FLUME		ALAMOSA NATIONAL WILDLIFE REFUGE (ANWR)				DELIVERY TO THE RIO GRANDE			PROJECT TOTALS
	CH03	CH04	MONTH TOTALS	TOTAL	CREDITABLE	CH01	CH02	PUMPING PLANT	MONTH TOTALS	Total at	Creditable	NON-	
	STA. 730+00	STA. 798+60		PASSING FLUME	AMOUNT AT FLUME	CHICAGO TURN-OUT	MUM TURN-OUT			Flume Minus Del. to ANWR	Amt. to RG and not used by ANWR	CREDITABLE @ LOBATOS	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	
JAN			0	1,067	1,067				0	1,067	1,067	0	1,067
FEB			0	936	936	54	54		108	828	828	0	936
MAR			0	1,258	1,258	386	403		789	469	469	0	1,258
APR	84	81	165	754	754	73	57		130	624	624	0	919
MAY		20	20	891	891				0	891	891	0	911
JUN	32	30	62	828	828				0	828	828	0	890
JUL	151	169	320	536	536	38	45		83	453	453	0	856
AUG	106	98	204	546	546	97	119		216	330	330	0	750
SEP	123	143	266	753	753	202	211		413	340	340	0	1,019
OCT			0	1,093	1,093	241	281		522	571	571	0	1,093
NOV			0	964	964	148	179		327	637	637	0	964
DEC			0	1,021	1,021				0	1,021	1,021	0	1,021
ANNUAL	496	541	1,037	10,647	10,647	1,239	1,349	0	2,588	8,059	8,059	0	11,684

Note: Delivery to BWHA includes 237 AF exchange from Colorado Parks and Wildlife.

The project continues to provide Priority 1 (Compact) and Priority 2 (mitigation) water deliveries. The San Luis Valley is in the midst of a long-term drought. Since 2002 the water table in the unconfined aquifer has dropped significantly in some areas. Pumping levels remain stable to allow the water table to recover while minimizing impacts to the surrounding area and preserving the integrity of existing project wells. Wells turned off at the recommendation of the Project Operating Committee remain off while monitoring nearby water levels.

Reclamation has been meeting with the U.S. Fish and Wildlife Service, Colorado Division of Parks and Wildlife, and RGWCD on the operation of San Luis Lake in an effort to make the Lake a viable recreation area and to store water for later use to deliver to the Rio Grande to meet Colorado Compact requirements.

The United States Geological Survey's (USGS) continues to provide quality assurance/quality control (QA/QC) of the observation wells' network data for Reclamation. Reclamation continues to work in partnership with the USGS, National Park Service, BLM, U.S. Fish and Wildlife Service, and the RGWCD to monitor several observation well networks in and around the Closed Basin Project.

Maintenance

Routine preventive maintenance and repair activities continue at salvage and observation well sites, canal structures, pumping plants, and shelterbelts.

Repair and replacement of pumps in the salvage wells is an ongoing process. Eighteen new pumps were installed in salvage wells in 2015. The salvage well preventive maintenance tasks were completed for the year. Four salvage wells were re-drilled and 28 were rehabilitated in 2015.

In 2015, the Closed Basin Division acquired a new drill rig. The R-20 work over rig is being outfitted with new tools; and is being studied to bring it into service and to be used for training.

Water Quality

Water quality monitoring of Closed Basin Division salvage wells, the Rio Grande, San Luis Lake, Head Lake, and the conveyance channel continued with 1,582 samples collected in 2015.

The Water Quality Laboratory continues to support the Operations and Maintenance groups with their salvage well rehabilitation and bio-fouling mitigation efforts. Currently all salvage wells are monitored for the presence of iron related bacteria.

The Water Quality Laboratory participated in the Spring and Fall USGS Evaluation Program for Standard Reference Water Samples. The Laboratory continues to perform commendably on these audits.

Rio Grande Water Conservation District

The RGWCD continues to perform civil maintenance on the Project based on a cooperative agreement with Reclamation. Canal berms, lateral access roads, and right-of-ways were maintained by blading and mowing. Other work included removal of aquatic weeds and sediment from structures and the canal, repair of fences, repair of erosion to the berms from large precipitation events, and assisting Reclamation personnel in maintaining equipment. RGWCD continued its involvement in the groundwater monitoring program and continues maintenance of the irrigation systems for shelterbelt areas.

The RGWCD continues to assist Reclamation in the re-drill and rehabilitation efforts due to the bio-fouling in numerous wells.

San Juan – Chama Project, Colorado – New Mexico

An area map of the San Juan – Chama Project is provided below in Figure 3.

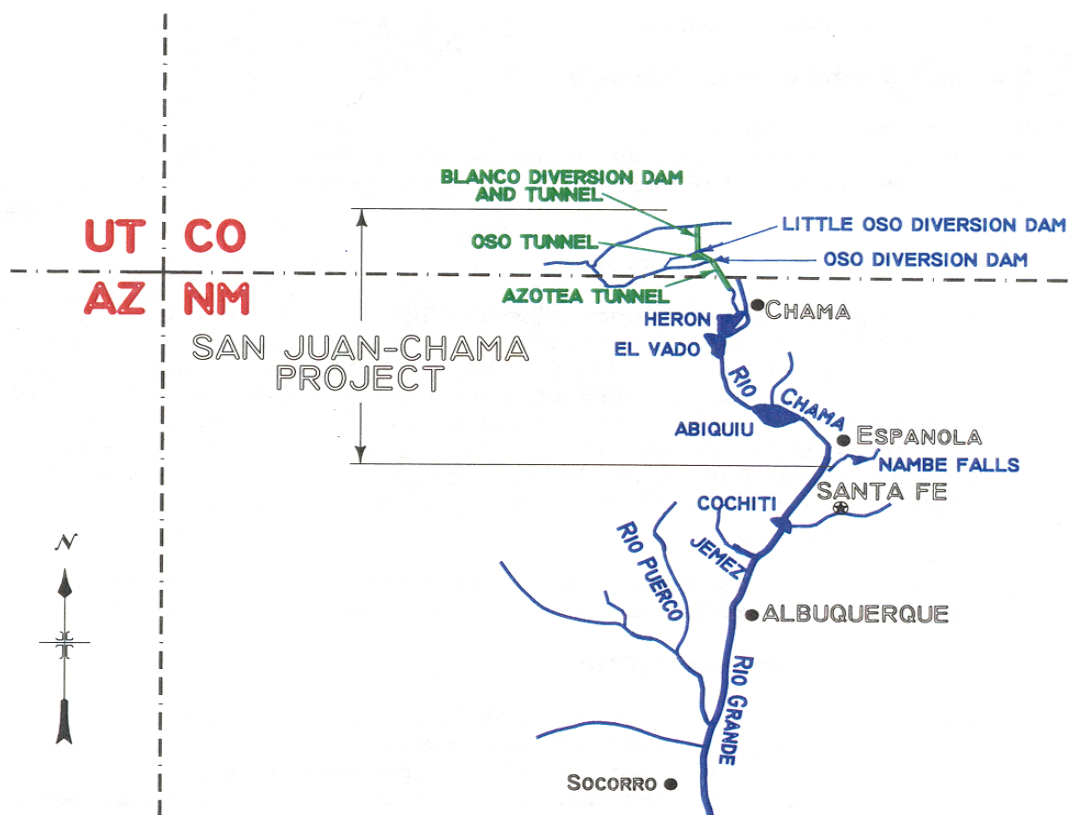


Figure 3: Area Map of the San Juan-Chama Project

San Juan - Chama Project Accounting

Water diverted from the San Juan Basin in Colorado through the SJ-C Project, authorized by Congress in 1962 through Public Law (P.L.) 87-483, introduced special circumstances for water use and management in the Middle Rio Grande Valley. Imported San Juan – Chama Project water must be accounted for separately from native Rio Grande flow, and must be fully consumed within New Mexico.

Reclamation is responsible for water contracts and accounting for the SJ-C Project. For several years, reports generated using an Excel[®] spreadsheet developed by Reclamation were compared to those generated with Crystal Reports[®], which mines RiverWare[®] accounting data from Reclamation's hydrologic database (HDB). Results were favorable, and since 2013 the accounting report has been generated using Crystal Reports[®]. SJ-C Project accounting for 2015

is provided in the separate *2015 Water Accounting Report*.

Heron Dam and Reservoir Operations

(All elevations are 1929 NGVD, storage reference is 2010 ACAP survey)

Diversions into the Azotea Tunnel began on January 30, 2015 and for the first time in many years, continued throughout the entire year. The total volume diverted through the tunnel was 90,566 ac-ft. The running 10-year average of Azotea Tunnel diversions decreased significantly this year, from 92,514 ac-ft for the period 2005 through 2014, to 86,051 ac-ft for the period 2006 through 2015 (Table 3).

Heron Reservoir began the year at an elevation of 7,096.80 feet (65,700 ac-ft) and finished the year at an elevation of 7,098.53 feet (68,555 ac-ft). The low point of the year was reached on February 26, 2015 at an elevation of 7094.95 feet (62,759 ac-ft). The reservoir peaked at an elevation of 7,128.95 feet (140,920 ac-ft) on July 20, 2015.

Table 3: SJ-C Project - Diversions through Azotea Tunnel (units are acre-feet)

AZOTEA	YEAR										10 YEAR TOTAL
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
MONTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
JANUARY	0	0	0	0	0	0	0	0	0	28	28
FEBRUARY	0	179	0	272	0	0	0	0	227	974	1,652
MARCH	706	12,976	4,745	5,938	546	2,008	7,014	1,036	1,984	6,890	43,843
APRIL	17,799	17,745	25,816	19,111	21,908	13,570	18,133	7,068	13,808	8,163	163,121
MAY	25,674	33,837	44,461	51,766	35,368	22,315	17,032	16,844	20,251	24,470	292,018
JUNE	7,600	26,679	47,463	23,544	27,249	42,779	4,037	8,387	18,851	38,438	245,027
JULY	3,785	4,302	13,428	4,392	1,815	8,404	670	511	1,550	8,581	47,438
AUGUST	4,868	7,375	2,606	232	1,501	1,594	260	3,115	788	889	23,228
SEPTEMBER	5,567	1,948	1,465	99	712	1,852	76	4,930	902	126	17,677
OCTOBER	12,795	33	0	0	251	4,452	0	2,761	1,334	811	22,437
NOVEMBER	0	0	0	0	53	1,295	0	1,049	335	862	3,594
DECEMBER	0	0	0	0	0	52	0	59	0	334	445
ANNUAL	78,794	105,074	139,984	105,354	89,404	98,321	47,222	45,760	60,030	90,566	860,508

Calendar year 2015 marked the first year where no initial allocation was made in January and the second year where the full allocation of 96,200 ac-ft was not delivered to the SJ-C Project contractors. Approximately 94% of the allocation was made throughout the year as water became available. The SJ-C Project contractors' 2015 and waived 2014 annual allocations were delivered as shown in Table 4, for a total delivery of 86,123 ac-ft. The remaining 2015 allocations are being held in Heron according to waivers. The waivers grant an extension for the delivery date for several contractors into 2016.

Table 4: SJ-C Project – Water Releases from Heron Reservoir (units are acre-feet)

SJ-C HERON RELEASE	MRGCD	SANTA FE	SANTA FE COUNTY	COCHITI	CITY OF ALBUQUERQUE	POUQUOE UNIT	TAOS	COUNTY OF LOS ALAMOS	CITY OF ESPAÑOLA	TWINING SANITATION	VILLAGE OF LOS LUNAS	TOWN OF BERNALILLO	BELEN	RED RIVER	JICARILLA APACHE	SAN JUAN PUEBLO	RECLAMATION	EL PRADO	TAOS PUEBLO	TOWN OF TAOS SETTLEMENT	TOTAL
MONTH																					
ALLOCATION	19,900	5,230	375	5,000	48,190	1,030	400	1,190	1,000	15	400	400	500	60	6,500	1,900	2,990	40	2,215	366	96,190
JANUARY	0	0	0	0	0	0	0	0	0	0	84	0	72	0	0	0	2,355	0	0	0	2,511
FEBRUARY	873	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	891	0	0	0	1,764
MARCH	279	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,455	0	0	0	1,734
APRIL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,083	0	0	0	3,083
MAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	633	0	0	0	633
JUNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JULY	539	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,458	0	0	0	1,997
AUGUST	1,515	2,658	0	0	18,553	0	0	0	0	0	0	0	0	0	0	0	3,585	0	0	0	26,311
SEPTEMBER	0	2,292	0	0	25,693	0	0	0	350	11	0	153	0	0	0	0	304	0	0	0	28,804
OCTOBER	4,272	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,272
NOVEMBER	10,481	0	0	0	0	0	0	0	0	0	127	0	45	0	0	0	31	0	0	0	10,684
DECEMBER	2,707	555	347	0	0	635	0	0	79	7	0	0	0	0	0	0	0	0	0	0	4,330
2015 CY TOTAL	20,666	5,505	347	0	44,246	635	0	0	429	18	211	153	117	0	0	0	13,795	0	0	0	86,123

The February and March release for MRGCD consists of 1,152 ac-ft of SJ – C water received in late 2014 to cover depletions incurred by the Rio Chama Acequia Association. Table 5 presents actual monthly Heron water operations for the 2015 calendar year.

Table 5: SJ-C Project – Monthly Water Storage in Heron Reservoir (units are acre-feet)

HERON STORAGE	INFLOW		OUTFLOW		SAN JUAN CHAMA LOSS	END-OF-MONTH CONTENT			ELEVATION (FEET)
	RIO GRANDE	SAN JUAN CHAMA	RIO GRANDE	SAN JUAN CHAMA		RIO GRANDE	SAN JUAN CHAMA	TOTAL	
MONTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DEC. 2014							65350	65700	7096.8
JANUARY	241	28	42	2511	0	199	63217	63416	7095.37
FEBRUARY	710	972	494	1764	22	416	62405	62821	7094.99
MARCH	2687	6876	2112	1734	0	416	67547	68538	7098.52
APRIL	969	8147	1579	3083	881	991	71730	72110	7100.60
MAY	2472	24421	1992	633	0	380	95517	96378	7112.62
JUNE	2539	38361	2718	0	0	861	133879	134560	7126.89
JULY	700	8564	1036	1997	403	681	140042	140387	7128.78
AUGUST	452	887	790	26311	0	345	114620	114627	7119.93
SEPTEMBER	61	126	61	28804	458	7	85484	85491	7107.64
OCTOBER	523	809	179	4272	0	7	82023	82373	7106.10
NOVEMBER	1265	860	1266	10684	0	350	72200	72550	7100.85
DECEMBER	342	333	341	4330	0	350	68205	68555	7098.53
SUB-TOTAL	12,961	90,384	12,610	86,123					
ADJUSTMENT						-350			
ANNUAL		103,345		98,733	1,764	0	68,555	68,555	

Note that 350 ac-ft of native Rio Grande water is annually retained in Heron to cover water use by New Mexico State Parks at their facilities under a water right they hold.

Heron Dam Facility Review and Safety of Dams Programs

There are no significant dam safety related operations and maintenance issues associated with Heron Dam and Dike other than aging infrastructure. Currently, there are three incomplete

Category 2 Operations and Maintenance (O&M) recommendations for Heron Dam.

Category 2 O&M recommendation 2013-2-B from the 2013 Comprehensive Review (CR) calls for abandoning the hydraulic piezometer system at Heron, which is no longer functional. The original plan was to backfill the piezometer well with sand, but a thorough review of the O&M Guidelines discouraged this route. Reclamation has solicited guidance on the appropriate method to complete this recommendation, and is currently monitoring the piezometer well on a monthly basis to verify no seepage into the well is occurring. There was no progress on resolving recommendation 2013-2-B in 2015.

The Annual Site Inspection was completed in September 2015. A Periodic Security Review was completed on the 1st quarter of FY 2016; no major issues were identified.

The previous private sector Qualified Elevator Inspector (QEI) retired in the spring of 2015. Reclamation is currently working on contracting a QEI, and it was hoped to have one will be on board by the end of 2015. The required weight test and inspections were due in 2015.

The Facility Review Rating was updated in September 2015. The total score for Heron is 90, which decreased from a score of 95 in 2014. Heron currently has an overall rating of “Good”.

Pojoaque Tributary Unit - Nambé Falls Dam and Reservoir

(All elevations are 1929 NGVD, storage reference is 2004 ACAP survey)

Nambé Falls began 2015 with a reservoir elevation of 6,807.76 feet (1,029 ac-ft). The reservoir filled and spilled during the year. The maximum elevation for the year was 6,827.25 feet (1,767 ac-ft) on April 6. The reservoir initially filled in late March and remained full until August 16, when irrigation releases began and reservoir storage and elevation started falling. Releases continued through September 19. The reservoir reached a low point of elevation at 6,806.46 feet (820 ac-ft) on October 18 and ended 2015 at elevation 6,822.16 feet (1,493 ac-ft). A new area-capacity relationship was implemented for the reservoir this year.

Cyclical operations of Nambé Falls Reservoir consist of non-irrigation season operations and irrigation season operations. During non-irrigation season (November through April), all inflow in excess of the bypass requirement of 0.5 cfs is 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 an elevation determined by 100 percent ice cover. An uncontrolled spill begins at elevation 6826.6 feet, which is the top of the spillway crest. During irrigation season (May through October), water is stored and released on demand to meet downstream requirements.

Initially, the net depletion of 604 ac-ft was calculated for Nambé Falls operations for 2015. That depletion amount (plus transportation loss) was released from Heron Reservoir in December. Later, a calculation error in the model was discovered. The depletion amount had been underestimated by 741 ac-ft. This amount will be released in 2016 to make the project whole. Table 6 is a summary of Nambé Falls use above Otowi and the Pojoaque Unit return flow credit used to calculate depletions during 2015 (columns 7 and 8). A summary of 2015 Nambé Falls

Reservoir operations is provided in Table 7.

Table 6: San Juan-Chama Project – SJ-C Water at Otowi (units are acre-feet)

SJ-C AT OTOWI	RELEASE FROM HERON	HERON RELEASE STORED IN EL VADO	RELEASE FROM EL VADO	TOTAL BELOW EL VADO	RELEASE FROM OR STORAGE IN ABIQUIU	TRANS. LOSSES	NAMBE FALLS USE ABOVE OTOWI	RETURN FLOW CREDIT - POJOAQUE UNIT	SAN JUAN WATER AT OTOWI
MONTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
JANUARY	2,511	0	3,683	6,194	-3,399	93	69	27	2,660
FEBRUARY	1,764	0	1,058	2,822	-1,446	43	257	20	1,096
MARCH	1,734	0	1,241	2,975	-565	54	583	18	1,792
APRIL	3,083	3,083	0	0	2,910	26	24	18	2,878
MAY	633	633	0	0	3,452	31	2	17	3,435
JUNE	0	0	2,852	2,852	1,598	71	1	12	4,389
JULY	1,997	0	4,916	6,913	860	146	8	6	7,625
AUGUST	26,311	9,806	0	16,505	-2,621	307	-12	6	13,595
SEPTEMBER	28,804	4,740	0	24,064	-20,741	295	15	47	3,059
OCTOBER	4,272	0	3,924	8,197	-6,501	105	100	72	1,561
NOVEMBER	10,684	10,498	0	187	11,936	111	432	26	11,607
DECEMBER	4,330	2,810	0	1,519	5,235	78	157	20	6,540
ANNUAL	86,123	31,570	17,674	72,228	-9,282	1,360	1,636	289	60,237

Table 7: SJ-C Project – Monthly Water Storage in Nambé Falls Reservoir (units are acre-feet)

NAMBÉ FALLS MONTHLY	INFLOW	OUTFLOW			RESERVOIR LOSSES	TOTAL OUTFLOW + LOSSES	END OF MONTH	
		BYPASSED	STORAGE RELEASE				CONTENT	ELEVATION
			OPERATIONAL	IRRIGATION				
MONTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DEC. 2014							1,029	6,807.76
JANUARY	304	236	0	0	-1	234	936	6,809.68
FEBRUARY	299	42	0	0	2	44	1,191	6,815.85
MARCH	788	205	0	0	13	218	1,761	6,827.16
APRIL	971	947	0	0	26	973	1,759	6,827.12
MAY	2,051	2,049	0	0	10	2,059	1,751	6,826.98
JUNE	2,421	2,420	0	0	16	2,436	1,736	6,826.72
JULY	1,396	1,388	0	0	4	1,392	1,740	6,826.79
AUGUST	1,137	1,142	0	383	12	1,537	1,340	6,819.08
SEPTEMBER	624	602	0	512	8	1,122	842	6,807.09
OCTOBER	484	382	0	34	2	418	908	6,808.94
NOVEMBER	507	76	0	0	3	78	1,337	6,819.00
DECEMBER	417	260	0	1	0	261	1,493	6,822.16
ANNUAL	11,399	9,749	0	930	95	10,772	1,493	6,822.16

Nambé Falls Dam Facility Review and Safety of Dams Programs

There are no significant dam safety related O&M issues associated with Nambé Falls Dam other than aging infrastructure. Currently, there is one incomplete Safety of Dams (SOD) recommendation and four incomplete Category 2 O&M recommendations for Nambé Falls Dam. No O&M recommendations were completed during FY 2015.

High sediment inflow resulting from the Pacheco Canyon Fire of 2011 burn scars continues to be a significant O&M concern, but does not currently present any known SOD issues. All three of the O&M recommendations developed during the FY 2013 Comprehensive Review are intended to improve management of the increased inflow of sediment and woody debris.

The Facility Review Rating was updated in October 2015. The rating for Nambé Falls Dam increased from a total score of 90 to a score of 93, which gives the facility an overall rating of “Good”.

2016 San Juan - Chama Project Outlook

On December 31, 2015, Heron Reservoir had 8,900 ac-ft of SJ-C Project storage. This amount is well below the calculated firm yield of 96,200 ac-ft, and is insufficient for a full annual allocation for all contractors prior to the 2016 runoff season. Water scarcity was contemplated in the SJ-C Project authorization, and all SJ-C Project 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.”

Heron Reservoir’s dead pool, which is water that cannot be drained by gravity through the outlet works, is 1,218 ac-ft. Available Project storage must also cover reservoir evaporation from January 1 until runoff begins in the Spring, usually during March. Therefore, contractors were notified on January 15, 2016, of an initial allocation of 7,000 ac-ft. Subsequent allocations will be made monthly, beginning in April. They will continue until either a full allocation is received or through the end of the calendar year.

Middle Rio Grande Project, New Mexico

The *Middle Rio Grande Project* (Figure 4) is operated out of the Albuquerque Area Office, with support provided by the Chama Field Division for operations and maintenance of northern facilities. The Socorro Field Division performs construction throughout the project area.

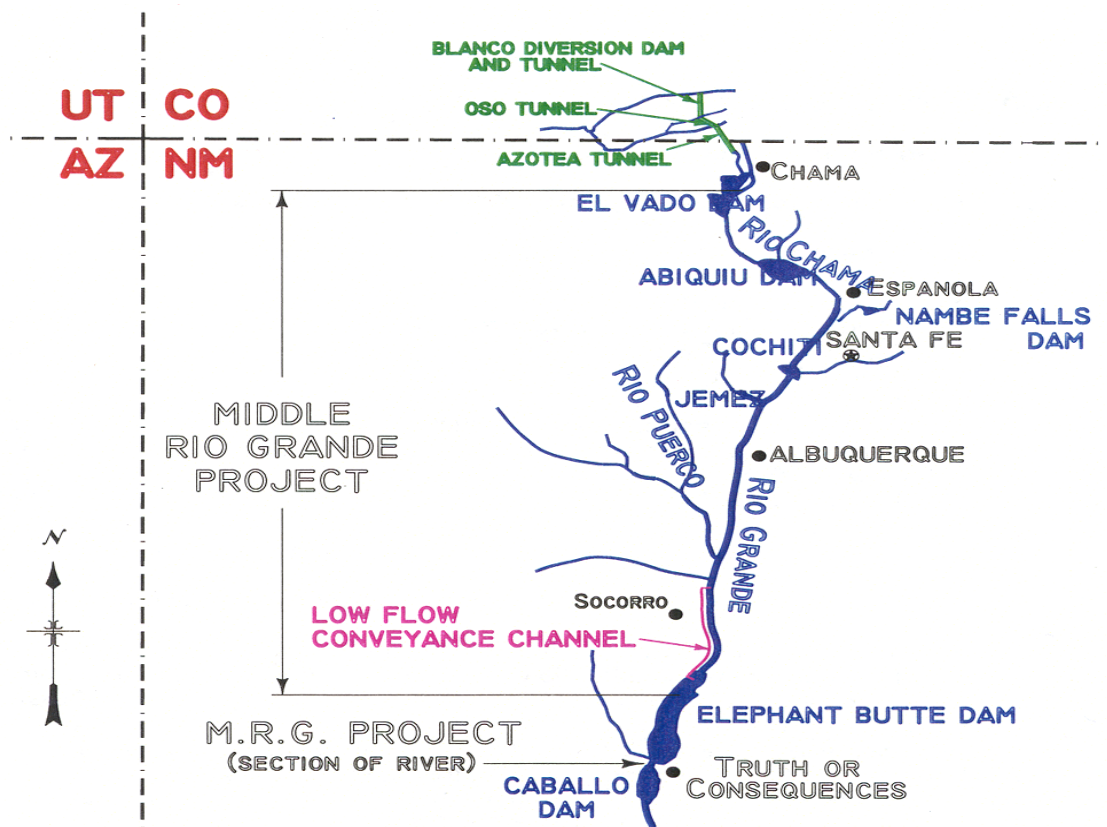


Figure 4: Area Map of the Middle Rio Grande Project

Article VII

Since 2011, the three Rio Grande Compact states have been unable to reach a consensus, have used different accounting methods, and have not finalized Compact accounting. While the Commission determines final Compact accounting, Reclamation performs daily accounting of San Juan – Chama Project and native Rio Grande water on the Rio Grande, including the composition of water in reservoirs from Heron to Caballo. This accounting is needed to make decisions for day-to-day operations.

To perform this accounting, Reclamation utilizes the interagency Upper Rio Grande Water Operations Model (URGWOM). Methods in URGWOM are consistent with accounting method 1 presented in various addendums to the Commission Reports since 2011.

Per the Rio Grande Compact Article I definition and method 1 accounting, the usable water in Rio Grande Project (RGP) storage (Elephant Butte and Caballo Reservoirs together) rose above 400,000 ac-ft on April 10, 2015. Article VII of the Rio Grande Compact stipulates that when usable water in RGP storage is below 400,000 ac-ft, no “native Rio Grande flows” will be stored in post-1929 reservoirs upstream of Elephant Butte Reservoir in New Mexico and Colorado unless relinquishment of credit waters in Elephant Butte Reservoir occurs. Therefore, Reclamation began storing native water for use by the Middle Rio Grande Conservancy District (MRGCD) on that date.

Per accounting method 1, on June 9, 2015, usable water in RGP storage fell below 400,000 ac-ft, and Article VII restrictions came back into effect. Reclamation began bypassing native inflow to El Vado on that date. From April 10 to June 8, 2015, 81,618 ac-ft of native water was stored in El Vado for use by the MRGCD. On December 31, 2015, 10,305 ac-ft of this water remained in storage in El Vado.

All daily operations decisions were made using provisional data available at the time of the decision. Because of that, reservoir storage in the final accounting model, which uses final data, may differ from reservoir storage used to make a daily operational decision. Hence, the dates mentioned above may differ from those determined using final 2015 data.

New Mexico Relinquishment of Rio Grande Compact Credit

Reclamation started 2015 with 2,634 ac-ft of Emergency Drought Water (EDW) stored in El Vado Reservoir. In 2015, 6,416 ac-ft of Emergency Drought Water was captured in El Vado Reservoir for the benefit of Reclamation and 2,000 ac-ft for the New Mexico Interstate Stream Commission under the 2003 Emergency Drought Water Agreement.

During the year, 9,594 ac-ft was released for Endangered Species Act (ESA) purposes. This includes all of Reclamation’s water (8,836 ac-ft) and 758 ac-ft set aside for ESA use by the NMISC. At the end of the year, 1,206 ac-ft of NMISC’s EDW water remained in storage

The balance of EDW available for capture and storage by Reclamation during 2016 or later years is 19,000 ac-ft, by NMISC is 13,000 ac-ft, and by MRGCD is 77,256 ac-ft.

El Vado Dam and Reservoir Operations

(All elevations are Middle Rio Grande Project Datum – add 7.8 feet for 1929 NGVD, storage reference is 2007 ACAP survey)

El Vado Reservoir began 2015 at an elevation of 6,805.41 feet (13,928 ac-ft), with a low point for the year on January 26, 2015 at 6805.06 feet (13,676 ac-ft). The reservoir peaked on June 16, 2015 at an elevation of 6,879.37 feet (124,957 ac-ft). The reservoir ended the year at 6,829.32 feet (36,503 ac-ft).

MRGCD began the year with no storage in El Vado for Middle Valley irrigation – Emergency Drought Water (EDW), general Rio Grande storage, or San Juan- Chama (SJ-C) Project water.

The only water MRGCD had in storage was 1,152 ac-ft of letter water in Heron Reservoir, which was received in late December to cover depletions to MRGCD's supply by the Rio Chama Acequia Association. There was insufficient project storage in Heron Reservoir to make a beginning-of-year allocation. MRGCD's 2015 SJ-C allocation in Heron was 19,446 ac-ft by the end of the year, about 93% of their full allocation of 20,900 ac-ft. At the end of the year in El Vado, MRGCD had no EDW, 10,305 ac-ft of general Rio Grande storage, and 17,653 ac-ft of SJ – C Project storage. No EDW was stored for MRGCD in 2015. MRGCD also had 1,911 ac-ft of SJ-C Project water stored in Abiquiu as of December 31, 2015.

El Vado was used as a re-regulating reservoir this year for water moving between Heron and Abiquiu in order to simplify operations and have water available for multiple purposes. Santa Fe moved its 2014 SJ – C allocation out of Heron and into El Vado late in that year. That water was used amplify winter flows below the dam while allowing native inflows to be captured for Prior and Paramount (P&P) storage.

A total of 21,687 ac-ft was captured and stored for Prior and Paramount (P&P) irrigation while under Article VII restrictions. No water was released to meet P&P needs during the irrigation season. From November 5 to December 4, 2015, 21,195 ac-ft of (P&P) storage was released to Elephant Butte. Loss to evaporation from El Vado Reservoir was 492 ac-ft in 2015.

El Vado total storage at the end of the year, excluding MRGCD storage, was 8,546 ac-ft, comprised of 4,712 ac-ft of the City of Santa Fe's SJ-C water, 2,040 ac-ft of Reclamation's leased SJ-C water, 588 ac-ft of SJC water held for the six Middle Rio Grande Pueblos, and 1,206 ac-ft of EDW stored for the State of New Mexico. Table 8 provides a summary of monthly operations and water accounting for El Vado Reservoir.

MRGCD voluntarily released some of its native water to Elephant Butte Reservoir in December. This may have helped New Mexico remain in a credit status under the Rio Grande Compact. Approximately 32,000 ac-ft was released.

Table 8: Reservoir Operation for El Vado Dam (units are acre-feet)

EL VADO RESERVOIR OPERATION	INFLOW		OUTFLOW		LOSSES		EOM CONTENT		
	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	TOTAL
MONTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DEC. 2014	3778	4255	8466	4450	114	-2	2634	11294	13928
JANUARY	3790	2511	85	6194	0	0	6338	7611	13949
FEBRUARY	5499	1764	357	2822	0	0	11481	6552	18033
MARCH	19427	1734	353	2975	63	8	30492	5304	35796
APRIL	37333	3083	13301	0	273	36	54251	8351	62602
MAY	78006	633	26473	0	311	610	104873	8974	113847
JUNE	40276	0	30432	2852	445	28	114274	6091	120365
JULY	11576	1997	12545	6913	403	18	112906	1154	114060
AUGUST	4201	26311	21401	16505	401	13	95307	10944	106251
SEPTEMBER	3127	28804	26207	24064	303	52	71927	15630	87557
OCTOBER	5051	4272	11684	8197	221	13	65073	11693	76766
NOVEMBER	5703	10684	22500	187	154	12	48123	22178	70301
DECEMBER	5687	4330	42198	1519	101	-4	11510	24993	36503
ANNUAL	219676	86123	207536	72228	2675	786			

El Vado Dam Facility Review and Safety of Dams Programs

The Corrective Action Study (CAS) required by the O&M recommendation 2011-SOD-A to investigate hydrologic failure modes at El Vado Dam continued during FY 2015. A new CAS was started during FY 2014 and continued through 2015. The new CAS began the investigations called for by recommendation 2013-SOD-A. Recommendation 2013-SOD-A calls for an investigation to determine where uncertainties exist and where risk reduction can be achieved based on the current understanding of the static risks at El Vado Dam.

Due to the two ongoing Corrective Action Studies, two Field Exploration Requests (FER #2 & #3) were developed by Reclamation's TSC. FER #3, which involves drilling additional holes on the crest of the dam near the control house, horizontal coring in the service spillway and test pits in the emergency spillway was completed in the first quarter of FY 2015. TSC has awarded the contract for FER #2 (sonic drilling) on the left abutment upstream and downstream and along the dam crest. This work is scheduled to begin in the first quarter of FY 2016. All environmental clearances were completed.

In the spring of 2015, the Los Alamos County Power Plant (LACPP) started a major project to remove the generator and have it shipped for repairs. They requested to cut the slope on the right side looking upstream of the power plant to allow them to safely load and haul the generator off site. Reclamation granted them permission, and in late summer, the dam tender noticed that there was a small area, on the recently cut slope, where the seepage had settled and an area of material sluffed. The dam tender monitors this area on his daily visits to the seepage collection weirs. LACPP completed the generator rewind and turbine rehabilitation project in late 2015 and is coordinating with Reclamation on conditions needed to test the turbine.

The previous private sector QEI retired in the spring of 2015. Reclamation is currently working on contracting a QEI, and hopes that one will be on board by the end of the 2015. The required weight test and inspections were due in 2015.

A Periodic Security Review was completed on the 1st quarter of FY 2016; no major issues were identified.

During the Visual Inspection process in the spring of 2015, some holes were identified on the upstream side of the crest adjacent to the top sections of the faceplate. The dam tender filled them in with material, but they continued to occur. In June of 2015 a much bigger fill material was used (cobble rock). The holes have not recurred, and the dam tender monitors them on his daily visits to the dam.

The ASI was completed in September 2015. The Annual Faceplate Inspection was completed in November 2015. No new issues were noted.

There are currently two incomplete SOD recommendations and ten incomplete Category 2 O&M recommendations for El Vado Dam.

The Facility Review Rating was updated in September 2015. The rating for El Vado increased

from a total score of 58 to a score of 59, which gives the facility an overall rating of “Poor”.

U.S. Army Corps of Engineers’ Related Reservoir Operations

Abiquiu Dam and Reservoir is a U. S. Army Corps of Engineers’ facility. P.L. 97-140 authorizes storage of up to 200,000 ac-ft of SJ-C Project water in Abiquiu Reservoir. The volume of SJ-C water in storage in Abiquiu Reservoir peaked on October 29 at 147,460 ac-ft. Abiquiu ended 2015 with 130,533 ac-ft of SJ-C water in storage. Table 9 provides a summary of monthly operations and water accounting for Abiquiu Reservoir.

During 2015, Reclamation had a storage agreement with the ABCWUA to store up to 10,000 ac-ft of supplemental water in the ABCWUA’s storage space in Abiquiu Reservoir. Over the course of the year, 12,661 ac-ft of leased SJ-C water was released from Abiquiu by Reclamation for endangered species purposes, namely the Rio Grande silvery minnow (silvery minnow). This does not include water released from El Vado under the Emergency Drought Water Agreement.

Table 9: Reservoir Operations for Abiquiu Dam (units are acre-feet)

ABIQUIU RESERVOIR OPERATION	INFLOW		OUTFLOW		LOSSES		EOM CONTENT			
	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	SEDIMENT	RIO GRANDE	SAN JUAN - CHAMA	TOTAL
MONTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
DEC. 2014	9308	4249	9938	2699	0	65	75	-567	129078	128586
JANUARY	1023	6234	623	2835	0	157	76	-269	132352	132159
FEBRUARY	2012	2821	1448	1375	-1	382	76	297	133417	133789
MARCH	3940	3043	4197	2478	8	567	76	32	133414	133522
APRIL	16768	0	17020	2910	1	1250	80	-220	129254	129114
MAY	35041	0	34486	3452	3	842	111	331	124960	125402
JUNE	34698	2821	34856	4419	7	1616	137	165	121746	122049
JULY	16786	5943	17123	6804	3	782	147	-175	120104	120075
AUGUST	25143	16048	25009	13426	9	1260	179	-50	121465	121594
SEPTEMBER	26658	24200	26665	3458	0	797	227	-57	141409	141580
OCTOBER	11837	8364	11948	1863	-3	476	234	-164	147435	147505
NOVEMBER	23126	186	23014	12123	0	299	245	-53	135200	135392
DECEMBER	45981	1359	45663	6593	0	-7	295	266	129972	130533
ANNUAL	243,013	71,019	242,052	61,736	27	8,421				

Cooperative Programs with the State of New Mexico

In September 2012, a new 5-year Cooperative (State Co-op) Agreement (R13CF40001) was executed between the New Mexico Interstate Stream Commission (NMISC) and Reclamation. The Agreement provides funding for joint benefit: water salvage work on the Middle Rio Grande Project. This work currently includes Delta Channel maintenance and other river maintenance projects, and riverside irrigation drain improvements with water salvage potential.

Delta Channel Maintenance

The term “Delta Channel” refers to the Rio Grande channel that flows into the delta of Elephant Butte Reservoir, and was previously called the temporary channel. In December 2014, Reclamation finalized consultation with the Service and was issued a Biological Opinion (Delta Channel BiOp) for Delta Channel maintenance activities. The Delta Channel BiOp expires in April 2017.

The maintenance work performed along the Delta Channel in 2015 extended from RM 47.5 upstream to approximately RM 52. Maintenance of the Delta Channel was conducted by NMISC’s contractor beginning January 14, 2015, through February 5, 2015. Maintenance work included: 1) in-channel excavation, 2) mowing of the access road right of ways, and 3) relocation of an existing spoil pile at Nogal Canyon staging area to build up a portion of the access road network.



Photo 1: West side berm below Red Rock, before and after maintenance

Lower San Juan Riverside Drain Vegetation Removal

Work on the Lower San Juan Drain was funded by both Reclamation and State Co-op funds. Work on the San Juan Drain was performed by Reclamation’s contractor. The goal of this maintenance on the west side of the Drain is to remove all vegetation from the edge of the channel to the west side of the spoil berm, for 4.5 miles from NM Hwy 60 south to Salas Arroyo. This work is still in progress and will finish in the spring of 2016.



Photo 2: Lower San Juan Riverside Drain Vegetation Removal (April 2015)

Irrigation Drain Improvements

The following work was accomplished in 2015 by the Reclamation Socorro Field Division.

LFCC Vegetation Removal: The purpose of the work on the LFCC is to improve wasteway flow conveyance and water salvage capabilities, improve maintenance access, and reduce potential safety risks to the general public and maintenance crews. Maintenance consisted of removing large vegetation and normal mowing operations. Photo 3 depicts a typical section of the LFCC mowing and/or vegetation removal. The main section of focus was between Neil Cup and Ft Craig.



Photo 3: LFCC Vegetation removal at San Marcial Gaging Station (April 2015)

LFCC Maintenance below Ft Craig Bridge: The goal of maintenance work on this portion of the LFCC was to clean sediment and vegetation out of the channel to allow flow in areas that are overgrown. This work is a continuance of a State Co-op task order that was issued in 2012. This portion of the maintenance work was funded by Reclamation.

River Maintenance

Reclamation has authorization for maintenance of the Rio Grande from Velarde, New Mexico, south to the headwaters of Caballo Reservoir under the Middle Rio Grande Project. Responsibilities include maintenance of the river channel, floodplain, project drains, and the 55-mile LFCC. Project purposes include improving water delivery efficiency, improving sediment transport, protecting riverside facilities and property, and preventing flooding. River maintenance includes any work done in the channel and floodplain and includes habitat restoration. Reclamation conducts annual river reviews of conditions of sites and reaches after the spring snowmelt runoff and summer monsoon events. Maintenance needs are prioritized based on these reviews and assessment of geomorphic trends and conditions, public and infrastructure risk, and water delivery effects for the 260-mile reach of the Middle Rio Grande. The realized project needs listed above are joined by newer considerations to enhance ecological function of the system, within the Project's authorization. Maintenance work is achieved through projects involving planning, construction, and adaptive management. All maintenance projects require adaptive and recurring maintenance over the life cycles of each of the project's intended design life.

River Maintenance Sites

Reclamation is currently pursuing work at 16 sites along the Middle Rio Grande Project reach. Of the active sites, six require an annual review of channel capacity and possible maintenance due to sediment accumulation. In 2015, Reclamation completed work at Drain Unit 7, Truchas Arroyo, and three downstream sites (River Mile (RM) 210, 210.1, and 210.3) on San Felipe Pueblo lands. During the 2015 spring runoff, some erosion occurred at the recently completed Santa Ana RM 205.8 site. Plans for temporary repair work at this location before the 2016 spring runoff are underway. During the 2015 spring runoff, bank erosion occurred along a private residence near Bernalillo, New Mexico. Technical staff worked with local agencies and the affected landowners to resolve this matter for the short term. In collaboration with the New Mexico Interstate Stream Commission, work continues through the Delta Channel to maintain a 20-mile temporary channel into the reservoir pool for effective water delivery. See the "Cooperative Programs with the State of New Mexico" section of this report for more detail on the Delta Channel Maintenance.

Reclamation's efforts at all maintenance sites include data collection, geomorphic and sediment investigations, design studies, alternative evaluation, 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 narrative, the terms "new", "existing", and "adaptive" are used to describe the

various river maintenance sites status. “New sites” are sites that developed following high flow events on the Rio Grande. “Existing sites” are sites in the process of being completed. “Adaptive sites” sites have been substantially completed and are being monitored for function and performance.

Truchas Arroyo (New Maintenance Site)

A summer monsoon flood event occurred on the Truchas Arroyo at approximately RM 283 on August 4, 2013. A large amount of sediment was deposited at the river confluence, constricting the river to as narrow as 10 feet wide in one location and creating a backwater effect upstream of the confluence. The flood event also caused the breach of a non-Reclamation arroyo berm, and deposited a large amount of sediment in the adjacent agricultural orchard, south of the Truchas Arroyo. The flood flows traveled through the orchard and exited the southern La Rinconada Dike approximately 800 feet downstream through an existing gap in the dike used as cross drainage.

A project was initiated for Truchas Arroyo confluence that involves two phases. The first phase was excavation of the sediment deposit at the arroyo confluence to restore the channel capacity. The second phase involves repairing a gap in the dike system and the replacement of a culvert that was used for cross drainage for agricultural lands. The existing condition, with the gap open, would allow high flows from the Rio Grande to flow back into the orchard and create pressure on the toe of the southern dike.

The first phase of the project was completed in April 2015 with 4,000 cubic yards of sediment removed from the arroyo confluence. River data collected immediately after sediment removal, monsoon season river monitoring in September 2015, and a one dimensional, fixed bed hydraulic model, showed that the main channel would safely convey 5,000 cubic feet per second (cfs) between the two dikes. The second phase of the project is scheduled for February 2016. The drawing set and project description were completed in December 2015.



Photos 4 & 5: Sediment deposits excavated and stockpiled (Bui 2015, Gonzales 2015)

El Guique Diversion Dam (New Maintenance Site)

This river maintenance site is located in the Velarde reach. This location had been identified as experiencing bank erosion upstream and downstream of the diversion dam. Reclamation technical staff performed two field trips and did research in 2015 at this location. The field trips involved meetings with representatives from the El Guique Diversion and Acequia organization

and the State Land Office who operate the Historic Los Luceros House. After reviewing the bankline and river conditions at this site, Reclamation will be conducting a hydraulic modeling analysis in the reach to evaluate the channel capacity and bank stability. Reclamation's authority for this reach involves safely passing 5,000 cfs around this diversion dam. The hydraulic modeling analysis will determine if a river maintenance project or continued monitoring is warranted at the site.

San Ildefonso Pond (Adaptive Maintenance Site)

This river maintenance site is located at RM 259. In spring 2007, a river maintenance project was constructed by Reclamation's Socorro Field Division to provide protection for the San Ildefonso fishing pond. During the spring runoff of 2009, the channel eroded through a line of dense vegetation planted as part of the project. This erosion resulted in the loss of up to 75 feet of bankline upstream of the previous project area. A temporary solution, prior to the 2010 spring runoff, was undertaken involving a buried trench riprap revetment and a riprap windrow.

This 2010 temporary protection work allowed for the development and permitting of a longer term solution. The longer term solution, completed in 2014, involved the construction of seven bendway weirs and the creation of a floodplain side channel on the west side. The project features continue to function as designed. In early 2016, additional planting is planned to replace the cottonwood trees that did not survive re-vegetation efforts during the 2014 construction. The major, planform features of the project can be seen in Photo 6, and a detailed view of the installed weir field in Photo 7.

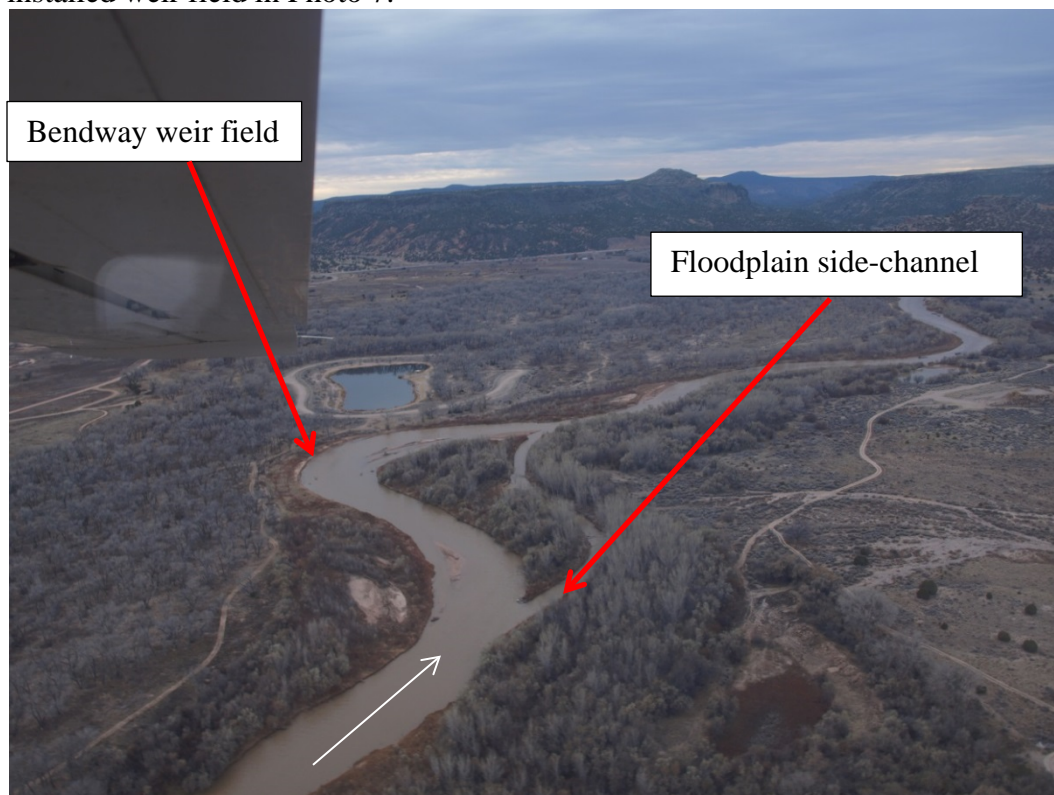


Photo 6: San Ildefonso Project Site Aerial View (AuBuchon, December 2015)



Photo 7: Bendway Weir Field (Devergie, May 2015)

Peralta Arroyo (Existing Maintenance Site)

The confluence of the Peralta Arroyo and the Rio Grande is located about 2.7 miles downstream of Cochiti Dam, within the Pueblo de Cochiti. The Peralta Arroyo watershed burned in the 2011 Las Conchas fire, affecting the stability of the slopes on the upper watershed. With less stable slopes from lack of vegetation and a diminished soil structure, soil erosion has increased. In 2013, an intense rainfall-runoff event on the Peralta Arroyo occurred that completely blocked the main river channel with sediment. This sediment block caused river flows to overbank onto the eastern terrace and against the existing spoil levee.

Reclamation, the US Army Corps of Engineers (USACE), and the Pueblo de Cochiti worked to develop a mutually acceptable project to deal with the limited channel capacity in the Rio Grande caused by the sediment block. The project involved excavation of a pilot channel through the sediment block and augmentation of natural flow paths on the eastern terrace. The goals of the project were to reduce the time needed for the river to respond naturally to the sediment block and to provide a minimum channel capacity of 5,000 cfs. The pilot channel was completed in fall of 2013. Photo 8 shows the major features of the project. The augmentation of natural flow paths on the eastern terrace was completed in the spring of 2014. Reclamation is currently working with the Pueblo de Cochiti on a Public Law 93 - 638 Native American Self-Determination Act (PL 93-638) grant to facilitate planting, monitoring, and maintenance of vegetation on the eastern terrace, as well as monitoring geomorphic changes and biological response to the project.

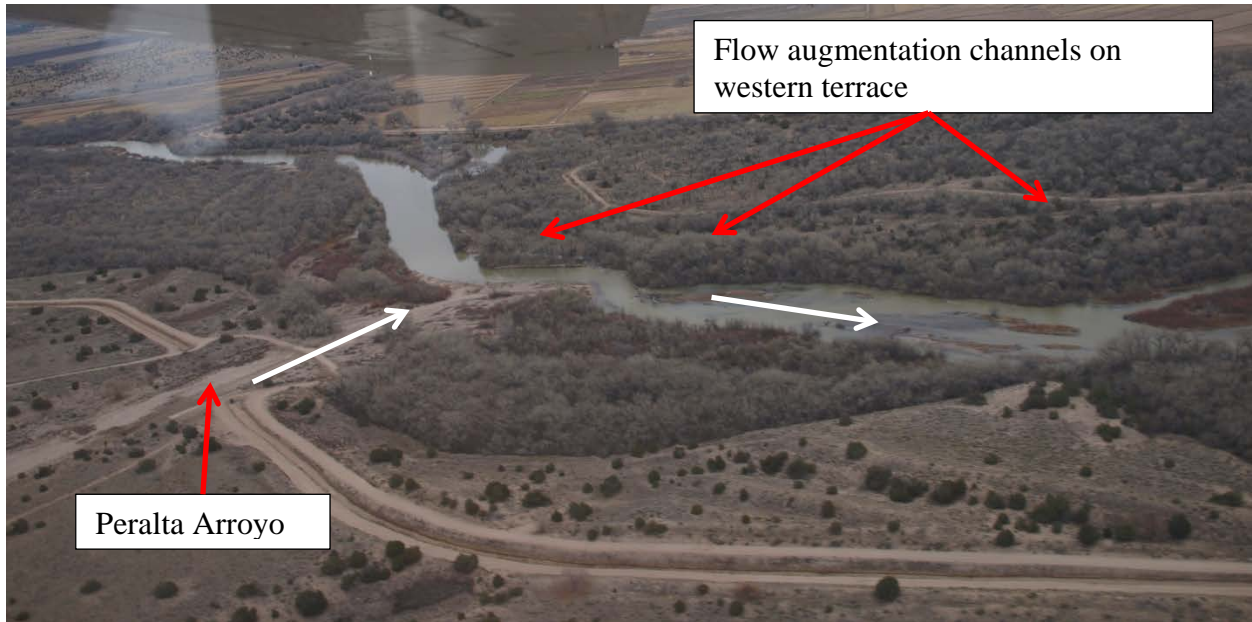


Photo 8: Peralta Arroyo Project (AuBuchon, December 2015)

Santo Domingo (Adaptive Maintenance Sites)

There are three river maintenance sites (RM 225.1, RM 224.6, and RM 223.9) where maintenance work was performed on the Pueblo of Santo Domingo. At these sites, bankline erosion on the west side of the river is the cause of concern because of the proximity to the levee and riverside drain. A “Data Collection and Confidentiality Agreement” was executed between the Pueblo of Santo Domingo and Reclamation in August 2007 to facilitate the development of these project sites. Construction was completed in 2013 for RM 225.1 and in 2014 for RM 224.6 and RM 223.9. Reclamation continues to collaborate with the Pueblo of Santo Domingo on vegetation planting and monitoring efforts.

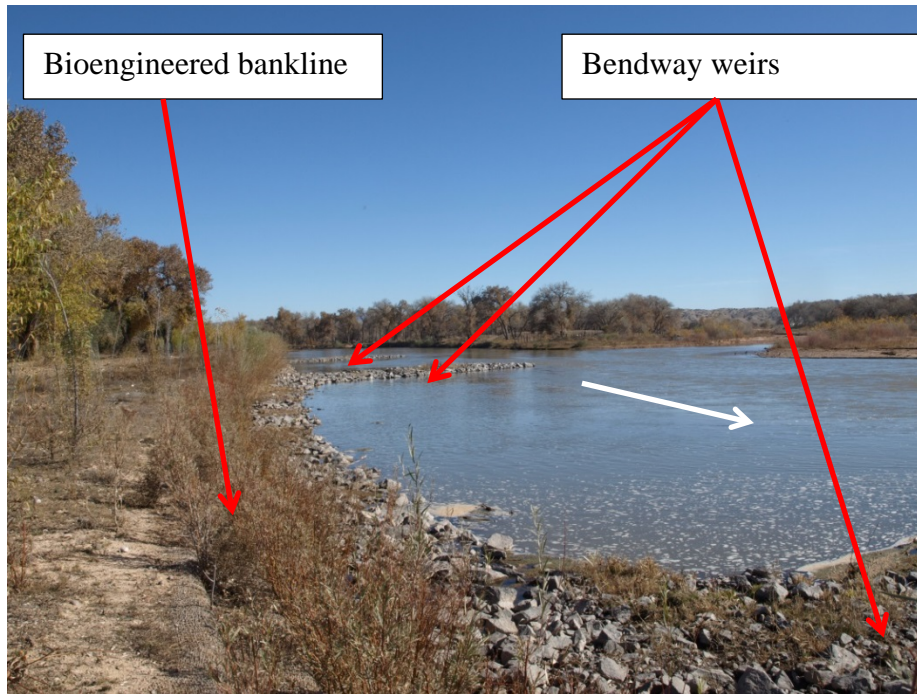


Photo 9: Installed Weirs and Bioengineered Bankline at Santo Domingo RM 224.6 (AuBuchon, November 2015)

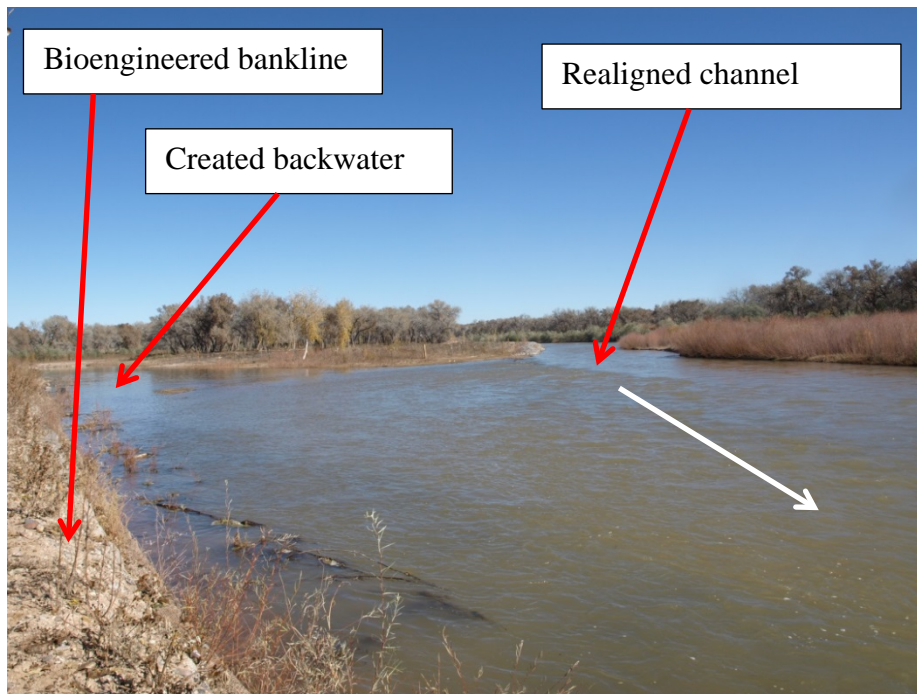


Photo 10: Installed Bioengineering Bankline and Realigned Channel at Santo Domingo RM 223.9 (AuBuchon, November 2015)

San Felipe (Adaptive Maintenance and Existing Sites)

There are 10 river maintenance sites on the Pueblo of San Felipe. Seven sites have been completed and three are active. Construction on four of the sites (RM 215.5, RM 213.4, RM 213.7, and RM 212.0) ended in March 2013. Construction on the next three downstream sites

(RM 210.3, RM 210.1, and RM 210.0) was completed in 2015. These projects involve bendway weirs, longitudinal foot stone toe-protection (LFSTP), and bar lowering, see Photo 11. Planting of coyote willows as a bioengineering design feature is expected to occur in the early winter dormant season of 2016. Planting of the coyote willows and replacing six cottonwoods removed during the downstream construction will be performed by the Pueblo of San Felipe under a PL 93-638 contract. Reclamation is continuing work with the Pueblo of San Felipe on vegetation monitoring and vegetation establishment. For the remaining three sites (RM 211.3, RM 212.8, and RM 214.4), construction is currently underway, with completion anticipated in 2017.

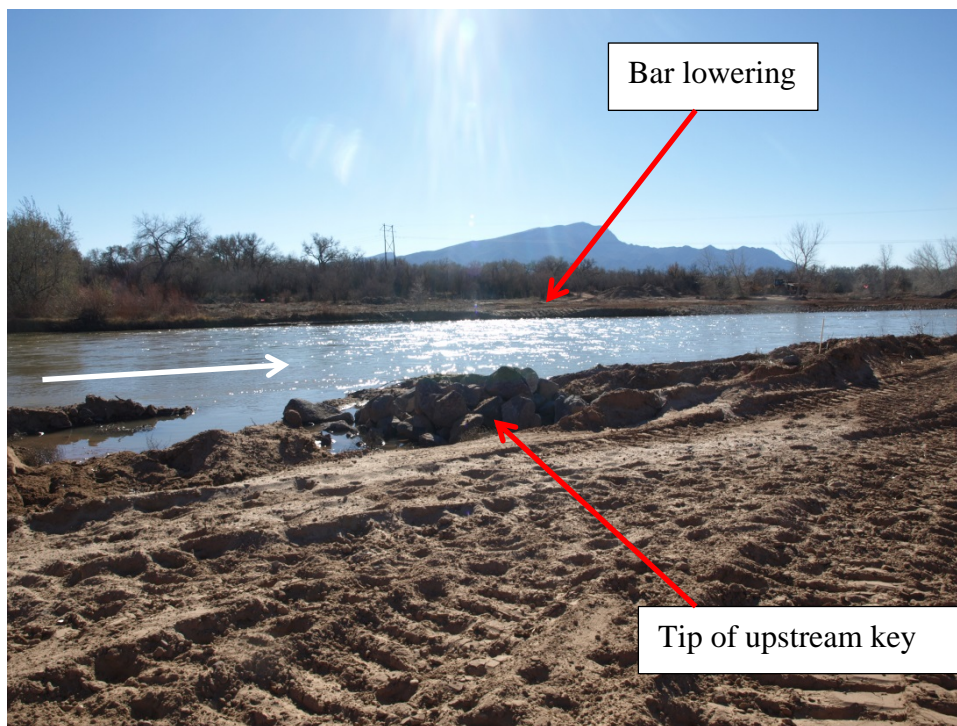


Photo 11: Installed LFSTP and Bar Lowering at RM 211.3 (AuBuchon, December 2015)

Santa Ana River Mile 205.8 (Adaptive Maintenance Site)

This site is within the Pueblo of Santa Ana, on the east bank of the Rio Grande across from the Tamaya Resort special events tent. A project consisting of nine bendway weirs and the creation of a low elevation floodplain was completed in 2014. The Pueblo of Santa Ana, through a PL 93-638 contract, planted vegetation at this site in early 2015. During the spring runoff in 2015, the Pueblo of Santa Ana notified Reclamation of unanticipated bank erosion that was occurring at this site, see Photo 12. The bank continued to erode through the end of May but has been stable since that time. An interim, adaptive management fix has been identified to safeguard threatened infrastructure and is scheduled for construction prior to the 2016 spring runoff. Reclamation and the Pueblo of Santa Ana are also pursuing investigation on the specific hydraulic and geomorphic conditions leading to the unexpected bank erosion. This investigation may result in the recommendation of additional adaptive management steps as part of a permanent repair project. Reclamation, the Pueblo of Santa Ana, and the University of New Mexico are also pursuing a collaborative research effort at this project site to investigate the effects of bendway weirs on primary producer organisms (i.e., that produce biomass from inorganic compounds), specifically

targeting those known to be food sources for the endangered Rio Grande silvery minnow.



Photo 12: Bank erosion at Santa Ana RM 205.8 (AuBuchon, October 2015)

Drain Unit 7 Priority Site (Adaptive Maintenance Site)

The Drain Unit 7 River Maintenance Priority Site is located 500 feet upstream of San Acacia Diversion Dam, on the right bankline of the Rio Grande at RM 116.3. The river was eroding a spoil levee embankment that protects the Drain Unit 7 Extension irrigation structure. The design at this site involved protection of the Drain Unit 7 Extension spoil levee with riprap along the river side of the eastern spoil levee for a length of approximately 1,030 feet. Construction of the first two phases of this work were completed in 2009 and provided protection for 650 feet of the spoil levee. The final phase 3 work to extend the riprap protection for the remaining 380 feet to achieve the full design length was completed in early 2015. The third phase of work ties the longitudinal riprap into an existing rock groin field, providing future flanking protection if the bend continues to progress upstream of the phase 3 work, see Photo 13.



Photo 13: Rio Grande at the Drain Unit 7 priority site (AuBuchon, December 2015)

Arroyo de las Cañas (New Maintenance Site)

The Arroyo de las Cañas site is located upstream of the Arroyo de las Cañas confluence, between River Mile 96 and 95 (Photo 14). The Rio Grande is close to the western spoil levee for the LFCC through this reach, with a potential for damage to the spoil levee from lateral erosion of the river. In 2005, significant bank erosion was observed at this site and plans were initiated for constructing a river maintenance project at this location. The project was ready for construction when the 2008 spring snowmelt runoff moved the river's alignment away from the spoil levee. The change reduced the probability of damage to the spoil levee and a decision was made to stop work at this site and monitor the area to see if future work would be warranted. A current project is being pursued to provide long-term protection for the LFCC's spoil levee, as the morphology of the Rio Grande continues to adjust through this area, with current bank erosion on the western bank across from the Arroyo de las Cañas confluence. The current project will include the exploration of habitat restoration potential.

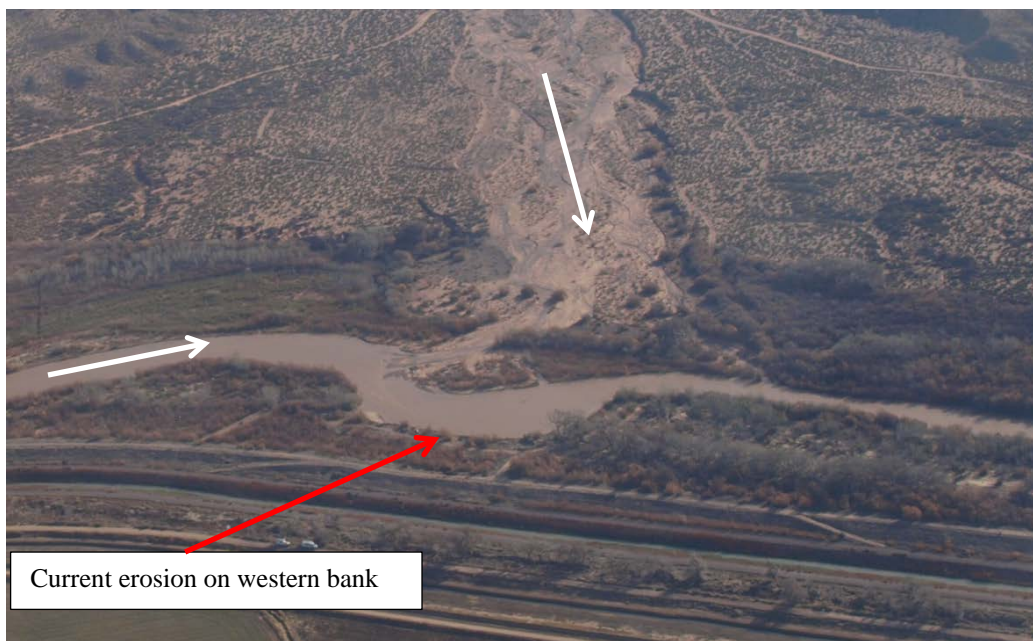


Photo 14: Arroyo de las Cañas and Rio Grande confluence (AuBuchon, December 2015)

Bosque del Apache Sediment Plug and Habitat Restoration Project (Existing Maintenance Site)

During the 2008 spring runoff, a sediment plug formed in the main channel of the Rio Grande at RM 81 located within the Bosque del Apache National Wildlife Refuge (BDANWR).

Reclamation and the NMISC partnered to construct a 25 foot wide pilot channel in October 2008. In 2014, a multi-agency project team consisting of Reclamation, BDANWR, the Fish and Wildlife Service State Ecological Services office, and the USACE began to pursue an east realignment strategy for addressing the ecological and engineering concerns affecting the Rio Grande near where the 2008 sediment plug formed. A preliminary channel alignment has been proposed and mobile bed modeling is currently underway to evaluate channel response and stability upstream and downstream of the project area. This has involved the analysis of both width and depths to assess suitable flow paths for realignment. The project team will continue to analyze groundwater levels, assess habitat conditions for the east realignment, and pursue environmental compliance. The project will involve realignment of two river segments about 3.5 miles and 2 miles in length.

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

In January 2015, hydraulic modeling of the levee and channel capacity from the Highway 380 Bridge to the Elephant Butte Reach Levee was performed utilizing data collected in 2013 and 2014. The design criteria used in the analysis of the levees involves effectively and safely passing the mean annual peak flow – a 2-year flood or 7,700 cfs – through the reach. The maintenance design criteria of the Delta Channel used in the analysis was effectively conveying a normal spring runoff peak flow of 5,000 and 4,000 cfs to the reservoir pool. Levee freeboard allowances are made to account for the predictive uncertainties of a one-dimensional hydraulic model with localized channel aggradation and degradation. The Bosque del Apache Levee is maintained with three feet of freeboard while the Tiffany and San Marcial Levees are maintained

with two feet of freeboard. The Delta Channel is essentially the active river channel, so there is no freeboard allowance in these reaches.

The findings of the January 2015 analysis are:

1. The Bosque del Apache Reach and Levee will be able to pass flows up to 7,700 cfs with three feet of freeboard.
2. The Tiffany Reach and Levee will be able to pass flows up to 7,700 cfs with at least two feet of freeboard for most of the reach except for RM 71 to RM 69 (2 miles upstream of Atchison Topeka and Santa Fe Rail Road Bridge at San Marcial). This area will only be able to pass flows up to 5,000 cfs with two feet of freeboard.
3. The San Marcial Reach and Levee will be able to pass flows up to 7,700 cfs with at least two feet of freeboard.
4. The Delta Channel will be able to pass flows up to 5,000 cfs at most areas except from RM 53.8 to RM 52.7 (immediately upstream of Nogal Canyon). This area will only be able to pass 4,000 cfs.
5. The Delta Channel downstream of Nogal Canyon will be able to pass flows up to 4,000 cfs.

This analysis applies to short duration events and without the presence of any potential sediment plugs that may develop in the reach. Longer duration flows that involve overbank flooding may lead to sediment plug formation and/or the saturation and weakening of the existing spoil levee system.

Fort Craig Bend and River Mile 60 (Existing Maintenance Site)

Historically, the Rio Grande has been a wide, braided, and relatively straight river channel. During recent years, the degree of meandering has increased in several areas as a more sinuous planform has developed. This has caused the formation of multiple bends including Fort Craig Bend near RM 64 (Photo 15) and the S-curve bend at RM 60 (Photo 16). The outside of these bends are near the western edge of the confined floodplain and adjacent to the spoil levee and the LFCC. Continued bank erosion and lateral migration at these locations threatens to breach the spoil levee and cause damage to the LFCC, access road, and the Fort Craig pump site. Downstream water delivery and habitat for endangered species are likely to be negatively impacted by a breach. A multi-disciplinary project team is being established to develop and evaluate alternatives to reduce maintenance frequency, increase water salvage, and enhance wildlife habitat. The project team decided to combine Fort Craig Bend and RM 60 into one comprehensive project because the two sites are close to each other. Work on the project is pending staffing availability and further scoping with stakeholders.



Photo 15: Fort Craig Bend, Pump Site, and LFCC (December 2015, AuBuchon)



Photo 16: RM 60 (December 2015, AuBuchon)

Truth or Consequences (Existing Maintenance Site)

Reclamation annually excavates sediment from the river channel to maintain the authorized 5,000 cfs capacity in the reach of the Rio Grande between Elephant Butte Dam and Caballo

Reservoir. Maintenance activities are conducted after releases are shut off from Elephant Butte Dam each fall. The primary activity consists of sediment removal at arroyo mouths. Secondary activities include sediment removal in other areas throughout the reach and bank stabilization with riprap at selected sites. In fall 2015, work involved sediment removal at the mouth of two major tributaries (Mescal and Cuchillo Negro), both located within this maintenance reach, see Photo 17. During periods of non-release, Reclamation installs a dike in the river to check up the water surface elevation to increase the alluvial groundwater levels for the benefit of the artesian hot spring bathhouse owners in Truth or Consequences. A new regional permit was obtained to extend Reclamation's Clean Water Act compliance through 2022, facilitating annual maintenance responsibilities in this reach of the Rio Grande.



Photo 17: Sediment to Be Removed at Mouth of Mescal Arroyo (AuBuchon, October 2015)

Middle Rio Grande River Maintenance Plan

The Middle Rio Grande River Maintenance program has developed a long term River Maintenance Plan that will assist in accomplishing project purposes in an environmentally and economically sound manner that is consistent with Project authorization. A final report is posted at the following web address:

<http://www.usbr.gov/uc/albuq/envdocs/reports/mrgRivMaint/index.html>

This maintenance plan is an engineering and geomorphic review 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 "living" long-term comprehensive plan and guide involves evaluating reach-based strategies for feasibility, prioritizing reaches, and evaluating effects of strategy implementation between reaches, upstream and downstream.

Work is also being pursued with respect to reach based planning and developing ecological criteria for endangered species suitable habitat to compliment current water delivery and public health and safety factors. Reach-based planning is underway to evaluate the geomorphic reaches from RM 201 (near Rio Rancho and Corrales) to Montano Bridge and Isleta downstream to Elephant Butte. This lower reach has been identified as a high priority reach for habitat restoration and meeting ecological goals. A report entitled “Lower Reach Conditions and Strategies” was completed in July 2015 for this reach. This document provides a geomorphic overview, a habitat suitability assessment, and a review of the viable river maintenance and habitat restoration strategies for Isleta Diversion Dam to Elephant Butte Reservoir reach.

Determination of River Maintenance Need at Individual Sites and Reaches

In 2014, Reclamation completed its “Determination of River Maintenance Needs” process, which involved a joint workshop between Reclamation’s Technical Services Center and the Albuquerque Area Office River Analysis Group. The workshop followed a newly 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 Middle Rio Grande. All monitored, existing, and completed sites were rated utilizing the new methodology and criteria developed. A total of 86 sites and 11 reaches were evaluated.

The technical rating system integrates information involving technical factors for channel instability, bank erosion, and loss of channel capacity with potential for impacts to riverside infrastructure, public health and safety, and water delivery. In addition, five distinct maintenance classes are identified by the assessment. The maintenance class designation helps define the apparent urgency related to addressing any need. The new maintenance class designations are:

- Maintenance Class 1 – Maintenance is required in the short term (typically before the next high flow event or could be required immediately) because there is a high likelihood of substantial consequences if no action is taken.
- Maintenance Class 2 – Maintenance can be planned but the consequences of no action could be substantial in the near term (the next normal spring runoff or within the next few years). This class includes the majority of ongoing or normal river work at existing and new sites.
- Maintenance Class 3a – Maintenance can be planned and the consequences of no action are less likely to be substantial in the near term (the next normal spring runoff or within the next few years). Work can be described as preventative maintenance and includes habitat enhancement.
- Maintenance Class 3b – Maintenance can be planned and the consequences of no action are less likely to be substantial in the near term (the next normal spring runoff or within the next few years). Data collection and/or analysis are required to determine if preventative or normal maintenance (including habitat enhancement) is needed.

- Maintenance Class 4 – Maintenance is not anticipated to be needed in the near term (the next normal spring runoff or within the next few years) because changes appear to be occurring at a slow rate. Work can be described as monitoring for potential changes that could accelerate the need for maintenance to the near term.
- Maintenance Class 5 – Maintenance may be needed but is not within Reclamation’s authority. Responsible parties will be notified if it appears that the consequences of no action could be substantial in the near term.

This approach for the ratings and maintenance class designation compliments the approaches in the long term Plan and Guide and the current 2015 Middle Rio Grande Biological Assessment for River Maintenance Actions.

Endangered Species

Programmatic Water Operations and River Maintenance Endangered Species Act (ESA), Section 7, Compliance

On March 17, 2003, the Service issued the 2003 Biological Opinion (BiOp) on the effects of actions associated with the Programmatic Biological Assessment (BA) of Bureau of Reclamation’s Water and River Maintenance Operations, U.S. Army Corps of Engineers’ Flood Control Operation, and Related Non-Federal Actions on the Middle Rio Grande, New Mexico for March 10, 2003 through February 28, 2013. The 2003 BiOp contained a Reasonable and Prudent Alternative (RPA) designed to alleviate jeopardy to the silvery minnow, adverse modification to silvery minnow critical habitat, and jeopardy to the Southwestern willow flycatcher (flycatcher) based on the biological needs of the species. The RPA elements address some of the long-term needs of the silvery minnow by incorporating four essential factors during the 10-year scope of the project: 1) water operations, 2) habitat improvement, 3) population management, and 4) water quality. The water operations elements establish flow requirements under different hydrologic scenarios that are needed to alleviate jeopardy to both species.

For the 2015 irrigation season, the Service made a determination that dry year flow requirements would be in effect, with anticipated incidental take calculated to be mortality of 53 silvery minnows. As the Rio Grande was experiencing a fifth consecutive year of drought with the prospect of limited minnow recruitment in the spring, Reclamation worked with the Collaborative Program’s Minnow Action Team (MAT), as in 2013 and 2014, to develop a water operations plan to best utilize the available water for endangered species purposes and water users’ needs. At the May 5, 2015, meeting of the Collaborative Program’s Executive Committee, the MAT presented its recommendations that the water management agencies seek to do the following: 1) monitor and collect eggs during any flow spikes; 2) if feasible, create a pulse in May using Rio Chama stored water; 3) for MRGCD, continue to monitor and develop refugial areas in the Isleta Reach; 4) provide some supplemental water for refugial habitats during the summer in the Isleta and San Acacia reaches; and 5) maintain continuous flows in the Albuquerque reach. Runoff from snowpack and frequent May storms was augmented by water managers with a modest release in mid-May, creating a seven-day spawning peak.

Reclamation remained in compliance with the 2003 BiOp throughout 2014. Monsoonal rains provided a wet July, and August and September were drier than normal. Due to the monsoonal rains and release of supplemental water, the Rio Grande was continuous until September 10. River drying occurred in the Isleta and San Acacia Reaches from September 11 to October 21. The pumps at the north and south boundaries of the Bosque del Apache National Wildlife Refuge (BDANWR) were used intermittently between August 15 and October 21. Refer to the LFCC pumping section for cumulative volumes for 2015 at each of the sites. Reclamation released a total of 21,497 ac-ft of supplemental water in 2015. Natural flow reconnected the river by October 22.

The Service provided a final 2015 Salvage Report on January 11, 2016. Between September 11 and October 1, 2015, the Service's New Mexico Fish and Wildlife Conservation Office (with assistance from Reclamation) conducted rescue and salvage activities on 17.4 unique miles of the Rio Grande, as compared to 26.4 miles in 2014. Of this, 12.2 unique miles were salvaged in the San Acacia Reach on 6 days in two areas of discontinuous flow, 2.1 miles from the south boundary of the BDANWR upstream and 10.1 miles from the north boundary BDANWR upstream. Rescue and salvage within 5.2 unique miles (just upstream of the Peralta Wasteway outfall) in the Isleta Reach occurred on 6 days.

One thousand, three hundred and nineteen (1,319) Rio Grande silvery minnow were found in isolated pools, with 1,246 found alive. Of these, 1,228 (443 Isleta, 785 San Acacia) were transported and released alive in continuous segments of the river within the same reach. Of the 1,246 minnows found alive, 1,117 were young of year (YOY) (435 Isleta, 682 San Acacia). All of the YOY were greater than 30 millimeters (mm) standard length (SL). There were 11 silvery minnow greater than 30 mm SL found dead after June 15, identified as incidental take under the 2003 BO. In addition, 62 RGSM were either too small or sick to salvage, or were found dead during secondary drying events. These mortalities do not count towards incidental take of silvery minnow greater than 30 mm SL. Of the 1,246 silvery minnow found alive in 2015, 106 (8.5%) were marked (VIE), with 98 (7.9%) in the San Acacia Reach, and eight (0.6%) in the Isleta Reach, indicating that they were hatchery-released individuals.

Formal ESA Section 7 consultation was reinitiated by the Service on February 22, 2013, prior to the end of the term of the 2003 BiOp, providing continued Federal and non-Federal coverage in accordance with the terms of the 2003 BiOp.

Rio Grande Silvery Minnow

The silver minnow was formerly one of the most widespread and abundant species in the Rio Grande Basin of New Mexico, Texas, and Mexico, but is now listed as endangered (Service 1994). Currently, the silvery minnow occupies less than 10 percent of its historic range, and is restricted to the reach of the Rio Grande in central New Mexico from Cochiti Dam to the headwaters of Elephant Butte Reservoir.

Studies of long-term trends of silvery minnow abundance have generally used October catch per unit effort (CPUE) data from the population monitoring project, which has used similar survey methods at established sites since 1993. Catch rates were highest in 2005, and were lower, but similar, in 2004, 2006, 2010, and 2011. No silvery minnows were found in the October 2012 or

2014 monitoring, but they were present in very low numbers in October 2013 monitoring. In October 2015, monitoring detected 16 silvery minnows, slightly more than in recent years (Figure 5; Dudley and Platania, 2015).

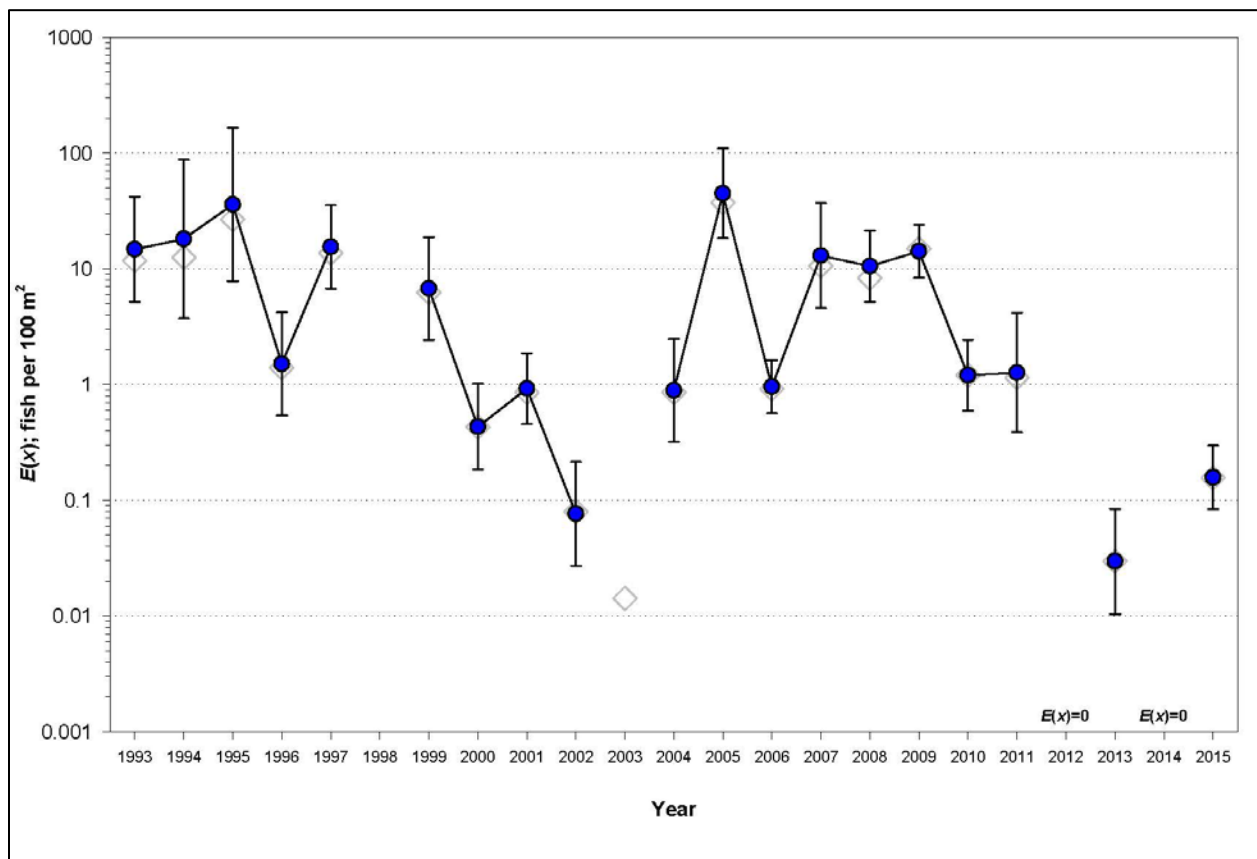


Figure 5: October silvery minnow density estimates ($E(x)$) for 1993–2015 from American Southwest Ichthyological Researchers. Solid circle indicate estimates and bars represent 95% confidence intervals.

During December 2015, silvery minnows were present in 80 of the 221 seine hauls that yielded fish and represented 3 age-classes (Dudley and Platania, 2016). As was the case in 2013 and 2014, there was a density increase during December 2015, likely due to the release of about 200,549 hatchery-reared individuals during October and November of 2015. A notable proportion of silvery minnow detected in December 2015 were from this stocking effort (41.5%) (Dudley and Platania, 2016).

Impacts of the exceptional drought in New Mexico over the last few years are reflected in the 2015 silvery minnow population monitoring results. It should be noted that population monitoring results are an indicator of relative and not absolute abundance. The 2015 monitoring shows a continuation of the low densities of silvery minnow observed from 2012–2014, indicating that the species is near its lowest numbers since monitoring began in 1993.

Reclamation conducted two periods of Rio Grande fish monitoring during 2015 associated with Reclamation projects. The winter electrofishing survey was carried out from February 17 to 26,

2015. Surveys were conducted at sites between Bernalillo and the Delta Channel, below the confluence of the LFCC. A total of 93 silvery minnows were found, 41 of which were unmarked. Reclamation's fall surveys were conducted October 26-28, 2015, using seine nets and electrofishing within the Delta Channel in the Elephant Butte Reservoir pool, from the confluence of the Low Flow Conveyance Channel downstream to just above the reservoir pool near the Monticello Boat Ramp. Seven unmarked silvery minnows were captured in the Delta Channel in 2015; two tagged minnows were also detected. Six of the nine total silvery minnow were young of year YOY fish.

Captive silvery minnows are maintained at the following permitted facilities: City of Albuquerque BioPark, Southwestern Native Aquatic Resources and Recovery Center (ARRC, formerly the Dexter National Fish Hatchery), and the Interstate Stream Commission's Los Lunas Silvery Minnow Refugium. In 2015, the following Middle Rio Grande releases of silvery minnow occurred as follows: 1) 59,357 VIE-marked released in the Angostura Reach¹; 2) 50,973 VIE-marked released in the Isleta Reach²; and 3) 90,118 VIE-marked released in the San Acacia Reach³.

The Service also annually stocks captively propagated silvery minnows from these facilities into Big Bend National Park, Texas. In October 2015, 96,517 silvery minnow were stocked from the Southwestern Native ARRC at Dexter, New Mexico, and 132,500 silvery minnow were stocked from the Uvalde National Fish Hatchery, Uvalde, Texas, with coordination from the Texas Fish & Wildlife Conservation Office.

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Southwestern Willow Flycatcher

The flycatcher (*Empidonax traillii extimus*) was listed as endangered by the Service effective March 29, 1995. Critical habitat was designated, effective August 21, 1997, in some areas of

¹ Angostura Reach releases in 2015 were all comprised of orange right dorsal VIE tags.

² Isleta Reach releases in 2015 were comprised of yellow right dorsal (n=8,760), and white right dorsal (n=42,213) VIE tags.

³ San Acacia Reach releases in 2015 were comprised of orange right dorsal (n=38,213) and white right dorsal (n=51,905) VIE tags.

New Mexico and other states throughout the species' range. The Rio Grande was not designated as critical habitat for the flycatcher at that time. The 1997 critical habitat proposal was later retracted. On October 13, 2004, under court order, the Service reissued a proposed designation for critical habitat for the flycatcher that included portions of the Rio Grande in New Mexico. The Service released a new proposal for critical habitat in August 2011 because of a lawsuit by the Center of Biological Diversity over the 2005 critical habitat designation. On January 3, 2013, once again, a final designation was published.

The 2013 final designation of critical habitat defines two units located along the Rio Grande in the state of New Mexico: the Upper Rio Grande Management Unit and the Middle Rio Grande Management Unit.

Upper Rio Grande Management Unit:

- The Upper Rio Grande New Mexico Segment is considered the area from the Taos Junction Bridge to the upstream boundary of Ohkay Owingeh Pueblo as well as a segment between the southern boundary of Ohkay Owingeh Pueblo to the northern boundary of Santa Clara Pueblo.
- The Rio Grande del Rancho Segment is considered the area from Sarco Canyon downstream to the Arroyo Miranda confluence.
- The Coyote Creek Segment is considered the area from 2 km (1.2 miles) above Coyote Creek State Park to the second bridge on State Route 518, upstream from Los Cocas.
- The Rio Fernando de Taos is a 0.2-mile segment located approximately 2 miles upstream from the Rio Lucero confluence.

Middle Rio Grande Management Unit:

- The northern-most Middle Rio Grande Segment is considered the area from the southern boundary of the Isleta Pueblo to approximately 2 miles north of the Sierra County line.

During the summer 2015, Reclamation conducted surveys and nest monitoring of the flycatcher in ten distinct reaches along approximately 400 kilometers (250 miles) of the Rio Grande in New Mexico, mainly between the southern boundary of the Isleta Pueblo and Elephant Butte Reservoir (Table 10). Other areas surveyed include a 6-mile stretch just north of Cochiti Reservoir, as well as select locations from Caballo Reservoir to El Paso, TX. Surveys were performed to contribute to current baseline population data of the flycatcher along the Rio Grande, and to meet Reclamation's ESA compliance commitments. In 2013, there were 627 resident flycatchers documented in 371 territories and forming 256 breeding pairs. In 2014, the number of total territories increased slightly resulting in 664 documented resident flycatchers occupying 405 territories and forming 259 breeding pairs. In 2015, there were 663 resident flycatchers documented in 389 territories and forming 274 breeding pairs. As in previous years, the San Marcial Reach of the river was by far the most productive, containing 524 resident

flycatchers and 300 territories (of which 224 were pairs).

Table 10: Southwestern Willow Flycatcher Territories – Middle Rio Grande Project, 2000 - 2015 Breeding Seasons (N/S = Not Surveyed)

Year/ Location	2 0 1 5	2 0 1 4	2 0 1 3	2 0 1 2	2 0 1 1	2 0 1 0	2 0 0 9	2 0 0 8	2 0 0 7	2 0 0 6	2 0 0 5	2 0 0 4	2 0 0 3	2 0 0 2	2 0 0 1	2 0 0 0
Frijoles	0	0	1	0	2	N/S	1	1	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Belen	17	18	23	14	9	6	3	4	10	1	4	0	N/S	1	N/S	N/S
Sevilleta	8	4	4	6	9	13	18	31	14	21	17	19	17	13	11	8
San Acacia	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0
Escondida	7	4	8	23	8	4	0	1	0	1	0	0	0	4	0	0
BDANWR	11	23	27	51	49	34	20	5	7	4	0	1	3	3	0	0
Tiffany	1	8	4	1	4	5	5	8	4	9	3	6	4	3	0	0
San Marcial	300	307	266	252	318	298	319	235	197	142	107	113	86	63	25	23
Caballo Reservoir	14	15	4	1	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Lower Rio Grande	31	26	34	27	3	N/S	5	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Total	389	405	371	375	402	360	372	287	232	179	131	150	113	87	37	33

(This table does not include detections outside of the active floodplain at Bosque del Apache NWR)

In 2015, nest monitoring was conducted at all sites where nesting pairs were detected from the southern boundary of Isleta Pueblo to Elephant Butte Reservoir, and in select sites from Caballo to El Paso, TX. Nests were monitored for success rates, productivity, and Brown-headed cowbird (*Molothrus ater*) parasitism. The San Marcial Reach proved most productive, producing 287 nests. Other studies continued in 2015 include: 1) flycatcher nesting hydrology and habitat variable study, 2) river maintenance impact monitoring, 3) photo monitoring of habitat development in the Elephant Butte delta, and 4) depredation monitoring via trail cameras. These studies are designed to provide further insight into potential threats to and habitat requirements of flycatcher populations.

When compared to the results from 2014, the 2015, the flycatcher population showed a small decline overall going from 405 territories to 389 territories respectively. There was little to no change in the Frijoles, Belen and Caballo Reaches. Increases of 3 to 5 territories occurred in the Sevilleta, Escondida, and Lower Rio Grande Reaches. San Marcial had a slight decline in going from 307 to 300 territories, and BDANWR and Tiffany Reaches showed a larger decline from 2014 numbers.

At Elephant Butte Reservoir, flycatchers have expanded their occupied habitat farther south near River Mile 38. Flycatcher occupied areas in the 'delta' portion of Elephant Butte Reservoir (i.e. River Miles 60 to 54) used to consist of mainly dense Goodding's and coyote willow of various age classes, with water provided by the LFCC outfall. However, with the drought the last few years, this area rarely receives any overbank flooding from the LFCC any longer and invasive

saltcedar is encroaching and taking dominance. Although this provides refuge habitat for flycatchers, the arrival of the saltcedar leaf beetle is particularly concerning because they would likely defoliate saltcedar during flycatcher nesting times – providing less foliage cover and making nests more vulnerable to predation, parasitism, and the natural elements.

Habitat modeling from 2012 throughout the Middle Rio Grande has shown that there is still suitable habitat that is not occupied, thus indicating that habitat is not a limiting factor to this population. The reason that flycatchers do not expand into all areas of suitable habitat is likely a cause of their site fidelity.

Nest success in the Middle Rio Grande rebounded to 40% in 2015 from the 2014 nest success of 28%, the lowest it has been since Reclamation has been conducting flycatcher surveys (Figure 6). The decline in nest success over the past few years may represent the decline in habitat suitability and quality in heavily populated areas. The 2014 decline in nest success can be directly attributed to the almost 60% predation rate for flycatchers that year. Predation, the biggest source of nest failure, is typically between 30 and 45%. In 2015, it was 47 % and consequently nest success was higher. These changes may be attributed to how habitat is influenced by hydrology. In 2014, the drought kept most of the sites relatively dry which reduced plant vigor and canopy cover, reducing concealment from predators, cowbirds and the elements. In 2015, the Rio Grande and Low Flow Conveyance Channel both saw better flows compared to the past several years, which translated into more vigorous plant growth and higher concealment from predators.

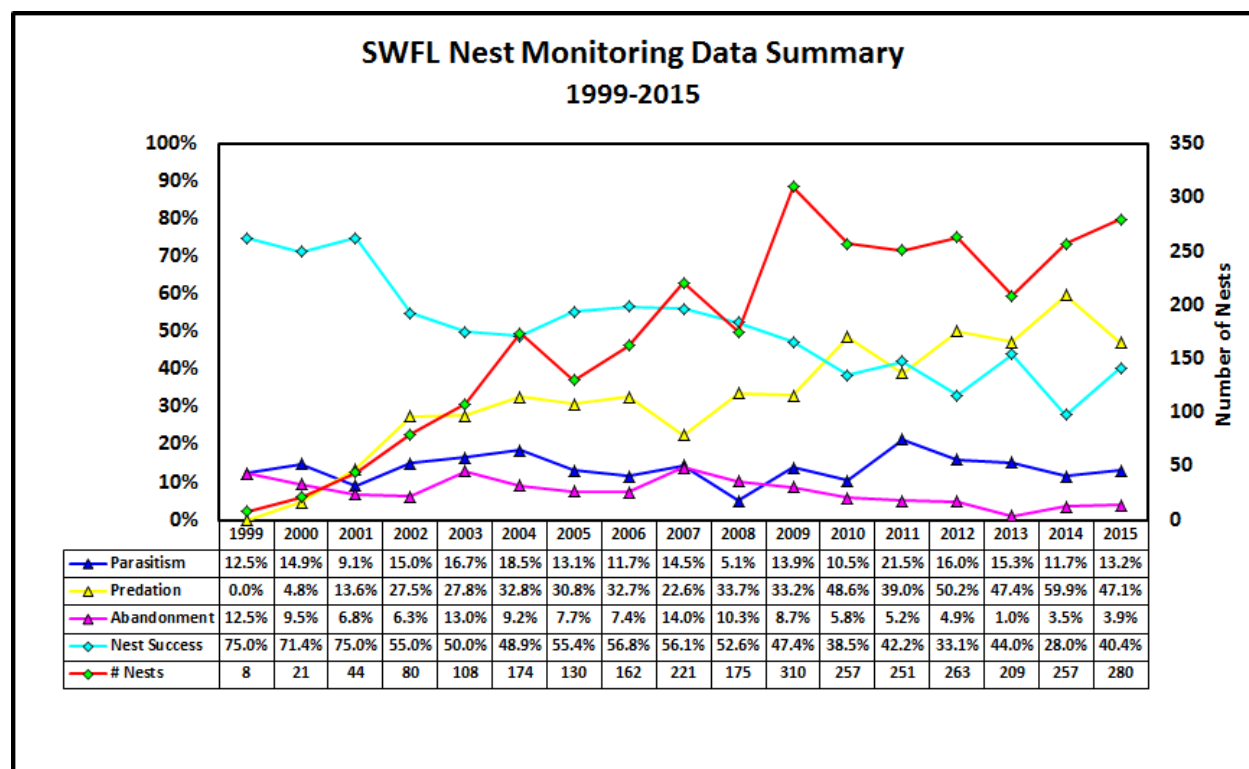


Figure 6: Summary of flycatcher nesting in the Middle Rio Grande from 1999 to 2015

Western Yellow-billed Cuckoo

The western distinct vertebrate population segment of the Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) (cuckoo) was listed as a threatened species by the Service in October of 2014. The proposed critical habitat posted on the Federal Register in August of 2014 includes eight units in New Mexico (Figure 7). Along the Rio Grande, this proposed area includes:

Unit 50: NM-6 Upper Rio Grande

This proposed critical habitat is 1,830 acres in extent and is a 10-mile long continuous segment of the upper Rio Grande from Ohkay Owingeh to near Alcade in Rio Arriba County.

Unit 51: NM-7 Middle Rio Grande 2

This proposed critical habitat is 1,173 acres in extent and is a 6-mile long continuous segment of the Middle Rio Grande starting from the Highway 502 Bridge at the south end of the San Ildefonso Pueblo upstream to a point on the river in Rio Arriba County south of La Mesilla.

Unit 52: NM-8 Middle Rio Grande 1

This proposed critical habitat segment is 61,959 acres in extent and is a continuous 170-mile long segment, from river mile 54 at Elephant Butte Reservoir upstream to just below Cochiti Dam. Within this reach is the largest breeding population of western yellow-billed cuckoos north of Mexico.



Figure 7. Proposed critical habitat locations along the Rio Grande in New Mexico.

During the summer of 2015, Reclamation conducted surveys in eleven distinct reaches within sites also surveyed for flycatchers from the south boundary of Isleta Pueblo to Radium Springs, New Mexico (Table 11). Surveys were performed to contribute to current baseline population data of the cuckoo along the Rio Grande, and to meet Reclamation's ESA compliance commitments. In 2015, there were an estimated 99 territories (resident individuals, pairs, or pairs with "helper males") derived from 338 detections. The estimated territories and documented detections were most concentrated in the southern portion of the San Marcial reach.

Table 11: Yellow-billed Cuckoo Detections/Estimated Territories – Middle Rio Grande Project, 2000 - 2015 Breeding Seasons (N/S = Not Surveyed)

Year/ Location	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006
Belen	39/10	24/5	20/6	44/15	16/4	3/0	1/0	N/S	N/S	N/S
Sevilleta	18/5	9/2	19/6	36/12	6/2	1/0	4/2	N/S	N/S	N/S
San Acacia	27/8	15/4	20/5	19/4	6/1	3/0	8/1	N/S	N/S	N/S
Escondida	62/16	27/7	80/23	68/21	15/3	6/2	29/9	19/10	3/2	N/S
BDANWR	40/12	34/12	29/8	36/10	17/4	14/3	47/11	35/14	22/13	N/S
Tiffany	2/0	2/0	4/1	10/2	4/1	2/0	10/3	7/3	12/4	10/6
San Marcial	215/59	190/61	219/70	202/57	202/58	249/58	257/69	299/60	222/52	106/38
Caballo	48/15	29/8	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Percha	1/0	0/0	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Hatch	4/1	0/0	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Radium Springs	10/4	8/2	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Total	466/130	338/99	391/119	415/121	266/73	278/75	356/95	360/87	259/71	116/44

(This table does not include detections outside of the active floodplain at Bosque del Apache NWR)

New Mexico Meadow Jumping Mouse

The historical distribution of the New Mexico meadow jumping mouse (jumping mouse; *Zapus hudsonius luteus*) likely included riparian areas and wetlands along streams in the Sangre de Cristo and San Juan Mountains from southern Colorado to central New Mexico, including the Jemez and Sacramento Mountains and the Rio Grande Valley from Española to Bosque del Apache National Wildlife Refuge (BDANWR), and into parts of the White Mountains in eastern Arizona. A final rule was published in the June 10, 2014, Federal Register (effective July 10, 2014) to list the jumping mouse as an endangered species under the Endangered Species Act (ESA) with proposed critical habitat. The final designation for critical habitat for the species is still being determined, but proposed critical habitat units have been identified for Bernalillo, Colfax, Mora, Otero, Rio Arriba, Sandoval, and Socorro Counties, in New Mexico; Las Animas, Archuleta, and La Plata Counties, Colorado; and Greenlee and Apache Counties, Arizona (79 CFR 33119).

In the Middle Rio Grande (MRG) valley, jumping mouse are known to use both natural wetlands and riparian habitats associated with irrigation channels (Frey and Wright 2012). In either case, tall, dense herbaceous riparian vegetation is a key habitat component. Current distribution of

jumping mouse within the MRG is uncertain, but the species was confirmed to be present at Ohkay Owingeh Pueblo and the adjacent Rio Chama (Rio Arriba County), Isleta Pueblo (Bernalillo County), near Casa Colorada Wildlife Area (Valencia County), and BDANWR (Socorro County) as of the late 1980s (Frey 2006). Survey efforts have regularly occurred at BDANWR. Surveys in 2014 and 2015 resulted in the capture of 19 and 6 jumping mouse respectively. With the exception of BDANWR, systematic survey efforts for jumping mouse and their habitat have not been conducted throughout the riparian corridor of the MRG. 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 river maintenance project (Reclamation 2014).

In January 2014, a preliminary assessment report was submitted to Reclamation for jumping mouse habitat associated with the Middle Rio Grande Project. Potential jumping mouse habitat was identified for the riparian zone of the MRG from levee to levee based on existing Hink and Ohmart vegetation classification data used by Reclamation in flycatcher (*Empidonax traillii extimus*) habitat mapping. This vegetation mapping data did not include the State Drains and LFCC, so field evaluations were conducted on survey points every mile. Where no drain access was available, Google Earth imagery and spot checks were used. While this information is useful in preliminary evaluations, on-site evaluations are necessary to determine if these areas are actually suitable jumping mouse habitat.

The Delta Channel is located on the southern fringe of the geographic area where jumping mouse could potentially occur. However, during the habitat assessment it was determined that the Delta Channel area does not represent suitable habitat 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. Based on the habitat assessments within the Delta Channel, it is unlikely that occupied or suitable jumping mouse habitat exists south of BDANWR.

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

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U.S. Fish and Wildlife Service. 2014. New Mexico meadow jumping mouse (*Zapus hudsonius luteus*) Survey Results at Bosque del Apache National Wildlife Refuge, United States Government Memorandum. 12 pp

New Middle Rio Grande Water Management and River Maintenance ESA, Section 7 Consultation

Formal ESA Section 7 consultation between the Service and Reclamation was reinitiated on February 22, 2013, prior to expiration of the 2003 BiOp, providing continued federal and non-federal coverage in accordance with the terms of the 2003 BiOp. Consultation goals include achieving and maintaining comprehensive ESA compliance through a hydrologically viable BiOp that maintains and improves the status of listed species.

For these reasons, Reclamation submitted a BA for Middle Rio Grande water operations and river maintenance to the Service on July 31, 2012 – including supplements submitted on August 15, 2012, on September 17, 2012, and on January 15, 2013 – addressing Reclamation, MRGCD, and State of New Mexico water management-related actions taken in the Middle Rio Grande, and State actions in the Upper Rio Grande. A revised BA was submitted on August 8, 2013, which included the Collaborative Program’s Recovery Implementation Program (RIP) as a conservation measure, as endorsed by the Executive Committee of the Collaborative Program in July 2013. The final BA, submitted August 31, 2015, was updated with information on the yellow-billed cuckoo and New Mexico meadow jumping mouse, and descriptions of specific measures to offset adverse effects and provide conservation benefits for listed species. The BA also includes a proposal for a 15-year consultation timeframe with an option to extend, and the role of the RIP as a conservation measure.

Supplemental Water Program

The Supplemental Water Program is utilized to comply with elements of the Reasonable and Prudent Alternative of the 2003 BiOp. The Program consists of water acquisition and storage, concurrence with waiver requests, and the continued conveyance of water from the LFCC to the Rio Grande. The Program supports ESA coverage under Section 7(a)(2).

Water Acquisition and Management

In 2015, a BiOp “dry” year, 21,497 ac-ft of supplemental water was released for endangered species purposes. This volume was composed of 12,661 ac-ft of leased SJ-C water released from Abiquiu and 8,836 ac-ft of Emergency Drought Water stored in 2014 and 2015 and released from El Vado. In addition, 758 ac-ft of 2,000 ac-ft of EDW stored in 2015 by Reclamation on behalf of the New Mexico Interstate Stream Commission was released from El Vado in the same manner as Reclamation’s supplemental water.

Reclamation ended the year with 3,781 ac-ft of water leased from ABCWUA in storage in Abiquiu and 9,417 ac-ft of 2015 leased SJ-C water in storage in Heron, El Vado, and Abiquiu. In addition, in 2016 Reclamation will likely have potential leases of approximately 13,000 ac-ft from 2016 SJ-C allocations. Because of the SJ-C Project shortage, however, available leased water could be much less.

Low Flow Conveyance Channel (LFCC) Pumping Program – San Acacia to Fort Craig Reach

During the irrigation season, flows in the Rio Grande between San Acacia Diversion Dam and the full pool elevation of Elephant Butte Reservoir can drop to a level that may result in adverse impacts to the silvery minnow and flycatcher. Reasonable and Prudent Alternatives D, G, K, and O of the 2003 BiOp require the use of pumps to manage river recession, maintain river connectivity, and supply water for nesting flycatchers. The LFCC Pumping Program also helps Reclamation comply with the continuous river requirements stipulated by Reasonable and Prudent Alternatives E, H, and L, and has been effective in allowing Reclamation to maximize the effectiveness of supplemental water releases made for ESA purposes.

Reclamation installed, maintains and operates portable pumps, with flow meters, at strategic locations along the LFCC. The pumps are used to move water from the LFCC into the Rio Grande. Meter data for the pumping sites is now posted in orange boxes on the MRGCD Gage Schematic page within the Reclamation ET Toolbox web site. The web address for the ET Toolbox is:

<http://www.usbr.gov/tsc/rivers/awards/Nm2/rg/riog/schematic/SCHEMATICsocorrodiv.html>

The total available pumping capacity for all pump locations is approximately 200 cubic feet per second (cfs). The maximum total pumping rate is limited to 150 cfs by the 2003 permit granted by the New Mexico Office of the State Engineer.

Due to the low flows in the Rio Grande and the need to manage recession through BDANWR, pumps located at the North Boundary pump site were started on August 15. To maintain connectivity from the south boundary of BDANWR to Elephant Butte Reservoir, pumps at the South Boundary site were turned on August 22. At the North Boundary, pumps were used sporadically to augment monsoon runoff. The pumps at the North Boundary site were shut off for the season on October 21 and the pumps at South Boundary were shut off on October 21.

In Table 12 below, the yearly volume accrual at each site is summarized in ac-ft.

Table 12: 2015 Pumping Volume by Site

Total Per Pumping Site For The Year	Neil Cupp	North Boundary	South Boundary	Ft. Craig
	0 ac-ft	2,887 ac-ft	2903 ac-ft	0 ac-ft

As seen in Table 12, pumps at the North Boundary and South Boundary sites were used, while pumps at the Ft. Craig and Neil Cupp sites were not used for pumping supplemental water during the 2015 season. The total volume of supplemental flow provided by the pumping effort in the 2015 season was 5,790 ac-ft.

Other Ongoing Water Management and Water Quality Related Projects

USGS MRG River Gage Operation and Maintenance

This project has been funded by the Collaborative Program since Fiscal Year 2002. The US Geological Survey operates and maintains a network of 24 streamflow gages in the MRG, including 12 in the mainstem and 12 in tributaries or distribution features. Four streamflow gages and one sediment gage are funded by the Collaborative Program. Data from the river gages helps the various middle Rio Grande water management agencies in many ways. The monitoring system assists agencies in meeting the needs of water users, fulfilling the requirements of the Rio Grande Compact, maintaining sufficient water in storage for future needs, maintaining adequate water in the river to support the silvery minnow, and providing the information needed to improve the daily management of the river system from Cochiti Dam to Elephant Butte Reservoir. The data from these gages are available to the public at:

<http://waterdata.usgs.gov/nm/nwis/current/?type=flow>.

RiverEyes

In the 2003 Biological Opinion, Element C of the Reasonable and Prudent Alternative states that monitoring must be performed when flows are less than 300 cubic feet per second (cfs) at San Acacia. RiverEyes is a program that provides current information on river flows and river drying and allows action agencies to react quickly to changing conditions on the river. RiverEyes also facilitates coordination among agencies to prevent unexpected drying, to prepare for silvery minnow salvage and to initiate rescue actions.

For the 2015 irrigation season, RiverEyes monitored river conditions along the Rio Grande from Isleta Diversion Dam to the full pool elevation of Elephant Butte Reservoir. Monitoring occurred from late April through the end of irrigation season on October 31, 2015. The total maximum river miles that experienced drying during the 2015 RiverEyes monitoring period was 18.5 miles, 5.5 miles in the Isleta Reach and 13 miles in the San Acacia Reach. The first occurrence of channel drying was recorded on September 10, 2015, and the last occurrence of channel drying was observed on October 21, 2015. River drying was restricted to three river segments: from just upstream of the Los Chavez Wasteway to 0.5 miles below the Peralta Wasteway in the Isleta Reach, from 1.5 miles above Brown Arroyo to the North Boundary pumping station in the San Acacia Reach, as well as a small 2-mile section just above the South Boundary pumping station. Unlike in previous years, and because of adequate water supply, the Low Flow Conveyance Channel pumps were kept on at the North Boundary station during dry times. There were two periods of drying, punctuated by re-wetting events during the summer monsoons.

Middle Rio Grande Endangered Species Collaborative Program

In 1994, the Service listed the silvery minnow as endangered, issued a recovery plan in 1999, and released a revised critical habitat designation in 2003⁴. The silvery minnow recovery plan⁵ was updated in 2010. The flycatcher was added to the endangered species list in 1995 and a final recovery plan⁶ was issued in 2002. The designation for flycatcher critical habitat was revised in January 2013⁷. Consultation was reinitiated on the 2003 BiOp prior to its expiration on March 1, 2013. The 2003 BiOp thus remains in effect and requires delivery of supplemental (leased) water and other measures to reduce impacts to the listed species and alleviate jeopardy on the MRG Project for water, river maintenance, and flood control operations.

The Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program) brings diverse groups together to support ESA compliance and address environmental issues along the Middle Rio Grande (MRG). The Collaborative Program consists of stakeholders representing diverse interests including federal, state, and local government entities; Indian tribes and pueblos; and non-governmental organizations working to support compliance with the ESA. The Collaborative Program began transitioning to a Recovery Implementation Program (RIP) through endorsement of a new Program document, action plan, Long-Term Plan, and draft cooperative agreement on July 18, 2013. The purpose of the RIP is to protect and improve the status of listed species within the MRG by implementing certain recovery activities to benefit those species and their associated habitats and, simultaneously, to protect existing and future water uses while complying with applicable state and federal laws, including Rio Grande Compact delivery obligations.

Currently, Reclamation manages and serves as the fiscal agency for the Collaborative Program as authorized by the Omnibus Appropriations Act of 2009 (P.L. 111-8). In FY 2015, total appropriations were \$5,000,000, of which \$3,000,000 was utilized for Collaborative Program activities and \$2,000,000 was utilized for water leasing, pumping, and Program administration activities. Related FY2015 accomplishments include:

- Contracting for the review of silvery minnow Genetics Projects and to conduct a fish population monitoring workshop to assist the development of future RIP fish monitoring programs;
- Supporting four USGS streamflow gages;
- Captive propagation of silvery minnow at the Southwestern Native Aquatic Resources & Recovery Center⁸, the City of Albuquerque's BioPark Aquatic Conservation Facility⁹ and the New Mexico Interstate Stream Commission's Los Lunas Silvery Minnow

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http://www.fws.gov/southwest/es/Documents/R2ES/FINAL_CH_EIS_Rio_Grande_Silvery_Minnow_no_appendices_Feb_2003.pdf

⁵http://www.fws.gov/southwest/es/Documents/R2ES/Rio_Grande_Silvery_Minnow_Recovery_Plan_First_Revision.pdf

⁶http://www.fws.gov/southwest/es/arizona/Documents/SpeciesDocs/SWWF/Final%20Recovery%20Plan/ExecSummary_Contents.pdf

⁷<http://www.gpo.gov/fdsys/pkg/FR-2013-01-03/pdf/2012-30634.pdf>

⁸<http://www.fws.gov/southwest/fisheries/dexter/>

⁹<http://www.cabq.gov/culturalservices/biopark/news/success-for-abq-bioparks-silvery-minnow-program>

Refugium¹⁰;

- Silvery minnow rescue efforts during river drying and reproductive monitoring;
- Annual monitoring of silvery minnow populations and flycatcher nests;
- Leasing of 13,531 ac-ft of supplemental water acquired from SJ-C Project contractors in FY2015;
- Pumping from the LFCC into the Rio Grande;
- Program management, assessment, reporting, and outreach activities.

¹⁰ <http://www.ose.state.nm.us/LLSMR/index.php>

Rio Grande Project (New Mexico - Texas)

Reclamation's El Paso and Elephant Butte Field Divisions are jointly responsible for the operations of the Rio Grande Project (Figure 8). Elephant Butte Field Division operates and maintains Elephant Butte and Caballo Dams. El Paso Field Division is responsible for scheduling releases from Elephant Butte and Caballo Reservoirs to meet irrigation demand and the delivery of Rio Grande Project water to the canal headings of Elephant Butte Irrigation District (EBID), El Paso County Water Improvement District No. 1 (EPCWID), and Mexico (under the 1906 International Treaty). EBID operates and maintains Reclamation's diversion dams on the Rio Grande, including Percha Diversion Dam, Leasburg Diversion Dam, and Mesilla Diversion Dam in New Mexico, under a contract with Reclamation. In September 2003, Reclamation completed work to remove Riverside Diversion Dam and the adjacent Coffey Dam, both in Texas. Riverside Diversion Dam had been inoperable since 1987, when flooding on the Rio Grande caused the structure to fail.

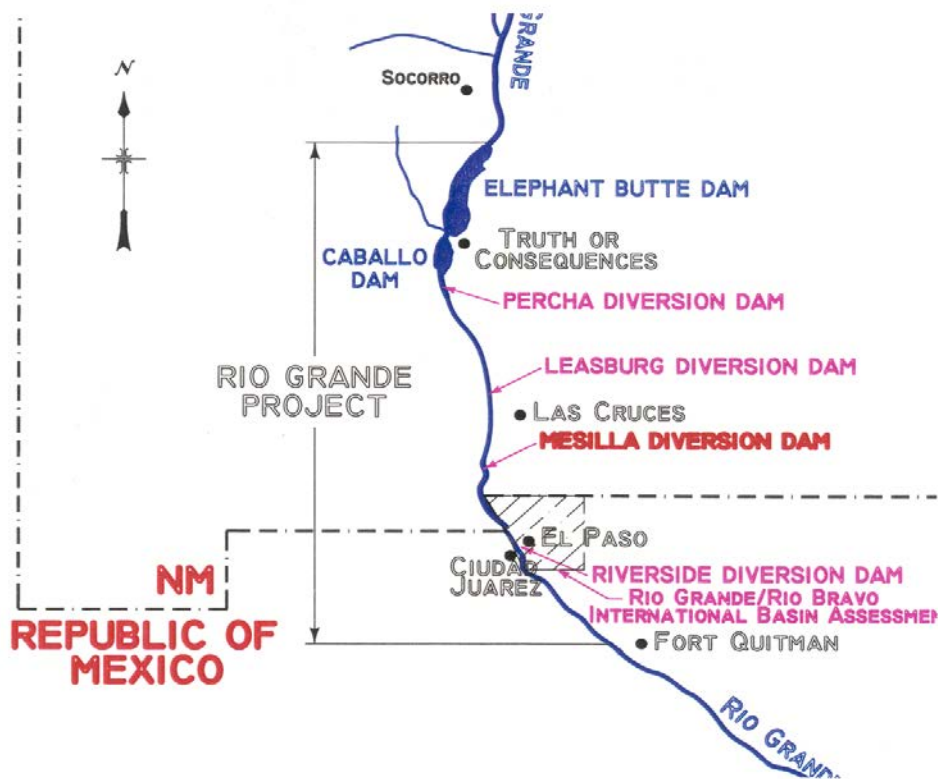


Figure 8: Area Map of the Rio Grande Project

Water Supply Conditions

Preliminary inflow data into Elephant Butte Reservoir during 2015 as measured at the Rio Grande Floodway (FW) plus the LFCC at San Marcial (FW+LFCC) was 495,190 ac-ft. The provisional flow record for the 2015 Spring Runoff (March - July), measured at San Marcial, is 253,400 ac-ft, or approximately 50% of the 30-year average.

During the period from 1998 to 2015, the spring runoff at the San Marcial gauging station continues to be below the 30-year average. From 1998 to 2015, average inflow was 265,035 ac-ft and only two years, 2005 and 2008, exceeded the 30-year average of 510,000 ac-ft.

Releases from Elephant Butte Reservoir began on May 1, 2015, and continued through September 16, 2015. During this period, a total release of 434,637 ac-ft was recorded by the USGS. July through December daily flow data remains provisional; all other data has been approved by the USGS.

During the 2015 irrigation season (May 11 to September 28), 424,199 ac-ft of water was released from Caballo Reservoir for delivery to Rio Grande Project water users. The water released is combined with drain and arroyo inflows downstream of Caballo Dam for use by the water users.

Combined total storage for Elephant Butte and Caballo Reservoirs was 288,860 ac-ft on December 31, 2015, or 12.8% of their total capacity. The available storage for both reservoirs during the winter months (October 1 to March 31) is equal to the capacity of Elephant Butte Reservoir, 2,024,586 ac-ft, minus 25,000 ac-ft that Reclamation reserves for winter operational flood control space (50,000 ac-ft during the summer), plus the capacity of Caballo Reservoir, 324,934 ac-ft, minus 100,000 ac-ft for flood control space, for a total of 2,224,520 ac-ft during the winter and 2,199,520 ac-ft during the summer.

Per the Rio Grande Compact Article I definition, the usable water in Project storage (Elephant Butte and Caballo Reservoirs together) was below 400,000 ac-ft through April 10, 2015; it was above 400,000 ac-ft through June 9, 2015. The usable water in Project storage remained under 400,000 ac-ft through the end of the year.

Since 2011, the average March through July runoff was 70,330 ac-ft. In 2015, the spring runoff was estimated at 253,400 ac-ft. With the combined Project storage and minimal runoff, Reclamation allotted 38.09% of a full supply to Rio Grande Project water users. The available storage was not sufficient to release in late February, as has frequently occurred in the past. Reclamation coordinated with the International Boundary Water Commission, Mexico, the Elephant Butte Irrigation District, and the El Paso Water Improvement District No. 1 to schedule a timely and organized irrigation release. Release from Caballo Reservoir began on May 11, 2015, and the irrigation season continued through September 28, 2015.

The initial allocation for 2016 is scheduled to occur by mid-March 2016. On January 15, 2016, combined storage in Elephant Butte and Caballo Reservoirs was 371,199 ac-ft; water available to the Project water users was 355,808 ac-ft. Based on the January 1, 2016, Natural Resources Conservation Service and National Weather Service spring runoff forecast at the San Marcial

gauging station, and uncertain El Nino Southern Oscillation (ENSO) activity and present hydrologic conditions, Reclamation anticipates a less than full supply for irrigation during 2016 for the Rio Grande Project.

Project Irrigation and Drainage Systems

Following title transfer, which was completed in 1996, the irrigation and drainage system, of the Rio Grande Project, is owned, operated, and maintained by EBID in New Mexico and by EPCWID in Texas. Reclamation owns and administers the lands and rights-of-way activities of the reservoirs and diversion dam areas. Reclamation also retains the title and O&M responsibilities for Elephant Butte and Caballo Dams and Reservoirs.

The districts performed flow measurements at canal headings, river stations, and lateral headings during 2015. In 2015, Reclamation also performed flow measurements at canal headings and river stations, and coordinated and maintained central control of releases, river operations, and water accounting. To accomplish the water allotment accounting, the 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 Project water supply use and accounting for 2015. The International Boundary and Water Commission (IBWC) own, operate, and maintain 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.

Drainage waters from the Rio Grande Project 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 gauging 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 Project between March 1 and September 30. In 2015, 20,387 ac-ft was diverted.

Elephant Butte Reservoir and Powerplant

In 2015, Elephant Butte Reservoir reached a daily minimum storage of 166,220 ac-ft (elevation 4306.63 feet) on September 16, 2015 and a daily maximum storage of 399,970 ac-ft (elevation 4,332.51 feet) on May 30, 2015.

The total gross power generation for 2015 was 38,153,560 kilowatt-hours (kWhr). Net power generation for 2015 was 37,652,418 kWhr, which is 98 percent of the 8-year average (2008 through 2015) of 38,477,032 kWhr. The power plant releases were utilized to meet downstream irrigation demand and manage Caballo Reservoir storage levels. The balance valves were not used to meet releases for the 2015 irrigation season. The balance valves will be available for any required release beyond the Elephant Butte Powerplant capabilities in 2016.

Elephant Butte Dam Facility Review and Safety of Dams Program

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 (SOD) recommendations and four incomplete Category 2 O&M recommendations for Elephant Butte Dam. No O&M recommendations were completed during FY 2015.

The upper balance valve-water piping was replaced in FY 2015. The original pipes were rusted and close failure in some locations. The electronic upper valves have not operated properly since installation, so were replaced with manual valves.

A Periodic Facility Review (PFR) Examination was completed in May 2015. The inspection produced three new O&M recommendations.

The Facility Review Rating was updated in October 2015. The rating for Elephant Butte increased from a total score of 89 to a score of 94, which gives the facility an overall rating of “Good”.

Caballo Dam and Reservoir

During the 2015 water year, October 2014 to October 2015, Caballo Reservoir reached a minimum storage of 16,080 ac-ft (elevation 4134.39 feet) on August 5, 2015 and a maximum storage of 52,060 ac-ft (elevation 4146.95 feet) on May 26, 2015.

According to Court Order No. CIV-90-95 HB/WWD of October 17, 1996, which resulted from a negotiated settlement with the Irrigation Districts, the Caballo Reservoir storage level is targeted not to exceed 50,000 ac-ft (4,146.44 feet) from October 1 to January 31 of each year, unless flood control operations, storage of water for conservation purposes, re-regulation of releases from Elephant Butte Dam, safety of dams purposes, emergency operations, or any other purpose authorized by Federal law, except non-emergency power generation, dictate otherwise. Significant variation above 50,000 ac-ft during the winter months of October through January requires collaboration and consultation between the Districts and Reclamation

Reclamation operated Caballo Reservoir during the irrigation release period, May 11 through September 28, 2015, by maintaining adequate storage levels. Operating Caballo Reservoir at these storage levels during the 2015 irrigation season allowed Reclamation to:

- Reduce evaporative losses between Elephant Butte and Caballo Reservoirs,
- Provide sufficient operational hydraulic head at Caballo Reservoir during the short irrigation demand releases,
- Use Caballo as a reserve pool should releases from Elephant Butte Dam be interrupted, and minimize changes to release rates from Elephant Butte Dam,
- Allow for data collection and maintenance of OPEC and 3D-sec (ET) systems at Caballo through cooperative research with New Mexico State University.

The Caballo Reservoir operating plan for the 2016 water year has not yet been finalized. Discussion between EBID, EPCWID and Mexico are ongoing to determine the optimum release date. Mid-March has been presented, however, no definite date has been settled on. In past years, releases have been scheduled to begin around June 1, which has been the practice during very low available water irrigation seasons. Due to the ongoing drought, all parties are coordinating release schedules to avoid block releases. Reclamation will finalize a reservoir operating plan in the spring of 2016. The operations plan will reflect accommodations to minimize evaporation at Elephant Butte and Caballo Reservoirs and meet water user needs.

Caballo Dam Facility Review and Safety of Dams Program

There are no significant dam safety related O&M issues associated with Caballo Dam other than aging infrastructure. There are currently seven incomplete Category 2 O&M recommendations for Caballo Dam. No O&M recommendations were completed during FY 2015.

The V-notch weir plate for the A and B drains was replaced in FY 2015. The old plate was corroded, allowing canal water back into the drain boxes and making it difficult to detect sediment movement through the dam.

A PFR was completed in May 2015. The examination report produced four new O&M recommendations.

The Facility Review Rating was updated in October 2015. The total score for Caballo increased from a total score of 94 to a score of 98, which gives the facility an overall rating of “Good”.

Rio Grande Project Adjudications

The United States filed the case *United States of America v. Elephant Butte Irrigation District, et al* Civ. No. 97-0803 JP/RLP/WWD (Quiet Title to the Waters for the Rio Grande Project) on June 12, 1997, requesting the Court to quiet legal title to the waters of the Rio Grande Project in its name. The United States District Court for the District of New Mexico dismissed the case in August 2000. On May 7, 2002, the United States Court of Appeals (10th Circuit) vacated the USDC’s August 2000 decision and remanded the case back to District Court for further proceedings. Chief Judge James A. Parker issued an order to stay the case and close for administrative purposes on August 15, 2002. He further ordered that: if it becomes necessary or desirable during the pendency of the water adjudications in New Mexico and Texas, any party may initiate proceedings as though the case had not been closed for administrative purposes.

The Lower Rio Grande Basin Adjudication (New Mexico), *State of New Mexico, ex rel, Office of the State Engineer v. EBID, et al*, CV-96-888 "stream adjudication" case was originally filed by EBID against the State Engineer in 1986. Negotiation meetings on the Offers of Judgment on Lower Rio Grande Basin Adjudication (New Mexico) have been held between the Office of the State Engineer and the United States. In 2011, as part of Stream System Issue No. 101, the Court

issued a final judgment approving a settlement agreement whereby the State of New Mexico and the farmers in the Rio Grande Project agreed to a total consumptive use amount of 4.5 ac-ft per acre per year. Of the 4.5 ac-ft, it was agreed upon that up to 3.024 ac-ft would be from surface water and the remainder from groundwater. The total may be increased to a maximum of 5.5 ac-ft if a farmer can prove beneficial use in excess of 4.5 ac-ft per acre per year.

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 would mean the United States still has a right to such inflows once they become surface water again.

In January 2013, Texas filed a motion in the United States 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 Rio Grande 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 Rio Grande Compact and the Rio Grande Project Act; plus award damages and other relief for the injury suffered by the State of Texas. On December 10, 2013, the United States filed a brief stating that Texas' motion for leave to file a complaint should be granted, and New Mexico should be invited to file a motion to dismiss the complaint. On January 27, 2014, the U.S. Supreme Court ruled that Texas can proceed to the next step in its lawsuit against New Mexico and invited New Mexico to file a motion to dismiss the action. On February 27, 2014, the United States filed a motion to intervene as a plaintiff. On November 3, 2014, the Supreme Court of the United State appointed Gregory Grimsal of New Orleans as Special Master. The Special Master held hearings on August 19-20, 2015, on New Mexico's motion to dismiss and the motions filed by the Elephant Butte Irrigation District in New Mexico and the El Paso County Water Improvement District in Texas for leave to intervene, but did not rule from the bench.

The Texas Commission on Environmental Quality (TCEQ) posted public notice of adjudication of all claims of water rights in the Upper Rio Grande (above Ft. Quitman) segment of the Rio Grande Basin and the requirement to file sworn claims pursuant to section 11.307 of the Texas Water Code on or before April 22, 1996. Threshold issues were briefed, and on July 31, 2003, the Administrative Law Judge ruled as follows: (1) the TCEQ has jurisdiction over the proceeding, (2) the river segment subject to the adjudication does not need to be revised or expanded, and (3) the proceeding qualifies as an adjudication of water rights under the McCarran Amendment. An evidentiary hearing was held on December 11, 2003, and Reclamation presented expert testimony about the Rio Grande Project. Notice was given under Texas Administrative Code §86.18 (c) that on April 13, 2006, the Texas Commission on Environmental Quality issued a Final Determination of all claims of water rights under adjudication in the Upper Rio Grande Segment of the Rio Grande Basin (above Fort Quitman) located within the State of Texas and which includes all portions of Hudspeth and El Paso Counties, Texas. The effective date of the Final Determination is May 15, 2006

Rio Grande Project Operating Agreement

On February 14, 2008, Reclamation, EBID, and EPCWID agreed to, finalized, and sign an operating agreement for the Rio Grande Project. This is very significant because the first negotiations of a draft operating agreement started almost 30 years ago. This agreement, and its accompanying operations manual, also finalized in August 2008, provides detailed procedures for operating the Rio Grande Project by Reclamation, EBID, and EPCWID while recognizing and fulfilling the terms of the 1906 Convention with Mexico to supply up to 60,000 ac-ft of irrigation water from the Rio Grande Project.

The most important items in the operating agreement are: (1) procedures for allocation of Rio Grande Project water supply to the three Project water users, (2) recognition of groundwater pumping in the Rincon and Mesilla Valleys affecting the water supply available to EBID and EPCWID and adjusting the allocation procedures to mitigate the allotment for EBID and EPCWID, and (3) an incentive for EBID and EPCWID to carry over their respective unused allotments each year with a maximum carryover provision for each District of 60% of their respective historical full allocation. This carryover incentive encourages each district to conserve and effectively utilize irrigation water, particularly during drought periods on the Rio Grande Project. The Rio Grande Project has completed eight irrigation seasons under the 2008 Operating Agreement. The ninth irrigation season may begin as early as March 2016 due to extremely low prior year storage.

EPCWID ended the 2015 irrigation season with 32,470 ac-ft in their allocation carryover account and EBID ended the season with 24,600 ac-ft in their allocation carryover account.

The technical team for the Rio Grande Project, which consists of representatives from EBID, EPCWID, and Reclamation, will meet in early 2016 to discuss amendments to the operations manual. At this time, none have been proposed.

During the 2015 irrigation season, the Project released 435,480 ac-ft from Rio Grande Project storage. The project water users (EBID, EPCWID, and Mexico) were charged for 343,050 ac-ft of delivered water. The release to delivery ratio of 0.9 shall be used in the calculation of the allocation at the start of the 2016 irrigation season.

The release to delivery ratios for the years that the operating agreement has been in effect show that the Project continues operating in an extreme drought scenario. Reclamation continues to work with each district to account accurately for water released from Caballo and water delivered at each diversion point. Snow pack conditions presently are near or above normal, however, reservoir levels are not expected to rise significantly for the 2016 irrigation season.

Elephant Butte and Caballo Reservoir Vegetation Management Cooperative Agreement

Under the Vegetation Management Cooperative Agreement, Reclamation performs maintenance

of previously managed vegetation, primarily by mowing to limit the non-beneficial consumption of water by woody phreatophytes such as saltcedar (*Tamarix*). Herbicide treatments to saltcedar and tornillo (screwbean mesquite) are also made to limit the amount of mowing necessary to complete the task. Approximately 7,041 acres have been sprayed at both reservoirs over the past eleven years with varying amounts of success. With assistance from New Mexico State University, scientific investigations are being done concurrently to estimate reductions in evapotranspiration after various treatments. A report with recommendations for optimization of storage for water conservation has been completed (Bawazir, et. al., 2013).

During FY2015, Reclamation managed 3,240 acres of phreatophytic vegetation at Caballo reservoir utilizing mowers and mulchers.

Literature cited:

Bawazir, A.S., Tanzy, Brent, Tran, D.T. (2013) *Optimizing Caballo Reservoir Water Operation By Reducing Evaporation Losses Through Control of Water Depth and Suppression of Exotic Plant Species*. Final Report submitted to the Bureau of Reclamation, Truth or Consequences, NM, September 2013, 186 pp

Other Reclamation Programs

The Secure Water Act

The SECURE Water Act became law on March 30, 2009, as a component of the Omnibus Land Management Act of 2009. It provides authority for Federal water and science agencies to work both independently and in partnership with States and with local water managers to plan for climate change and other threats to our water supplies, and to take action to secure water resources for the communities, economies, and ecosystems they support. The SECURE Water Act authorizes and funds a number of programs under the Department of the Interior's WaterSMART Program to evaluate the risk that climate change and other threats pose to water supply and to initiate local actions to adapt to projected future conditions, and provide for resilient social and ecological systems. These programs include:

- Basin Study Program
 - West-Wide Climate Risk Assessments
 - Basin Studies
 - SECURE Feasibility Studies
 - Landscape Conservation Cooperatives
- Reclamation's Water Conservation Field Services Program (AAO)
- Cooperative Watershed Management Program
- Title XVI Water Reclamation and Re-use Program

Basin Study Program

Reclamation's Basin Study Program, a component of the WaterSMART Program, represents a comprehensive approach to identifying and incorporating the best available science into climate-change adaptation planning. Within the Basin Study Program, Reclamation and its partners seek to identify strategies for addressing imbalances in water supply and demand, as authorized in the SECURE Act. The Program includes three complementary activities: the West-Wide Climate Risk Assessment (WWCRA) and basin-specific WWCRA Impacts Assessments, Basin Studies, and SECURE Feasibility Studies. The Basin Study Program is also closely affiliated with the Landscape Conservation Cooperatives (LCCs). The Southern Rockies and Desert LCCs encompass the Middle Rio Grande and are jointly managed by Reclamation and the U. S. Fish & Wildlife Service. Further information about each of these sub-programs is provided below.

West-Wide Climate Risk Assessments

WWCRA implementation activities focus on development of consistent climate projections for Western river basins, and evaluation of impacts of the projected changes to water supply, water demand, water/reservoir operations, water quality, hydropower generation, endangered species, fish and wildlife, flow- and water-dependent ecological resiliency, and recreation. WWCRA activities include development and refinement of climate projections, water supply analyses, water demand analyses, WWCRA impact assessments, and development of guidance for analysis of potential impacts of climate change on Reclamation projects.

WWCRA Impacts Assessments are Reclamation-only projects, which focus on the development

of baseline projections of the impacts of climate change alone, isolated from other human-induced changes to our water supply and ecological resources, so that the magnitude of the impacts of climate change can be understood. A WWCRA Impact Assessment for the Upper Rio Grande was completed in 2013 (Llewellyn, et. al., 2013). The work performed for this Impact Assessment has formed the basis for a number of studies, environmental compliance, and planning efforts, both within Reclamation and among Reclamation's partners in the Middle Rio Grande. These studies include a transportation and land-use planning effort led by the Mid-Region Council of Governments and the Department of Transportation's John A Volpe National Transportation Systems Center (Ecosystem Management 2014a and 2014b, John a Volpe National Transportation Systems Center 2015, and MRMPO and MRCOG, 2015), and a long-term planning process for the Albuquerque-Bernalillo County Water Utility Authority (internal document to the Authority). Within Reclamation, the projections have been used to support the Middle Rio Grande Endangered Species Biological Opinion, the Pojoaque Basin Regional Water System Environmental Impact Statement, and the Rio Grande Project Operating Agreement Environmental Impact Statement. In 2016, Reclamation's Albuquerque Area Office will be initiating a Reservoir Operations Pilot Study on the Rio Chama, which will evaluate the range of operational flexibility on that tributary to the Rio Grande.

In 2015, the WWCRA team updated its hydroclimate projection website to include downscaled and bias corrected streamflow and climate projections from the Coupled Model Intercomparison Project Phase 5 (CMIP5; Reclamation 2015). The WWCRA Team also completed a projection of agricultural demands and reservoir evaporation over the course of the 21st century (Huntington, et. al. 2015). The WWCRA team also submits reports to Congress on the achievements of the Basin Study Program every five years, and is currently finalizing the 2016 SECURE Report to Congress. This report will include the projections developed from the most recent set of hydroclimate projections for the Western US, developed from CMIP5, and a summary for each of the major Reclamation river basins, including the Rio Grande, of the work on projection of the impacts of climate change and development of adaptations and resilience-building strategies over the past five years.

Basin Studies

Reclamation has been engaging in partnerships with local water management agencies to perform Basin Studies. 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), which was performed as a component of the West-Wide Climate Risk Assessment. The projects are managed out of the Upper Colorado Region, Albuquerque Area Office, and seek to develop adaptation and mitigation strategies for watersheds affected by climate change. Basin studies require a 50% cost share from Reclamation's local water-management partners, and involve considerable cooperation with other members of the water community in a basin. Reclamation and its partners have recently completed the Santa Fe Basin Study, and are scheduled to complete the Pecos Basin Study in 2016. Letters of interest for 2016 Basin Studies are expected to be due from potential project partners to Reclamation in March 2016. Reclamation will select qualified partners who have submitted letters of interest to submit a full Basin Study proposal. Reclamation expects to select the final 2016 Basin Studies by May 2015.

Santa Fe Basin Study

In 2015, Reclamation's Albuquerque Area Office, 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). This study evaluates projected impacts of climate change, population growth, and other stressors on the Santa Fe watershed, and on water supplies for the combined municipal water system of the City and County.

Under this study, a Preliminary Assessment was performed to evaluate the range of potential impacts of climate change on the Santa Fe watershed, including its human and ecological systems, and to develop a list of potential adaptation actions that the community could take to mitigate the impacts, along with a summary of adaptation actions that are already underway in the watershed. Extensive modeling work was then performed to evaluate projected imbalances between water supply and demand for the City and County. The City and County's combined municipal system obtains water from the Santa Fe River watershed, the headwaters of the Rio Grande as far downstream as Otowi gage, the San Juan Basin tributaries that contribute to Reclamation's San Juan-Chama Project, and local groundwater supplies. Therefore, all of these water sources were considered in the study.

The study concludes that if no adaptation actions are taken to offset the growing gap between water supply and demand, for the City and County, annual deficits to the combined municipal supply could range from 3,500 ac-ft per year to 14,000 ac-ft per year, with recurring water shortages likely by the 2050s. To mitigate for the projected gap between supply and demand, the project team recommended a portfolio of measures, which together could provide approximately 8,350 ac-ft per year in additional water through direct reclaimed water reuse, conservation, direct injection aquifer storage and recovery, indirect aquifer storage and recovery through infiltration through the bed of the Santa Fe River, and acquisition of some additional Middle Rio Grande water rights. These recommendations will be incorporated into the Long-Range Water Supply Plan for the City and County's combined municipal supply, and will be implemented over time by the City and County.

Pecos Basin Study

In 2012, Reclamation's Albuquerque Area Office initiated a partnership with the NMISC for a Basin Study focusing on the Pecos River watershed in eastern New Mexico. This project emphasizes groundwater resources in the New Mexico portion of the Pecos River Basin, with a particular focus on the Fort Sumner area. Projections of the hydrologic impacts of climate change have been developed by Reclamation for this Basin, and used in simulations of the river system using the Pecos River Operations model, a RiverWare model, which simulates groundwater/surface-water interaction. This study is scheduled for completion by June 30, 2016. Additional information on this study is provided in the Pecos River Compact Report.

Middle Rio Grande Basin Study: Plan of Study

In 2015, Reclamation's Albuquerque Area Office entered into a partnership with the MRGCD, Audubon, The Nature Conservancy, Sandia Pueblo, and the Middle Rio Grande Water Assembly to develop a Plan of Study for a comprehensive Middle Rio Grande Basin Study. The Plan of Study team partners plan to engage the full suite of water management partners in the Basin Study process. The team's plan is to submit a proposal for the comprehensive Middle Rio

Grande Basin Study in Reclamation's 2017 Basin Study proposal process. The Basin Study, like the Plan of Study, will be funded as a 50/50 cost split between Reclamation and all of the other partners combined.

Landscape Conservation Cooperatives

Reclamation is partnering with the U. S. Fish & Wildlife Service to manage the Desert and Southern Rockies LCCs. LCCs are designed to be links between science and conservation actions, which address climate change and other stressors within and across landscapes. The Upper Rio Grande straddles the Southern Rockies LCC and the Desert LCC. Reclamation invites all federal, state, tribal, local government, and non-governmental management organizations to become partners in the development of these cooperatives.

Southern Rockies Landscape Conservation Cooperative

The following are the ongoing and/or completed projects of the Southern Rockies LCC in the Upper Rio Grande Basin:

- *Collaboration between the USDA Forest Service, Rocky Mountain Research Station and the SRLCC to complete vulnerability assessments and analysis work for the Upper Rio Grande geographic focus area.*
 - Awarded to U.S. Forest Service, Rocky Mountain Research Station, Albuquerque.
 - Funding: Bureau of Reclamation \$65,000 and US Fish and Wildlife Service \$65,000
 - Timeline: August 2015 to February 2017.
 - Status: Project Underway
 - More information about the project can be obtained from: John Rice (SRLCC Science Coordinator) jrice@usbr.gov; or Kevin Johnson (SRLCC Coordinator) kevin_m_johnson@fws.gov.

- *Identifying Refuge Streams and Lakes for Rio Grande Cutthroat Trout in a Changing Climate*
 - Awarded to U.S. Geological Survey, Fort Collins Science Center.
 - Funding U.S. Fish and Wildlife Service \$75,000.
 - Timeline: January 2015 to December 2015.
 - Status: Final report in development.
 - More information about the project can be found at: <http://southernrockieslcc.org/project/identifying-refuge-streams-and-lakes-for-rio-grande-cutthroat-trout-in-a-changing-climate/>

- *Vulnerability Assessments: Synthesis and Application for Aquatic Species and their Habitats.*
 - Awarded to U. S. Forest Service Rocky Mountain Research Station.
 - Funding: Bureau of Reclamation \$40,176, in kind/other funding: \$49,200.

- Timeline: December 2014 to March 2014.
- Status: Completed, final report available.
- More information about the project can be found at: <http://southernrockieslcc.org/project/vulnerability-assessments-for-aquatic-species/>
- *Watershed Disturbance and Restoration Impacts on Hydrologic Function Relative to Increased Snowmelt Water Yields, Stream Water Quality, and Species Conservation in the Jemez Mountains, New Mexico: Model Calibration and Validation on a Landscape Scale*
 - Awarded to U. S. Department of Agriculture Valles Caldera Trust.
 - Funding: Bureau of Reclamation \$92,160, in kind/other funding: \$197,347.
 - Timeline: December 2013 to December 2016.
 - Status: Project underway
 - More information about the project can be found at: <http://southernrockieslcc.org/project/watershed-disturbance-and-restoration-impacts-on-hydrologic-function/>
- *Improving Seasonal Water Supply Predictions and Water Management in the Upper Rio Grande River Basin through use of Enhanced Observations of Snowfall, Snowpack and Physics-Based Modeling Systems*
 - Awarded to National Center for Atmospheric Research.
 - Funding: Bureau of Reclamation: \$89,982, Colorado Water Conservation Board: \$215,000; National Science Foundation: \$12,856
 - Timeline: December 2013 to December 2015
 - Status: Final report in development.
 - More information about the project can be found at: <http://southernrockieslcc.org/project/modeling-systems-to-inform-water-management/>
- *Improving Crop Coefficients for the Middle Rio Grande*
 - Awarded to: New Mexico Office of the State Engineer.
 - Funding: Bureau of Reclamation: \$150,000, in kind/other funding: \$151,641.
 - Timeline: October 2012 to October 2014
 - Status: Completed, final report available.
 - More information about the project can be found at: <http://southernrockieslcc.org/project/improving-crop-coefficients/>

- *Modeling Woody Plant Regeneration and Woody Debris Accumulation Under Future Streamflow and Wildfire Scenarios in Semi-Arid Riparian Ecosystems*
 - Awarded to U. S. Forest Service Rocky Mountain Research Station.
 - Funding: Bureau of Reclamation \$51,840, in kind/other funding: \$52,000.
 - Timeline: September 2012 to December 2014.
 - Status: Completed, final report available.
 - More information about the project can be found at:
<http://southernrockieslcc.org/project/modeling-woody-plant-regeneration-and-woody-debris-accumulation/>

- *Vulnerability of Riparian Obligate Species in the Rio Grande to the Interactive Effects of Fire, Hydrological Variation and Climate Change*
 - Awarded to U. S. Forest Service Rocky Mountain Research Station.
 - Funding: Bureau of Reclamation \$89,940, in kind/other funding: \$89,933.
 - Timeline: November 2012 to September, 2014.
 - Status: Completed, final report available.
 - More information about the project can be found at:
<http://southernrockieslcc.org/project/vulnerability-of-riparian-obligate-species/>

Desert Landscape Conservation Cooperative

The Desert Landscape Conservation Cooperative is planning a Rio Grande Forum, which will cover all reaches of the Rio Grande, in Spring 2017. As part of the planning for the Rio Grande Forum, it has worked with the USGS South Central Climate Science Center to initiate the development of a “state of the Rio Grande” report and assessment of how people value the Rio Grande. The work is being performed by the University of Oklahoma. In addition, the Desert LCC is currently initiating a Conservation Planning and Design Effort for the Big-Bend / Rio Bravo area. Additional ongoing projects are described below.

The following are the active projects of the Desert LCC in the Upper Rio Grande Basin:

- *Ecological Changes in Aquatic Communities in the Big Bend Reach of the Rio Grande: Synthesis and Future Monitoring Needs* (this project was funded by USFWS in 2014 –
 - Awarded to Utah Cooperative Fish and Wildlife Research Unit and Utah State University
 - Funding: US Fish & Wildlife Service, \$49,860
 - Timeline: July 2014 to June 2015
 - Status: In progress
- More information about the project can be found at: http://fws.sciencebase.gov/sb_frame/index.php?sb_id=548b63d7e4b0279dd8f12c83)

- *Developing a Geodatabase and Geocollaborative Tools to Support Springs and Spring-Dependent Species Management in the Desert LCC*
 - Awarded to: Museum of Northern Arizona
 - Funding: Bureau of Reclamation, \$149,839, cost-share \$173,771
 - Timeline: October 2013 to September 2015
 - Status: Completed

- More information about the project can be found at:
(http://fws.sciencebase.gov/sb_frame/index.php?sb_id=53235da8e4b07f555751f5ac)
- *Fire-Smart Southwestern Riparian Landscape Management and Restoration of Native Biodiversity in View of Species of Conservation Concern and the Impacts of Tamarisk Beetles*
 - Awarded to Texas A&M University
 - Funding: , \$114,946, cost-share \$115,691
 - Timeline: October 2014 to September 2016
 - Status: In progress
- More information about the project can be found at:
(http://fws.sciencebase.gov/sb_frame/index.php?sb_id=548a27d6e4b0becfd8cebc35)
- *Modeling Woody Plant Regeneration and Debris Accumulation under Future Streamflow and Wildfire Scenarios in the Desert LCC*
 - Awarded to Grassland, Shrubland, and Desert Ecosystem Science Program, USDA Forest Service Rocky Mountain Research Station
 - Funding: Bureau of Reclamation, \$51,840, cost-share \$52,000
 - Timeline: January 2013 to December 2014
 - Status: Completed
- More information about the project can be found at:
(http://fws.sciencebase.gov/sb_frame/index.php?sb_id=5323552ee4b07f555751f572)
- *The Impact of Ecosystem Water Balance on Desert Vegetation: Quantification of Historical Patterns and Projection under Climate Change*
 - Awarded to US Geological Survey Southwest Biological Science Center
 - Funding: Bureau of Reclamation, \$98,244 cost-share, \$161,788
 - Timeline: September 2012 to September 2014
 - Status: Completed, final report available
- More information about the project can be found at:
(http://fws.sciencebase.gov/sb_frame/index.php?sb_id=532355c0e4b07f555751f57a)
- *Vulnerability of Riparian Obligate Species in the Rio Grande to the Interactive Effects of Fire, Hydrological Variation and Climate Change*
 - Awarded to Grassland, Shrubland, and Desert Ecosystem Science Program, USDA Forest Service Rocky Mountain Research Station
 - Funding: Bureau of Reclamation \$89,940, cost-share \$89,933
 - Timeline: January 2013 to December 2014
 - Status: Completed

More information about the project can be found
(http://fws.sciencebase.gov/sb_frame/index.php?sb_id=53235630e4b07f555751f57d)
- *Environmental Flows Database*
 - Awarded to: University of Arizona Water Resources Research Center and Northern Arizona University
 - Funding: \$97,546
 - Timeline: 2014 - 2016

- o Status: ongoing

More information about the project can be found at:

(<http://www.usbr.gov/dlcc/science/projects.html?projId=5494ce05e4b0a2b9adad8efc>),

- o *Fish Data Compilation and Climate Change Assessment*
- o Awarded to University of Texas at Austin, in cooperating with New Mexico Game and Fish Department, Western Governor's Association, Desert Fish Habitat Partnership, University of Washington, and Arizona Department of Environmental Quality.
- o Funding: \$90,640
- o Timeline: 2011 - 2013
- o Completed 11/30/2013

More information about the project can be found at:

(<http://www.usbr.gov/dlcc/science/projects.html?projId=5322180fe4b02e6e19ed36e3>)

- Physiological Effects of Climate Change on Species in the Desert LCC
 - o Awarded to: University of Arizona
 - o Funding: \$38,500
 - o Timeline: 2014-2015
 - o Status: In progress

More information about the project can be found at:

(<http://www.usbr.gov/dlcc/science/projects.html?projId=54909c41e4b09de2d2889565>).

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Reclamation's Water Conservation Field Services Program (AAO)

Through the Water Conservation Field Services Program (WCFSP), Reclamation provides cost-share funding and technical assistance to a number of water management entities in New Mexico and Texas. The WCFSP seeks to promote water use efficiency through support of outreach efforts, research projects, and technical assistance to water users. The program also supports other programs such as Native American Affairs, Emergency Drought Relief, and WaterSMART.

Reclamation continued to support conservation outreach aimed at increasing public and industrial awareness of water issues during 2015. Through collaboration with the New Mexico Water Conservation Alliance, the WCFSP has greatly extended its outreach capabilities. WCFSP staff was able to support outreach programs to hundreds of children in Rio Rancho and Santa Fe, by demonstrating water conservation principles through the game of Water Jeopardy at their respective Children's Water Festivals. The Town of Bernalillo used funding to complete its Water Conservation Plan. The City of Española is using funding to complete their Water

Conservation Plan. Bernalillo County Public Works has received another award to help small water districts complete their water conservation plans. The Village of Tijeras has received funding to audit their metering system and replace antiquated meters with more accurate meters. The Madrid Mutual Domestic Water Association also received funding to create a water conservation plan.

In 2015, Reclamation provided technical support for water conservation activities to the Pueblos of San Felipe, Santo Domingo, and Cochiti in the form of laser leveling design, drafting, and inspection. The work includes the conversion of traditional earthen ditches into pressurized underground pipes, including the construction of check valves and measuring devices. This work enables the tribes to irrigate more effectively and efficiently as well as maintain historical water rights while assisting in the preservation of their traditional farming culture.

The WCFSP also supported the Emergency Drought Relief Program by providing technical assistance to the Village of Regina Mutual Domestic Water Association's exploratory drought well project.

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. The purpose of the CWMP is to improve water quality and ecological resilience, conserve water, and to reduce conflicts over water through collaborative conservation efforts in the management of local watersheds.

Reclamation provided CWMP funding to Rio Grande Restoration, Inc., a watershed group which plans to broaden its membership, expand its geographic scope to the entire lower Rio Chama Basin, and rename it the Rio Chama Watershed Partnership.

Title XVI Water Reclamation and Re-use Projects

Under the authority of P.L. 102-575 and P.L. 104-266, Reclamation participates with the cities of Albuquerque and Santa Fe, New Mexico, and El Paso, Texas, in the construction of water reclamation and reuse projects.

City of El Paso

The City of El Paso has been using recycled water since 1961. The City's philosophy is that "every gallon of reclaimed water used to irrigate crops and landscapes or for construction or manufacturing is one gallon of potable water that is saved and does not have to be pumped from our aquifers or treated from the Rio Grande." Reclamation has contributed to El Paso's efforts since 1996 through the Title XVI Program. El Paso currently recycles nearly 2 billion gallons of water per year (~ 6,000 ac-ft per year) through 50 miles of purple pipe.

El Paso prepared a Title XVI feasibility study for rerouting collection system flows that are currently delivered to the Haskell R. Street Wastewater Treatment Plant. The feasibility study was approved by Reclamation and the City of El Paso will begin construction on this project in 2016. The new collection system reconfiguration will then deliver flows to the Fred Hervey

Water Reclamation Plant for treatment and re-use in northeast El Paso. When implemented, this project will recycle an additional 365 million gallons (~ 1,100 ac-ft per year) of water per year.

The City of El Paso has also developed a Title XVI feasibility study for Collection, Storage, Recharge and Recovery of Conserved Source Waters for Advanced Purified Treatment of Reclaimed Water, to reuse wastewater as a possible component of potable supply for the area. El Paso developed an advanced pilot study testing various treatment technologies with varying progressions using actual wastewater. The pilot study informed the findings of the Title XVI feasibility study. El Paso submitted the feasibility report to Reclamation in September 2015 and it was approved on November 8, 2015. The City of El Paso is looking into a Title XVI authorization for the design and construction of this project.

City and County of Santa Fe

The City and County of Santa Fe are developing a Title XVI feasibility study with the intent to use reclaimed water as a component of the water supply by evaluating several augmentation alternatives. The City and County are assessing which of these could optimize the benefit of reclaimed water in terms of environmental and economic sustainability, regional water needs, administrative and legal limitations, and compatibility with existing infrastructure and infrastructure planning efforts. The City and County interfaced with the City of El Paso on its findings on its Title XVI feasibility study. The City and County of Santa Fe Title XVI feasibility study will be completed in 2016.

Upper Rio Grande Water Operations Model

URGWOM is a computational model developed through an interagency effort and is used to simulate processes and operations in the Rio Grande Basin in New Mexico as well track the delivery of water allocated to specific users. 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 accounting, forecasting, flood risk management operations, and management of water in the Upper Rio Grande Basin. URGWOM is used for water accounting on multiple SJ-C Project water contracts and forecasting to simulate daily storage and delivery operations in the Rio Grande Basin. The model is used to complete forecasting of operations for an upcoming year for an Annual Operations Plan (AOP) and for long-term planning studies.

The Technical Team meets approximately monthly, while the Executive and Advisory Committees meet less frequently but at least annually. The URGWOM website (<http://www.spa.usace.army.mil/Missions/CivilWorks/URGWOM.aspx>) is updated with details on recent activities, postings of the latest documentation, and meeting notes.

In 2015, work continued to extend the URGWOM model both upstream and downstream. Initial work developed separate models for Colorado and for the lower Rio Grande. The Colorado model extends upstream from the current URGWOM boundary at the Lobatos gage to Platoro dam on the Conejos River and the Thirty Mile Bridge gage in the Rio Grande headwaters. The Lower Rio Grande model extends downstream from last object in the current URGWOM model,

the Rio Grande at El Paso gage, to Hudspeth County, Texas. The three models were merged in 2015. Initial testing has been successful, and the Tech Team hopes that this model will be ready for use for 2016 Annual Operating Plan runs.

With support from the tech team, Sandia National Laboratories created a monthly time step model, called the Upper Rio Grande Simulation (URGSiM) model, using PowerSim software. The tech team is using that work to inform a new URGWOM monthly timestep model, which can be used to more efficiently complete runs for scenarios that extend over significant periods. In 2015, work focused on how to convert daily time step data into monthly time step, and determining whether developing a new ruleset was preferable to altering the one used in the daily time step model. The team decided to create separate rulesets for daily and monthly time step models, and work continues on this process.

The team also worked on physically based loss rates. Proposed loss rates would be based on estimated evaporation and channel seepage. The focus of the study was in the upper portions of the model, from the Lobatos gage on the Rio Grande to Cochiti Reservoir, and including the Rio Chama. Work this year indicates that current URGWOM loss rates in these reaches are too high, and that they should be primarily based on evaporation, as these are gaining reaches. No changes were made to the existing model because of the ongoing studies in 2015.

Water Accounting Reports Projects

2015 San Juan – Chama Project Water Accounting

The 2015 San Juan – Chama Project water accounting was accomplished using version 6.7.1 of the RiverWare modeling system software and version 6.7 of the URGWOM accounting module. All accounting data and information is stored directly in the final version of the 2015 accounting model. Reclamation consulted with representatives of the NMISC and the USACE, Albuquerque District, to verify accounting data throughout the year. The continued consultation minimized year-end data quality and accounting concerns.

Oracle® Hydrologic Database (HDB)

The Hydrologic Database (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 Reclamation use with RiverWare® models. HDB is an Oracle® relational database application, and includes connections to data sources such as Reclamation's Hydromet, DOMSAT, DSS, and models such as RiverWare. HDB was originally developed at the University of Colorado's CADSWES. The previous AAO HDB instance is now dissolved into a regional, Upper Colorado HDB instance, maintained by Reclamation's Upper Colorado Regional Office as well as through contract with Precision Water Resources Engineering. HDB has been customized by Reclamation consultants and offices for specific office and model requirements. HDB is currently used by Reclamation's Upper and Lower Colorado Regional Offices for joint management of the Colorado River. The Albuquerque Area Office and the El Paso Field Division depend on HDB installations for data storage and retrieval.

Development of water accounting and reporting functionalities for the Upper Colorado HDB installation continued during 2015. Water accounting data is directly transferred from the RiverWare URGWOM Accounting Model to HDB, and from HDB to URGWOM, via an HDB/RiverWare Data Management Interface.

Planned work for 2016 includes continued maintenance of HDB, continuing to back-populate historical data to HDB, and possibly implementing a new version of HDB. Additional Crystal Reports (Version 2011) accounting table reports for internal use and external reporting may be developed, as well as work to automatically update certain accounting tables posted to the internet.

RiverWare®

Numerous improvements to RiverWare® were accomplished during 2015 through multiple contracts (Reclamation and USACE) with CADSWES at the University of Colorado. Work included developing an executable to generate graphical teacup representations of reservoir pool level, work on a Scenario Manager that could be used by stakeholders, enhancements to RiverWare Policy Language, and improving the documentation of some RiverWare-specific methods. An annual report produced by CADSWES summarizes the 2015 improvements to URGWOM and RiverWare. The report is distributed to the user community at their annual meeting.

Evapotranspiration (ET) Toolbox Decision Support System

ET Toolbox was intended to make accurate, real-time ET predictions available to URGWOM for daily water operations model runs. This connection was never developed, but ET Toolbox has nonetheless proven to be a useful tool for water managers within and outside of Reclamation, supplying accurate, real-time ET predictions via a dedicated website, and providing a real-time ET dataset (daily riparian and crop water use estimates, open water evaporation estimates, and rainfall estimates). The ET Toolbox is an extension of Reclamation's Agricultural Water Resources Decision Support (AWARDS) system that provides internet access to high-resolution rainfall and daily crop water use estimates for improving the efficiency of water management and irrigation scheduling. ET Toolbox coverage extends from Cochiti Dam to Elephant Butte Reservoir. ET currently accounts for an estimated 67 percent of the water depletions over this reach of the Rio Grande, including riparian vegetation, irrigated crops, and open water/wet sand evaporation.

The ET Toolbox model processes and predictions are highly dependent on local farm weather station data feeds. Other remote forms of data acquisition are under study, but for the near term significant resources are necessary to update and maintain the data collection and telemetry platforms that feed critical hourly weather data to the Toolbox.

The ET Toolbox daily rainfall and water depletion predictions for the Rio Grande are available to users and water managers at <http://www.usbr.gov/tsc/rivers/awards/Nm2/riogrande.html>

In 2015, a new contract for ET Toolbox support was awarded through Fiscal Year 2016, with

option years through Fiscal Year 2018. In 2015, the following tasks were performed on the ET Toolbox: general development and maintenance, updates to cropping patterns, improvements and simplifications to the data acquisition workflow, and updating ET Toolbox documentation.

In 2016, Reclamation hopes to continue to update cropping pattern information, update documentation to represent all ET Toolbox features, and remove unused components. Some effort will also be spent encouraging MRGCD to update and maintain their weather station network as required for the standardized reference ET method. The site is currently using forecast weather data and the Hargreaves method.

Native American Affairs Programs

Reclamation has numerous projects underway with Pueblos and Tribes. These projects fall under several categories including the Native American Affairs Program, planning, water conservation, water rights settlements, WaterSMART Program, cooperative ventures with other federal agencies, and special projects funded through Congressional legislation.

As part of Reclamation's Native American and other programs, assistance was given to various Pueblos to evaluate and improve irrigation system efficiency. Some of the projects and purchases included concrete lining of farm ditches, terracing, laser leveling, check structures, pipes, culverts, and turnouts. Reclamation is working with the U.S. Department of Agriculture, Natural Resources Conservation Service, on additional irrigation improvements at Taos Pueblo. Reclamation is also working with the Bureau of Indian Affairs on irrigation system improvements for Middle Rio Grande Conservancy District facilities on lands of the six Middle Rio Grande Pueblos.

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 eighteen Rio Grande Pueblos' irrigation infrastructure. The focus will be to obtain increased water efficiency through infrastructure improvements. Upon approval of the study Report by Congress, construction is authorized up to \$6 million per year through FY 2019, not to exceed \$60 million. In FY2015, Congress continued appropriations in the amount of \$1,508,000 toward the study efforts. An additional \$1,500,000 was made available through a fund transfer. These funds were spent on land surveying at various Pueblos to collect data to be used in the study. The anticipated date of the draft study Report is May 2016, after which it will go for review to Reclamation and other Federal agencies before being submitted to Congress.

Funding was also provided to Laguna and Acoma Pueblos for an integrated groundwater and surface water model of the Rio San Jose Basin. The model will be completed over a four year period by the U.S. Geological Survey.

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 (Taos Pueblo) settlement. Title VI, the Aamodt Litigation Settlement Act, authorizes the implementation of the Aamodt (Pojoaque, Nambe, Tesuque, and San Ildefonso Pueblos) settlement. Reclamation is working with the Bureau of Indian Affairs (BIA), the Pueblos, the State of New Mexico, and other involved parties to implement the provisions of these settlements.

Pursuant to Title V of the Claims Resolution Act, Reclamation's Albuquerque Area Office is working on implementing Reclamation's responsibilities under the Taos Pueblo Indian Water Rights Settlement. Under the terms of the Settlement, Taos Pueblo has a recognized right to 11,827.71 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 in order to allow non-Indian water uses to continue.

Over time, the Pueblo would reacquire the forborne water rights through purchase of surface water rights from willing sellers. Reclamation entered into contracts for San Juan –Chama Project water with the Pueblo for 2,215 ac-ft per year, the Town of Taos for 366 ac-ft per year, and El Prado Water and Sanitation District for 40 ac-ft per year.

Once the Settlement Agreement is final and enforceable, Reclamation will administer the Federal and State settlement funds and provide grants to the eligible non-Pueblo entities for the design and construction of mutual benefit projects. These projects will minimize adverse impacts on the Pueblo's water resources by pumping future non-Indian groundwater from wells located farther away from the Pueblo's Buffalo Pasture (a culturally sensitive wetland), mitigating surface water depletion effects, and implementing the resolution of a dispute over the allocation of certain surface water flows between the Pueblo and water right owners in the community of Arroyo Seco Arriba. The overall cost of the settlement is estimated to be \$144 million, of which \$124 million would be paid by the Federal government and \$20 million by the State of New Mexico.

For the Settlement Agreement to become final and effective, seven conditions precedent need to be fulfilled by March 31, 2017. To date, all but one of these have been satisfied: entry of the partial final decree, which has to become final and non-appealable. Implementation of the settlement appears to be on track and, barring unforeseen issues, all of the conditions precedent likely will be fulfilled before the Settlement Agreement's expiration date. The remaining Federal discretionary appropriations were included in the President's FY 2016 budget, and the District Court overruled all of the objections to the partial final judgment and decree on July 30, 2015. During 2016, Reclamation will be working with the mutual benefit projects' parties to begin preliminary design work in support of pending NEPA compliance.

The Aamodt Settlement Agreement provides for settlement of water rights claims in the Pojoaque Basin including claims of the Pueblos of Nambe, Pojoaque, San Ildefonso, and Tesuque; the County of Santa Fe; and the City of Santa Fe. The Secretary, and all other governmental parties,

signed the Settlement Agreement and Cost Sharing and System Integration Agreement on March 14, 2013.

The Aamodt Litigation Settlement Act authorizes Reclamation to plan, design, and construct a Regional Water System (RWS), and establishes several deadlines, including completion of all “conditions precedent” by September 15, 2017, and completion of the RWS by June 30, 2024. The RWS will consist of a water diversion and water treatment facilities at San Ildefonso Pueblo on the Rio Grande, and storage tanks, transmission and distribution pipelines, and aquifer storage and recovery well fields that will supply up to 4,000 ac-ft of water annually to Pueblo and non-Pueblo customers within the Pojoaque Basin. Permits from the New Mexico Office of the State Engineer (NMOSE) will be obtained to divert and consume the water supply for the RWS. The Pueblo water supply includes 1,079 ac-ft of SJ-C Project water, 1,141 ac-ft of “Top of the World” water rights that BIA acquired from the County of Santa Fe, and 302 ac-ft of Nambé reserved water rights that are being purchased from the Pueblo of Nambe.

The SJ-C Project repayment contract with the four Pueblos was executed on January 21, 2016. There was one public negotiating meeting regarding this contract on November 4, 2015. Three separate applications to transfer these water rights were filed with the NMOSE in January 2015. Reclamation completed its feasibility design and related cost estimates for the RWS in December 2015. Reclamation and the 11 cooperating agencies have developed five alternatives to be analyzed in the EIS and the draft is scheduled for release in November 2016.

Quagga and Zebra Mussel Update

Quagga and zebra mussels (*Dreissena rostriformis bugensis* and *Dreissena polymorpha*) are invasive, freshwater, bivalve mollusks (Figure 9). Originally from Eurasia, zebra mussels were first introduced in the Great Lakes in the mid-1980s and have spread to the Western United States. A single female mussel can produce hundreds of thousands of eggs a year, which produce microscopic, swimming larvae (veligers). These veligers spread in numerous ways, mainly by floating in the currents of the water body or by hitching a ride on a boat or other water vessels that are used in infested water and then transported to another water body. Once they reach their settling stage, the veligers attach to hard surfaces and continue to grow. They clump onto these hard surfaces, clogging infrastructure and damaging operation and maintenance for water storage, water delivery, and hydropower structures and systems; recreational use; and aquatic ecosystems (Source: <http://www.usbr.gov/research/docs/ks/ks-2015-04.pdf>)



Figure 9. Adult zebra and quagga mussels. Source: U. S. Geological Survey, http://nas.er.usgs.gov/taxgroup/mollusks/zebramussel/zebra_gallery.aspx

Because Reclamation believes that preventing the spread of mussels is the least costly option for protecting the state's water bodies and Reclamation infrastructure, it is assisting with, providing resources for, or directly engaged in the following:

Outreach: Reclamation's Albuquerque Area Office has engaged in public outreach effort since 2009, printing some 41,000 'Zap the Zebra' brochures and 1,000 mussel posters. These brochures and posters that have been dispersed throughout New Mexico at the state parks, convenience and sporting good shops, libraries, etc. Permanent signs with the "Stop Aquatic Hitchhikers!" message have been installed at boating docks and other key park locations that are under Reclamation's jurisdiction.

Watercraft Monitoring and Decontamination: Reclamation does not have a direct role in watercraft monitoring and decontamination in New Mexico; however, Reclamation supports these activities primarily by providing equipment and contractual support. Reclamation utilizes up to five mobile decontamination units for Aquatic Invasive Species (AIS) inspections; two are permanently assigned to Elephant Butte Reservoir (generally stationed near Marina del Sur), and at Navajo there are two mobile units on the Colorado side (large and small) and one mobile unit on the New Mexico side. There is one permanent decontamination station at Navajo State Park, Colorado and one unimproved decontamination station at Navajo Lake State Park, New Mexico (Pine River Recreation Area). Seven mussel decontamination station locations have been designated at the following reservoir locations: Heron, El Vado, Elephant Butte Main Entry, Elephant Butte Hot Springs, Sumner, and two sites at Brantley. Funding shall determine if any of these facilities are built.

Reclamation is currently reviewing a solicitation for AIS Inspection Services in FY 2016. The expectation is to receive proposals by end of January 2016. The objective of this contract is to protect Elephant Butte Reservoir and Navajo Reservoir from AIS introduction through:

- Watercraft inspections for watercraft entering Navajo and Elephant Butte Reservoirs.
- Decontamination of watercraft considered “high risk,” as defined by NMDGF.
- As needed, coordination with NMDGF or other law enforcement for issuance and removal of red warning tags, etc.

Reclamation Reservoir Monitoring: Since 2008, Reclamation has been sampling seven of its New Mexico reservoir bodies (Navajo, Heron, El Vado, Elephant Butte, Caballo, Sumner, and Brantley) for mussels and processing these water samples through Reclamation’s research lab (Reclamation Detection Laboratory for Exotic Species or RDLES) in Denver, CO. RDLES performs microscopy on all water samples. Microscopy techniques use a dissecting microscope equipped with cross-polarized filters that create a black background and causes the calcium carbonate of the veliger shell to glow as light passes through the filters (Johnson 1995, Reclamation 2013). Some portion of the shell will fall in line with the axis of the cross polarizing filters creating a distinctive Maltese cross pattern on the shell. The Maltese cross pattern is the main identifying feature for veliger identification. A polarized filter is utilized to view the distinctive “cross” that confirms the specimen is either a zebra or quagga mussel.

Polymerase Chain Reaction (PCR) testing (Johnson 1995, Reclamation 2013) is performed on samples from all water bodies that have ever had positive microscopy. All positive PCR results will be sent for gene sequencing to verify species (quagga or zebra) using deoxyribonucleic acid. RDLES provides remaining bulk water samples for independent lab testing, which most States (including New Mexico) require prior to water body classification. RDLES positive results may be confirmed by:

- Microscopic photos (using scanning electron microscopes) are taken and verified by dreissenid mussel experts in independent labs.
- Positive microscopic results verified with positive PCR results.
- Positive microscopic results with positive PCR results verified with gene sequencing.

State Aquatic Invasive Species coordinators routinely request independent lab verification of RDLES test results, which may or may not confirm Reclamation test results:

- Microscopy results agreed upon/not agreed upon
- PCR results replicated/not replicated
- If PCR results replicated, then gene sequencing replicated/not replicated.

Each State has its own definition of what constitutes a positive water body and the action it takes to manage the water body is dependent upon its definition. In New Mexico, the NMGF is responsible for designating a water body’s status for invasive mussels using waterbody designations created by western states AIS coordinators, including: status unknown,

undetected/negative, inconclusive, suspect, and positive (USFWS 2013).

Reclamation does not make water body designations; however, it does make notifications of all positive test results for a water body. All of RDLES confirmed test results are posted to the Reclamation Mussel SharePoint Database and that data is available to designated State and Reclamation employees. Reclamation follows standard operating procedures and quality control and assurance practices, which are documented and available on the Reclamation Mussel internet site at: <http://www.usbr.gov/mussels/index.html>.

Reclamation continues to sample seven of its New Mexico reservoir bodies under the RDLES' direction. Represented below is the respective reservoir, total number of tests sites, the total number of months over which the tests were conducted, associated PCR test results and Microscopy test results (Table 13).

Table 13: 2015 AIS sampling results for seven Reclamation Reservoirs in New Mexico.

Water-body	Number sites sampled	Microscopy Results	PCR Results
Navajo Reservoir	25	1 sample positive (91 veligers)	2 samples positive
Heron Reservoir	7	Negative for all	Negative (1 tested)
El Vado Reservoir	11	Negative for all	Negative for all
Elephant Butte Reservoir	12	Negative for all	Negative for all
Caballo Reservoir	4	Negative for all	Not tested
Sumner Reservoir	10	Negative for all	Negative for all
Brantley Reservoir	12	Negative for all	Negative (1 tested)
Farmington Lake	9	Negative for all	Not tested

In 2015, RDLES had positive microscopy and PCR for samples taken at Navajo Reservoir (Table 13), in the vicinity of Simms Marina. Monitoring samples collected by NMDGF throughout the 2015 monitoring season near Simms Marina and other locations within Navajo Reservoir did not result in a positive result for zebra or quagga mussels. Subsequent inspection of the anchored structures in and around Simms Marina (facilitated with Dive Teams) by NMDGF and Colorado Parks and Wildlife did not reveal adult mussel presence. Using waterbody designations created by the Western Regional Panel and the Navajo Reservoir Incident Rapid Response Plan for Dreissenid Mussels (Dominguez and Patten, 2014), NMDGF has re-designated Navajo Reservoir as inconclusive for invasive mussels. NMDGF is planning an increased monitoring effort at Navajo Reservoir during the 2016 monitoring season. Factors that may contribute to a lack of mussel occupation in New Mexico reservoirs include a fast spring run-off coupled with high levels of suspended solids, rapid drawdown of reservoir waters and canals, and ongoing drought (D. Hosler, *pers. comm.*). Continued vigilance is important, as conditions more suitable to AIS establishment may occur in the future.

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Non-Federal Hydroelectric Power Development

The Town Sites and Power Development Act of 1906 and the Reclamation Project Act of 1939 (1939 Act) authorize Reclamation to enter into Lease of Power Privilege (LOPP) contracts with non-Federal entities to use Reclamation facilities for electric power generation consistent with Reclamation project purposes. Reclamation published *Hydropower Resource Assessment at Existing Reclamation Facilities Draft Report*, which indicates that it may be economically feasible to develop the hydropower potential at Caballo Dam and at the drop structures within the SJ-C Project. Title to those Reclamation facilities, and any modifications to those facilities, remains with the United States. Title to any installed power plant facilities is with the lessee, unless legislated or contracted otherwise.

Hydroelectric Power Development at Caballo Dam

Reclamation processed the award of a Preliminary Lease and Funding Agreement to HydroPower Capital. This agreement was signed by the Regional Director for the Upper Colorado Region on November 11, 2012, and HydroPower Capital signed this agreement on November 19, 2012. Reclamation has requested the necessary information from HydroPower Capital to set up a federal account to receive funds from HydroPower Capital for the development of the LOPP. HydroPower Capital has not yet provided this information. Attempts have been made to contact HydroPower Capital without success.

Hydroelectric Power Development on Azotea Tunnel Outlet

Reclamation has been requested to develop hydropower on the Azotea Tunnel and possibly other drop structures associated with the SJ-C Project. Reclamation and FERC have resolved jurisdiction and Reclamation will proceed to develop hydropower on the SJ-C Project. A Federal Register Notice was prepared and published on August 7, 2013. The 150 day period for submitting proposals ended on January 6, 2014.

Only one proposal was received by this deadline from ABCWUA, which would qualify as a preference entity under PL 113-24. Review of the proposal resulted in a request from Reclamation for ABCWUA to clarify the proposal with additional information. Reclamation requested the information by April 7, 2014. The follow up information was provided and subsequently approved by Reclamation. Reclamation is currently working on a draft Preliminary Lease and Funding Agreement with ABCWUA to initiate the LOPP process for the SJ-C Project. ABCWUA is still working on coordinating funding and logistics for the project.