RECLAMATION

Managing Water in the West

Calendar Year 2009 Report to the Rio Grande Compact Commission

Colorado	New Mexico	Texas
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Federal Chairman
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U. S. Department of the Interior
Bureau of Reclamation
Albuquerque Area Office
Albuquerque, New Mexico

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Cover photo – Azotea Tunnel outfall, taken May 2009.

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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 ground water salvage project located near Alamosa, Colorado, which pumps water from the shallow unconfined aquifer.

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 and 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 entails 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 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, Mesilla, and Riverside Diversion Dams. The Project resides in 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 1906 Treaty 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 provides generation of 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 operating agreement.

This background generally does not change from year to year.

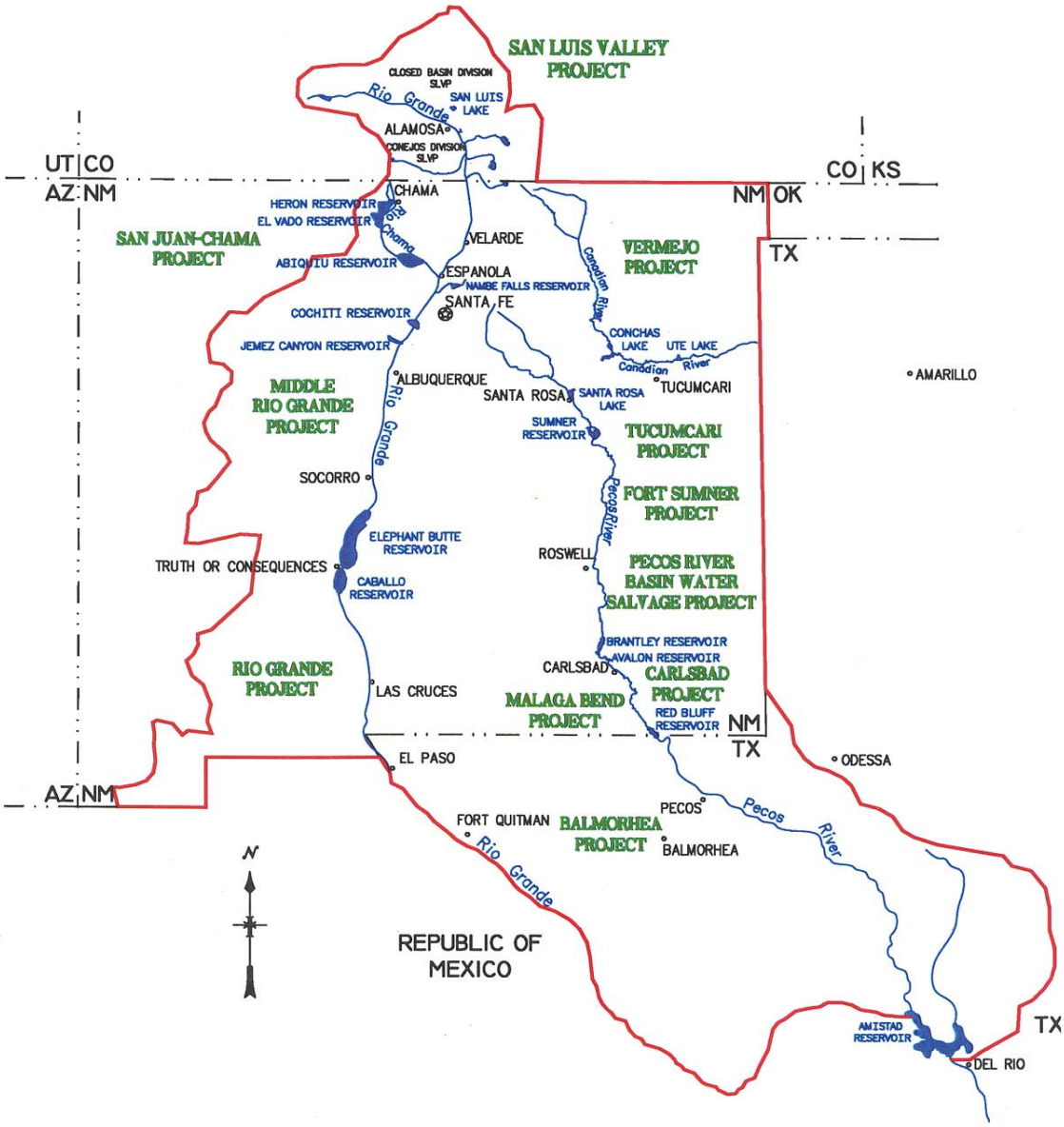

Figure 1: Project Map of Reclamation's Albuquerque Area Office

San Luis Valley Project, Colorado

Conejos Division, Platoro Reservoir

The Conejos Water Conservancy District (CWCD) operates Platoro Reservoir, which provides storage for the San Luis Valley Project (Figure 2). The Conejos Water Conservancy District's office is located in Manassa, Colorado.

Platoro Reservoir began January 1, 2009, at elevation 9977.97 feet AMSL, with a content of 17,246 ac-ft. The September 30, 2009, elevation was 10,001.5 feet, with a content of 32,016.0 ac-ft. Of that content, 1,697.9 ac-ft was direct-flow storage (re-regulated water that was evacuated by the end of October 2009), and 0 ac-ft of Compact water. December 31, 2009, data were: elevation 9,997.94 feet, with a storage content of 29,518.5 ac-ft – 472.6 ac-ft of Compact water remained in storage.

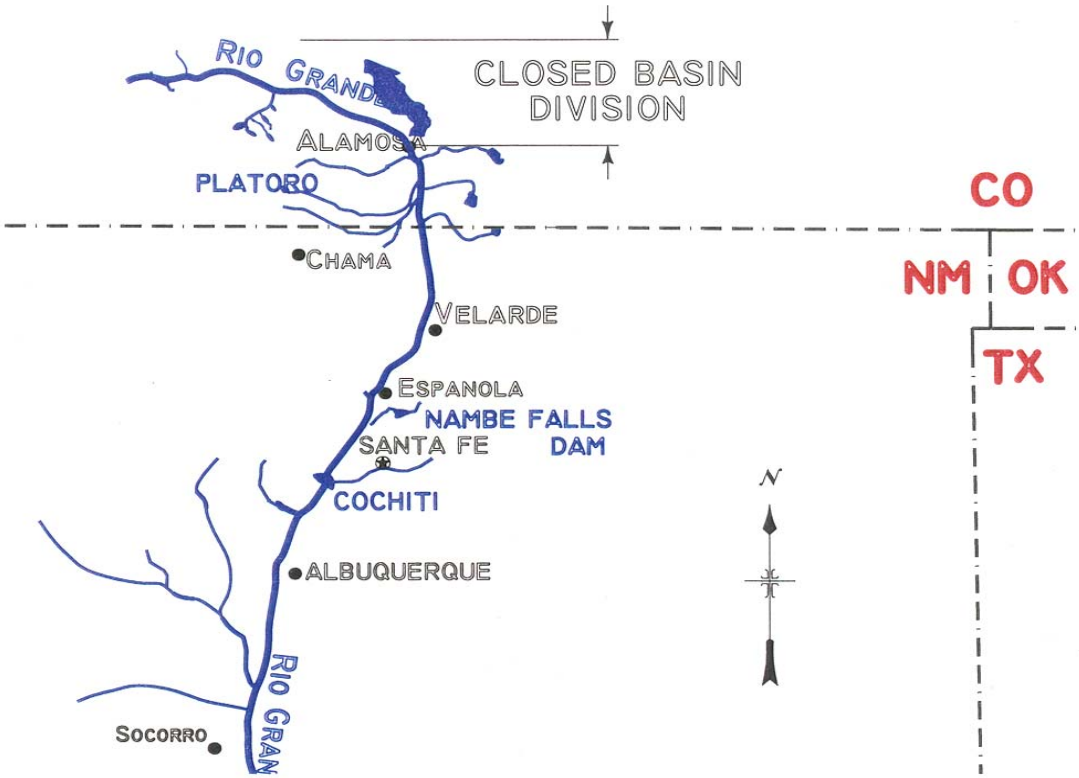

Figure 2: Area Map of San Luis Valley Project

Platoro Dam Facility Review and Safety of Dams Programs

In 2009, the following activities were implemented for Platoro Dam:

- The "transitional areas," at the guard-gate and existing butterfly valves, both upstream and downstream, still contain high levels of lead base paint that exceed Environmental Protection Agency tolerances. The butterfly valve area could be resolved in 2011 by replacing the existing gates with jet-flow gates.

  The Bureau of Land Management was able to provide the Albuquerque Area Office with a one-time funding source of $50,000 to help Reclamation design and layout specifications and scope of work for replacing the existing butterfly valves with jet-flow gates.

- Congressman John Salazar (Colorado) has written in $600,000 to assist the district in resolving some of their safety concerns. The funding will be used to design and fabricate a stop-log gate, enabling Reclamation staff to conduct an upper conduit inspection, with an inspection of the upstream side of the filler-line and guard gate.

- CWCD also hired a contractor to cut the existing woody debris into one foot sections, leaving the remains in place.

- The annual inspection was completed in October of 2009, concluding that the dam is in good and functional operating condition. The Facility Rating Review (FRR) was completed with no major issues.

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 of the project is to salvage unconfined ground water from the Closed Basin that would otherwise be lost to evaporation and evapotranspiration. The salvaged water is pumped from 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 provides for the delivery of mitigation water to the Alamosa National Wildlife Refuge and Blanca Wildlife Habitat Area, and stabilization of 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. A Review of Operations and Maintenance examination (RO&M) was conducted in October of 2005. The next RO&M examination is scheduled for 2011.

Closed Basin – Operations and Maintenance

Operations

Closed Basin water deliveries in Calendar Year (CY) 2009 included deliveries to the Rio Grande, Blanca Wildlife Habitat Area, Alamosa National Wildlife Refuge, and San Luis Lake to help stabilize the lake elevation.

A total of 17,360 ac-ft of project water was delivered in CY2009. Total deliveries of Compact water to the Rio Grande for CY2009 were 13,741 ac-ft. Total water deliveries to the Bureau of Land Management (BLM) Blanca Wildlife Habitat Area for CY2009 were 800 ac-ft for annual mitigation and 250 ac-ft for a Colorado Division of Wildlife (CDOW) exchange. Total water deliveries to the Alamosa National Wildlife Refuge for CY2009 were 2,569 ac-ft for annual mitigation.

Natural inflows to San Luis Lake (SLL) are measured by the SLL inlet flume or estimated at the spillway and culverts. Natural inflow to SLL during CY2009 totaled 2907 ac-ft. Of the 366 ac-ft delivered to SLL via the Feeder Canal, 226 ac-ft was Closed Basin Project production and 140 ac-ft was through an exchange with the CDOW. This exchange was Weminuche Trans-mountain water from Rio Grande Reservoir. The Closed Basin Project is storing this 140 ac-ft for CDOW.

Closed Basin Division water accounting for the 2009 calendar year is summarized in Table 1.

Table 1: San Luis Valley Project - Closed Basin Division Water Accounting (units are acre-feet)

San Luis Valley - Closed Basin Division	BLANCA WILDLIFE HABITAT AREA			PARSHALL FLUME		ALAMOSA NATIONAL WILDLIFE REFUGE (ANWR)				DELIVERY TO THE RIO GRANDE			PROJECT TOTALS
MONTH	CH03 STA. 730 + 00	CH04 STA. 798 + 00	MONTH TOTALS	TOTAL PASSING FLUME	CREDIT-ABLE AMOUNT AT FLUME	CH01 CHICAGO TURN-OUT	CH02 MUM. TURN-OUT	PUMPING PLANT	MONTH TOTALS	TOTAL AT FLUME MINUS DEL. @ ANWR	Credit Amt. Del. To R.G. & not used by ANWR	NON-CREDIT-ABLE AT LOBATOS	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
JANUARY	0	0	0	1,650	1,650	0	0	0	0	1,650	1,650	0	1,650
FEBRUARY	0	0	0	1,553	1,553	0	0	0	0	1,553	1,553	0	1,553
MARCH	0	0	0	1,694	1,694	420	434	249	1,103	591	591	0	1,694
APRIL	0	0	0	1,678	1,678	29	262	0	291	1,387	1,387	0	1,678
MAY	0	0	0	1,692	1,692	0	0	0	0	1,692	1,692	0	1,692
JUNE	3	5	8	1,513	1,513	0	0	0	0	1,513	1,513	0	1,521
JULY	118	214	332	1,174	1,174	0	0	34	34	1,140	1,140	0	1,506
AUGUST	133	239	372	868	868	0	0	0	0	868	868	0	1,240
SEPTEMBER	96	135	231	1,273	1,273	0	155	38	193	1,080	1,080	0	1,504
OCTOBER	48	59	107	1,212	1,212	127	277	67	471	741	741	0	1,319
NOVEMBER	0	0	0	664	664	243	225	0	468	196	196	0	664
DECEMBER	0	0	0	1,339	1,339	5	4	0	9	1,330	1,330	0	1,339
ANNUAL	398	652	1,050	16,310	16,310	824	1,357	388	2,569	13,741	13,741	0	17,360

The project continues to provide Priority 1 (Compact) and Priority 2 (Mitigation) water deliveries. The San Luis Valley is in the midst of a severe drought and 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 Hydrologist in 2007 remained off in 2008 and 2009.

The 2008 annual report on vegetation monitoring within the project boundary summarized that, in some areas, an average of 1,127 acres within the project boundary indicated a significant decrease in vegetation from the pre-project baseline. Much of this amount is known to be attributed to factors other than project pumping. This amount is far less than the 8,460 acres that were predicted in the Final Environmental Impact Statement, and subsequently mitigated. In some areas, an average of 787 acres within the project boundary indicated a significant increase in vegetation from the pre-project baseline.

The United States Geological Survey's (USGS) Pueblo Colorado Office continues to provide quality assurance/quality control (QA/QC) of the observation wells' network data for Reclamation. Reclamation received an excellent rating through the 2009 QA/QC program.

Maintenance

Routine preventive maintenance and repair activities continued at salvage and observation well sites, canal structures, pumping plants, and shelterbelts. Other work included aquatic and noxious weed control, rodent control, and ice removal.

A total of three replacement wells were drilled in 2009. This low number was the result of several malfunctions in our newly refurbished drill rig. We have permits for five more wells in 2010, and the drill crew believes they can drill more than that. These replacement salvage wells range from 100 gallons per minute (gpm) to 500 gpm. With the different well screen design and change in the gravel pack style, these wells continue to prove that the re-drills have been very successful to the project and the commitment to the Rio Grande Compact, the Alamosa National Wildlife Refuge, and the Blanca Wildlife Habitat Area. A total of 53 salvage wells have been re-drilled from 2002 through 2009.

The Fish & Wildlife Service requested a quote to re-drill two wells at the Baca National Wildlife Refuge. They were given a quote, which they accepted. The wells will be drilled in the spring of 2010.

Repair and replacement of pumps and motors in the salvage wells' vaults is an ongoing process. The maintenance crew will continue to chemically treat salvage wells in our rehabilitation efforts in 2010. Annual preventive maintenance of salvage wells is ongoing as well as maintenance on the lateral valves.

Over the last 18 months, Reclamation has undertaken a program to improve salvage well efficiency, by increasing salvage well yield while reducing pump energy consumption and cost. The improvement in salvage well efficiency is being achieved by:

1. Designing pumps to maintain a higher pumping water level in re-drilled wells. This requires smaller pumps and energy use, because the water lift requirement is reduced. This will also maintain well efficiency over a longer period of time. The decreased rate of pumping slows down the processes of bio-fouling and plugging of the gravel pack with fine sand particles.

2. Rehabilitation of existing wells. A combination of brushing, surge blocking, and an acid treatment is used to maintain or improve salvage well yield.

3. Improvement in monitoring and measurement techniques. Great improvements have been made in the measurement and monitoring of salvage well flow and drawdown, and pipeline pressure. By having good measurement of these parameters the most efficient pump can be selected for each well.

Energy savings realized so far has been approximately $300,000.

Equipment has been updated with a 10 yard dump truck, wheeled excavator, downhole camera, 18' equipment/utility trailer. The drill rig was also completely refurbished and mounted on a new cab and chassis.

Water Quality

Water quality monitoring of Closed Basin Division salvage wells, the Rio Grande, San Luis Lake, Head Lake, and the conveyance channel continued throughout 2009. In addition to the standard water quality parameters, dissolved oxygen, nitrogen, and carbon dioxide continue to be monitored to assist canal grass carp survival studies and dissolved nitrogen reduction endeavors. This work is conducted in cooperation with Reclamation's Denver Technical Service Center personnel.

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.

The laboratory has the capability to culture and identify "iron related bacteria" to support salvage well rehabilitation and bio-fouling mitigation efforts. All salvage wells are currently monitored for the presence of these bacteria.

Rio Grande Water Conservation District

The Rio Grande Water Conservation District (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. Three wells have been replaced during 2009 and numerous

others were treated and rehabilitated.

San Juan-Chama Project, Colorado – New Mexico

Reclamation's Albuquerque Area Office Water Management Division continued to maintain its internet web page for Middle Rio Grande Water Operations during 2009. This web site provides the current year's monthly data for the operation and water accounting of the San Juan-Chama Project. To reach the internet web page, type http://www.usbr.gov/uc/albuq/water/ into a web browser. An area map of the San Juan-Chama Project is provided below in Figure 3.

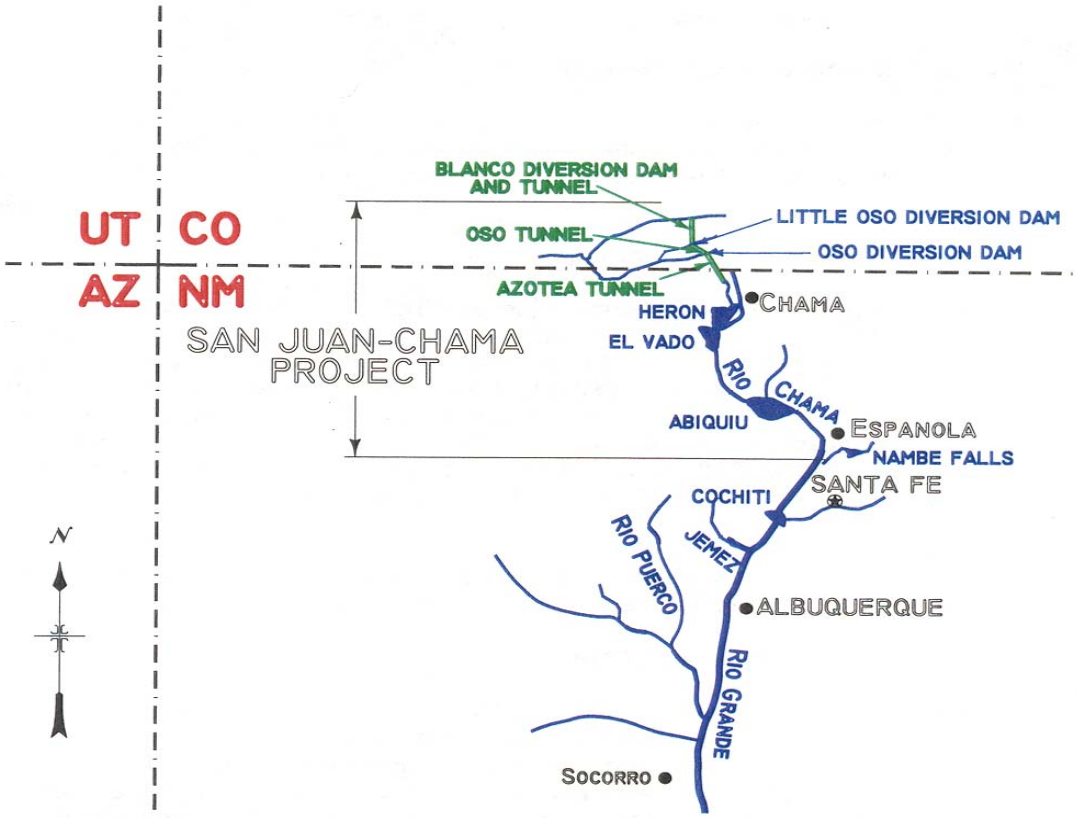

Figure 3: Area Map of the San Juan-Chama Project

San Juan-Chama Project Accounting

Water diverted from the San Juan Basin in Colorado through the San Juan Chama Project authorized by Congress in 1962 through 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 fully consumed in New Mexico.

Reclamation is responsible for water contracts and accounting for the San Juan Chama Project.

Historically, accounting was accomplished with Fortran code models, which were replaced by reports produced via a Lotus® electronic file spreadsheet around 1993. A Microsoft Excel® version of the Lotus® spreadsheet was developed around 2004, at about the time a RiverWare® accounting model was constructed. The Fortran models and Lotus® spreadsheet captured and implemented the approved Compact methods of accounting until 2008, when an Excel® spreadsheet, developed to capture and implement approved Compact methods, replaced the unsupported Lotus® spreadsheet and was used to produce the final accounting document. Improvements to the RiverWare® accounting model using the hydrologic database (HDB) for data storage and Crystal Reports® for report generation allowed side-by-side comparison of accounting tables produced independently by Excel® and the RiverWare® accounting model/HDB/ Crystal Reports® method with favorable results. Reclamation intends to use the RiverWare® accounting model/HDB/ Crystal Reports® method in the future, but will continue side-by-side comparison accounting between the Excel® spreadsheet and Crystal Reports® output tables in 2010. San Juan Chama Project accounting for 2009 is provided in the separate report *2009 Water Accounting Report*.

San Juan-Chama Diversion Dams and Tunnels

Initial diversions for the San Juan Chama Project begin in Colorado at the Blanco, Oso, and Little Oso diversion dams, depicted on Figure 3. Operation begins with the spring runoff, and maintenance occurs in the fall, when the intake forebay areas and associated structures are dredged and cleaned to allow unobstructed access to the associated tunnels. The Azotea Tunnel collects diversion flows for transport to the outfall at Willow Creek above Heron Reservoir.

As a requirement of the Corps of Engineers 404 program, permits for maintenance at the Blanco and Oso Diversion Dams were acquired, and are available at the Albuquerque Area Office and Chama Field Division Office. The permits expire December 1, 2011, and require an annual reporting of any maintenance that was accomplished for that year, including sediment removal, bank stabilization, and maintenance of the diversion dams and associated infrastructure.

In 2009, a sluice gate malfunctioned at the Oso Diversion and allowed a sediment discharge downstream. Reclamation received a notice of violation from the Corps of Engineers. Reclamation is responding to the notice and working to correct sluice gate programming that caused the discharge. Reclamation also worked with downstream landowners to repair the effects of the discharge.

Heron Dam and Reservoir Operations

(All elevations are 1929 NGVD, storage reference is 1987 ACAP survey – new survey scheduled for 2010)

Diversions into the Azotea Tunnel began on February 12 and ended on September 14 during 2009. The total volume diverted through the tunnel was 105,355 ac-ft. The running 10-year average Azotea Tunnel diversion decreased slightly this year, from 90,518 ac-ft for the period 1999 through 2008 to 89,163 ac-ft for the period of 2000 through 2009 (Table 2). Heron Reservoir began the year at an elevation of 7155.52’ (243,441 ac-ft), which was also the lowest

point in the year, and finished the year at an elevation of 7157.45' (252,110 ac-ft). Storage peaked on July 12 at an elevation of 7175.86' (343,453 ac-ft).

Table 2: SJ-C Project - Diversions through Azotea Tunnel (units are acre-feet)

AZOTEA	YEAR										10 YEAR TOTAL
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
MONTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
JANUARY	0	0	0	0	0	0	0	0	0	0	0
FEBRUARY	0	0	0	0	0	93	0	179	0	272	544
MARCH	536	1,512	743	1,170	11,505	1,931	706	12,976	4,745	5,938	41,762
APRIL	15,864	19,284	4,499	11,366	15,427	31,721	17,799	17,745	25,816	19,111	178,632
MAY	20,987	51,092	865	26,613	30,164	45,146	25,674	33,837	44,461	51,766	330,605
JUNE	5,019	29,283	204	18,816	20,390	50,210	7,600	26,679	47,463	23,544	229,208
JULY	106	4,643	0	669	2,139	13,347	3,785	4,302	13,428	4,392	46,811
AUGUST	229	4,455	0	487	237	3,779	4,868	7,375	2,606	232	24,268
SEPTEMBER	0	313	0	3,340	1,973	3,360	5,567	1,948	1,465	99	18,065
OCTOBER	0	0	0	246	1,821	4,873	12,795	33	0	0	19,768
NOVEMBER	0	0	0	0	1,218	735	0	0	0	0	1,953
DECEMBER	0	0	0	0	12	0	0	0	0	0	12
ANNUAL	42,741	110,582	6,311	62,707	84,886	155,195	78,794	105,074	139,984	105,354	891,628
								TEN YEAR AVERAGE =			89,163

The SJ-C contractors' 2009 and waivered 2008 annual allocations were delivered as shown in Table 3, for a total delivery in 2009 of 89,169 ac-ft. The remaining 2009 allocations are being held in Heron according to waivers which grant an extension for the delivery date for several contractors into 2010. Table 4 presents actual monthly Heron water operations for the 2009 calendar year.

Table 3: SJ-C Project – Water Deliveries from Heron Reservoir (units are acre-feet)

SJ-C HERON RELEASE / MONTH	MRGCD	SANTA FE	SANTA FE COUNTY	COCHITI	CITY OF ALBUQUERQUE	POJOAQUE 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	UNCON-TRACTED	TOTAL
ALLOCATION	20,900	5,230	375	5,000	48,200	1,030	400	1,200	1,000	15	400	400	500	60	6,500	2,000	2,990	
JANUARY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FEBRUARY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MARCH	0	0	0	42	0	130	0	0	34	0	0	0	12	0	0	0	0	219
APRIL	0	0	0	0	0	199	0	0	0	0	0	0	0	0	0	0	0	199
MAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JUNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JULY	0	0	0	0	2,698	0	0	0	0	0	0	0	0	0	0	0	0	2,698
AUGUST	0	0	0	0	21,564	0	0	0	0	0	0	0	0	0	0	0	0	21,564
SEPTEMBER	0	8,230	375	89	23,126	0	400	1,200	871	15	331	350	470	60	3,000	2,000	2,990	43,507
OCTOBER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NOVEMBER	10,610	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10,610
DECEMBER	10,290	0	0	0	0	81	0	0	0	0	0	0	0	0	0	0	0	10,372
2009 CY TOTAL	20,900	8,230	375	132	47,388	411	400	1,200	905	15	331	350	482	60	3,000	2,000	2,990	89,169

Table 4: 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)
MONTH	RIO GRANDE	SAN JUAN CHAMA	RIO GRANDE	SAN JUAN CHAMA		RIO GRANDE	SAN JUAN CHAMA	TOTAL	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DEC. 2008						682	242,759	243,441	7,155.52
JANUARY	429	0	120	0	0	991	242,759	243,750	7,155.59
FEBRUARY	461	272	108	0	0	1,344	243,031	244,375	7,155.73
MARCH	3,551	5,926	3,694	219	0	1,201	248,738	249,939	7,156.97
APRIL	1,797	19,073	2,998	199	784	0	266,828	266,828	7,160.64
MAY	134	51,662	134	0	274	0	318,217	318,216	7,171.08
JUNE	465	23,497	138	0	1,172	326	340,543	340,868	7,175.38
JULY	462	4,383	344	2,698	1,424	443	340,805	341,248	7,175.45
AUGUST	143	232	143	21,564	151	443	319,321	319,764	7,171.38
SEPTEMBER	130	99	224	43,507	1,118	349	274,795	275,145	7,162.40
OCTOBER	128	0	128	0	668	349	274,127	274,477	7,162.26
NOVEMBER	123	0	123	10,610	1,008	349	262,510	262,859	7,159.79
DECEMBER	123	0	123	10,372	378	349	251,761	252,110	7,157.45
SUB-TOTAL	7,946	105,145	8,278	89,169					
ADJUSTMENT						-350	(A)		
ANNUAL		113,091		97,447	6,975	-1	252,111	252,110	

Acknowledgment

Reclamation acknowledges release and elevation determination issues in 2009 at Heron and El Vado Dams. The following text describes the issues and corrections to annual accounting.

Data Issues

While the major source of error for Heron releases was determined and corrected early in 2009, a minor source of error remains. The error is related to the interpretation of metrics on an analog chart. Skilled precision following the SOP using the Heron Dam Outlet Works Discharge Curves Diagram, relating lake stage, gate opening and release, still results in minor release inaccuracies, due to the analog nature of the process and the lack of precision to tenths of a percent of gate openings in the diagram itself. Reclamation continues to pursue a digital method to replace the current analog based SOP. The same release precision issue exists at El Vado for the same reason. While El Vado has a downstream gage, disagreement regarding which reported release value was correct persisted until Reclamation and USGS synchronized gage rating tables.

Reclamation found that the El Vado data errors were two-fold. First, the lake elevation recorder was sticking occasionally, possibly due to a plugged or partially plugged communication pipe. Secondly, there was a misunderstanding between the Chama Field Office and the USGS regarding the gage rating table version in use. Appropriate action was taken to remedy both issues (the stilling well was flushed and surged to clear foreign material, and is being monitored

and flushed regularly, and the current shift rating table was acquired for use) and currently El Vado Reservoir is operating properly.
A summary of actions taken by the Reclamation Chama Field Office and Albuquerque Area Office are as follows:

- End-of-Month elevation surveys at Heron and El Vado.
- More frequent (weekly now, previously every six-months) flushing/surging of still well and communication pipe.
- Current USGS "Blw El Vado" gage rating table chart in use.
- Monthly review of the Accounting Model data with ISC and the COE.
- State and COE supported data revisions when erroneous data is reported due to mechanical malfunctions, typographical errors, or other sources.

For previous Heron issues, there were several outstanding actions that were completed in the beginning of 2009 – these actions are listed below:

- Gate opening displays at the Heron Dam facility re-programmed to read tenths decimal place for greater accuracy in reporting and operating.
- Continuing review of RTU/SCADA system software and code to ensure proper calculations and reporting.
- Rating of the new USGS stream gauging station just downstream of Heron Reservoir continues.

Accounting
Accounting in 2009 was impacted by several issues, as previously described. In addition, incorporation of the new (2007) El Vado Sediment Survey Report and ACAP tables resulted in a gain in reported storage at El Vado. 'Extra' water was assigned to the native Rio Grande account on January 1, 2009.

The second issue is that there were numerous instances of inaccurate lake level readings reported from March through September at El Vado, in conjunction with differences in reported release values between Reclamation and USGS. The issue is compounded by potential data revisions by USGS outside the end-of-month review window, currently practiced to assure ongoing accounting model data integrity and accounting accuracy. Chama office-reported release data was used instead of USGS gage data for the period of disparate data values.

Reclamation believes all issues have been reconciled, with correct final values entered into the RiverWare® Accounting model, resulting in correct 2009 final accounting values being reported.

Heron Dam Facility Review and Safety of Dams Programs

The following work was completed for Heron Dam during 2009:

- Facility Reliability Rating (FRR) was completed with no major issues.

- A new Emergency Action Plan (EAP) was prepared and a tabletop exercise is scheduled for early 2010.
- The annual site and security exams were completed.
- The annual EAP Review, Drill, and Communication Directory update was completed.
- The last embankment point survey was completed and placed on stand-by, to be surveyed only when requested from the Technical Service Center in Denver.
- The final Comprehensive Security Review (CSR) report was completed by Denver.
- The Standing Operating Procedures (SOP) is scheduled for revision in 2010.

Pojoaque Tributary Unit - Nambé Falls Dam and Reservoir

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

Nambé Falls began 2009 with the reservoir at elevation 6,822.85 feet, providing a storage volume of 1,712 ac-ft. During the winter, releases averaged around 1 ft^3/s to maximize conservation storage as agreed to by the Pojoaque Valley Irrigation District and Native American water users. The reservoir filled and spilled in 2009. The maximum elevation for the year was 6,826.83 feet (1,933 ac-ft) on May 23. The reservoir filled (elev. 6826.6 feet) on March 21, 2009, and remained full until July 12, 2009, when irrigation releases began and reservoir storage and elevation started falling. Nambé Falls Reservoir ended 2009 at elevation 6,819.20 feet (1,525 ac-ft).

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 ft^3 is stored until an elevation of 6,825.60 feet is reached. Once an elevation of 6,825.60 feet 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.

A net depletion of 542 ac-ft was calculated for Nambé Falls operations for the entire year. The depletion amount (plus transportation loss) was released from Heron and Abiquiu reservoirs during March, April, and December of 2009. Table 5 provides a summary of Nambé Falls use above Otowi, and the Pojoaque Unit return flow credit used to calculate depletions during 2009. A summary of 2009 Nambé Falls reservoir operations is provided in Table 6.

Table 5: SJ-C Project – San Juan-Chama Water at Otowi (units are acre-feet)

SJ-C AT OTOWI MONTH	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
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
JANUARY	0	0	3,089	3,089	1,746	77	136	18	4,640
FEBRUARY	0	0	0	0	572	5	61	16	522
MARCH	219	0	0	219	419	8	35	15	610
APRIL	199	0	7,078	7,277	525	150	48	16	7,621
MAY	0	0	0	0	238	2	21	13	228
JUNE	0	0	5,148	5,148	-2,633	79	6	11	2,440
JULY	2,698	0	7,707	10,405	-492	204	-8	11	9,728
AUGUST	21,564	10,643	0	10,921	-4,645	177	1	57	6,156
SEPTEMBER	43,507	34,004	0	9,503	-2,115	171	38	58	7,237
OCTOBER	0	0	9,424	9,424	-1,757	173	104	34	7,425
NOVEMBER	10,610	5,042	0	5,567	101	112	212	21	5,365
DECEMBER	10,372	1,662	0	8,709	-1,884	157	179	19	6,508
ANNUAL	89,169	51,351	32,446	70,263	-9,924	1,316	833	291	58,482

Table 6: SJ-C Project – Monthly Water Storage in Nambe Falls Reservoir (units are acre-feet)

NAMBÉ FALLS MONTHLY MONTH	INFLOW	OUTFLOW			RESERVOIR LOSSES	TOTAL OUTFLOW + LOSSES	END OF MONTH	
		BYPASSED	STORAGE RELEASE				CONTENT	ELEVATION
			OPERATIONAL	IRRIGATION				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DEC. 2008							1,707	6,822.75
JANUARY	279	143	0	2	0	145	1,840	6,825.21
FEBRUARY	266	205	0	5	5	215	1,892	6,826.12
MARCH	458	421	0	20	13	454	1,897	6,826.20
APRIL	709	661	0	0	19	680	1,925	6,826.70
MAY	2,132	2,111	0	0	18	2,128	1,929	6,826.76
JUNE	1,426	1,419	0	0	10	1,429	1,925	6,826.70
JULY	796	797	0	400	10	1,207	1,515	6,818.98
AUGUST	385	376	0	375	9	760	1,140	6,810.60
SEPTEMBER	308	267	0	131	3	401	1,047	6,808.24
OCTOBER	317	211	0	9	3	223	1,140	6,810.62
NOVEMBER	270	59	0	0	6	64	1,346	6,815.41
DECEMBER	230	52	0	0	0	52	1,525	6,819.20
ANNUAL	7,577	6,721	0	942	95	7,758		

Nambé Falls Dam Facility Review and Safety of Dams Programs

During 2009, Nambé Falls Dam had the following activities implemented or completed:

- In February 2009, the Army Dive Team was called in to complete recommendation 2007-2-D, to repair the trash rack by replacing corroded attachment nuts, at a substantial savings to the water district. The Army used it as a training exercise.
- In March 2009 the UC Regional Drill Team (Provo), along with our Denver Office and hired grouting specialist consultant, Peter P. Aberle (retired from Reclamation), were called in to address SOD-2003-A to permanently grout the flat jacks and evaluate the ethylene glycol. The grouting was completed, and there were no problems encountered.
- The annual inspection was completed in October of 2009, with the conclusion that the dam is sound and in good operating condition. The FRR was completed with no major issues.

M&I Water Use - National Environmental Policy Act Compliance

Reclamation is involved in City and County of Santa Fe water supply projects. The City, County, and a private developer (Las Campanas) worked with the U.S. Forest Service and the Bureau of Land Management on an Environmental Impact Statement (EIS) to address effects of the proposed Buckman Direct Water Diversion Project. Reclamation served as a cooperating agency on the Buckman EIS. U.S. Fish and Wildlife Service issued a Biological Opinion on the Buckman project in June 2007.

The final Buckman EIS and Record of Decision (ROD) are completed. The Notice of Availability for the ROD was published in February 2008, and construction began in July of 2008. The diversion structure is under construction and is expected to be completed early in the spring of 2010. Construction of the other project features is ongoing.

Reclamation is assisting the Cities of Española and Chimayo, New Mexico, with drinking water projects that include the conveyance of San Juan-Chama Project water from a point of diversion on the Rio Grande and new municipal wells. A new Public Law (PL 108-354) was enacted that provides 25% federal funding for construction of a filtration facility for Espanola and 75% funding for Chimayo infrastructure. The Corps of Engineers, New Mexico Interstate Stream Commission, and the New Mexico Environment Department have additional funding from EPA and other federal sources for the Cities to construct their water projects. Chimayo has expended approximately half of their funding. Espanola has not yet determined the scope and design of their project. Additional NEPA compliance will be required for the Espanola project.

Middle Rio Grande Project, New Mexico

The *Middle Rio Grande Project* (Figure 4) 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, which can supply water to approximately 50,000 to 70,000 acres of land.

New Mexico Relinquishment of Rio Grande Compact Credit

Per the Rio Grande Compact Article I definition, the usable water in Project storage (Elephant Butte and Caballo Reservoirs together) was above 400,000 ac-ft for part of 2009. Article VII storage restrictions were in effect beginning on August 12, 2009. Article VII of the Rio Grande Compact stipulates that when usable water in Project 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.

During 2009 no Emergency Drought Water was captured by Reclamation for the benefit of the Middle Rio Grande Conservancy District (MRGCD) under the Emergency Drought Water Agreement (EDWA) nor was any of Reclamation's remaining Emergency Drought Water balance captured during the year. The balance of Emergency Drought Water available for capture and storage by Reclamation and MRGCD during 2009 or later years is 78,036 ac-ft. Reclamation's balance for use as supplemental water for endangered species is 30,451 ac-ft, and 48,585 ac-ft remains to be captured for the benefit of MRGCD. These amounts may increase as further relinquishment of credit water in Elephant Butte Reservoir by the State of New Mexico occurs.

Reclamation started 2009 with 0 ac-ft of Emergency Drought Water stored in El Vado Reservoir for use on behalf of listed endangered species. MRGCD started 2009 with 10,117 ac-ft of Emergency Drought Water in El Vado Storage, and ended the year with a total of 9,666 ac-ft in storage.

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 2009 at an elevation of 6,893.42 feet (159,619 ac-ft). The reservoir peaked on May 8 at an elevation of 6,900.08 feet (184,703 ac-ft). The lowest elevation of the year, 6,872.21 feet (107,751 ac-ft), occurred on November 12, 2009. Due to the reservoir starting off the year at such a high level and a snowpack that was above average, a small pre-release of water to create storage space was started in late February. The pre-release was not large enough, however, and weather conditions of 20 degrees above normal caused a rapid inflow into the reservoir. With the reservoir already reaching full, a near-record release of 5,070

(daily average) was made on May 9, 2009. Inflow on May 8, 2009, approached an instantaneous value of almost 7,000 cfs, with the daily average being 4,040 cfs. The reservoir finished the year at elevation 6,876.05 feet (116,717 ac-ft).

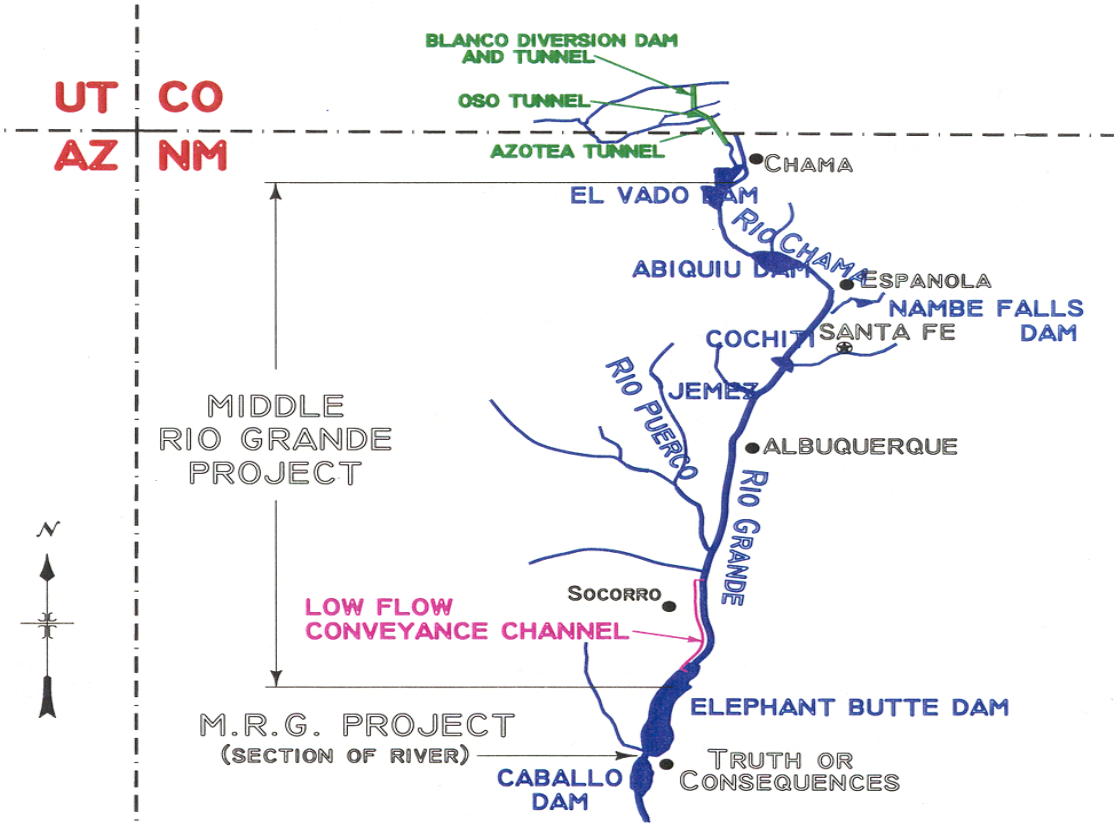

Figure 4: Area Map of the Middle Rio Grande Project

MRGCD began the year with 10,117 ac-ft of Emergency Drought Water, 111,349 ac-ft of general Rio Grande storage, and 39,452 ac-ft of SJ-C water in El Vado for Middle Valley irrigation. This was in addition to MRGCD's 20,900 ac-ft of 2009 SJ-C allocation in Heron, and a beginning year balance of 1,532 ac-ft of SJ-C stored in Abiquiu Reservoir. At the end of the year, MRGCD had 9,666 ac-ft of Emergency Drought Water, 46,250 ac-ft of general El Vado Rio Grande storage, and 52,248 ac-ft of SJ-C storage in El Vado reservoir. MRGCD also had 1,971 ac-ft of SJ-C stored in Abiquiu as of December 31, 2009.

Reclamation re-regulated a total of 16,500 ac-ft of native inflow for the Prior and Paramount (P&P) needs of the six Middle Rio Grande Pueblos during 2009. All Prior and Paramount water was re-regulated outside of Article VII storage restrictions. Water that was identified for P&P use was returned to the Rio Grande pool in November, with the exception of approximately 298 ac-ft released in August at the request of the Bureau of Indian Affairs Designated Engineer.

The total SJ-C water in El Vado storage at the end of the year was 60,801 ac-ft. This included 2,430 ac-ft of water leased to Reclamation from willing contractors and 899 ac-ft of Albuquerque-Bernalillo County Water Utility Authority's (ABCWUA's) water temporarily stored in El Vado due to lack of storage space in Abiquiu. Table 7 provides a summary of

monthly operations and water accounting for El Vado Reservoir.

Table 7: Reservoir Operation for El Vado Dam (units are acre-feet)

EL VADO RESERVOIR OPERATION	INFLOW		OUTFLOW		LOSSES		EOM CONTENT		
MONTH	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	TOTAL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DEC. 2008	2,003	30,715	3,125	15,510	-10	-103	116,897	42,722	159,619
JANUARY	4,712	0	4,934	3,089	71	-11	121,174	39,645	160,818
FEBRUARY	5,266	0	3,802	0	143	30	122,493	39,614	162,108
MARCH	17,371	219	18,687	219	391	91	120,786	39,524	160,310
APRIL	48,479	199	31,178	7,277	578	117	137,508	32,329	169,837
MAY	145,187	0	134,390	0	857	103	147,448	32,226	179,674
JUNE	23,830	0	16,894	5,148	494	48	153,890	27,030	180,919
JULY	6,110	2,698	26,311	10,405	684	68	133,004	19,254	152,259
AUGUST	1,784	21,564	44,858	10,921	581	141	89,350	29,757	119,106
SEPTEMBER	2,570	43,507	26,106	24,014	172	-14,358	65,641	63,608	129,249
OCTOBER	2,508	0	11,964	5,823	257	3,664	55,928	54,121	110,049
NOVEMBER	3,668	10,610	3,567	0	134	5,665	55,896	59,066	114,962
DECEMBER	2,881	10,372	2,752	5,839	109	2,797	55,916	60,801	116,717
ANNUAL	264,365	89,169	325,444	72,736	4,472	-1,646			

El Vado Dam Facility Review and Safety of Dams Programs

The following work was completed for El Vado Dam during 2009:

- The Facility Reliability Rating (FRR) was completed with no major issues.
- The Emergency Action Plan (EAP) was revised and a tabletop exercise is scheduled for early 2010.
- The Annual EAP Review, Drill, and Communication Directory updates were completed.
- Completed the annual site and security exams.
- Completed SOD recommendation 2007-SOD-A, eleven new survey pins were installed on the crest of the dam to measure movement on the lobe area of the landslide.
- After the Dam Safety Advisory Team (DSAT) meeting in 2009 and other meetings throughout the year, it was decided to proceed with the Corrective Action Study (CAS) on the spillway. Reclamation's Denver office is working on setting up a Project Management Team (PMT) to evaluate the need for repairs.
- The wet spot that was identified a few years ago continues to be monitored on a monthly basis, with no apparent changes.
- General maintenance was done and some O&M recommendations were completed.
- The packer seals on the outlet work gates were replaced.
- The Cathodic Protective System is currently still functioning, but has a life span of 20 years and began operation more than 20 years ago. Additional funding will be needed to replace the whole system with deeper anode beds. Monthly rectifier readings are sent to Reclamation's Denver office for analysis. Due to the CAS no work is planned.
- Reclamation's Denver office is working on preparing specifications for repairing the

exposed rebar on the stilling basin. Core samples were taken on December 2008. Due to the CAS no work is planned.

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

Abiquiu Dam and Reservoir is a Corps of Engineers facility. Public Law 97-140 authorizes storage of up to 200,000 ac-ft of San Juan-Chama (SJ-C) water in Abiquiu Reservoir. Adjustments for sediment reduced the sum of the available storage allocations to 181,241 ac-ft at the start of 2009, which is calculated as the total capacity at the top of the SJ-C storage pool (elevation 6,220.00') less the total accumulated sediment in the reservoir at the end of 2008. The volume of SJ-C water in storage in Abiquiu Reservoir peaked on January 1, 2009, at 181,851 ac-ft. Abiquiu ended 2009 with 180,477 ac-ft of SJ-C water in storage. Table 8 provides a summary of monthly operations and water accounting for Abiquiu Reservoir.

During 2009 Reclamation had a storage agreement with the Albuquerque/Bernalillo County Water Utility Authority 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, 22,113 ac-ft of leased SJ-C water was released by Reclamation for silvery minnow purposes.

Table 8: Reservoir Operations for Abiquiu Dam (units are acre-feet)

ABIQUIU RESERVOIR OPERATION	INFLOW		OUTFLOW		LOSSES		EOM CONTENT			
MONTH	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	SEDIMENT	RIO GRANDE	SAN JUAN - CHAMA	TOTAL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
DEC. 2008	4,775	14,959	4,675	7,221	0	196	2,640	102	181,786	184,529
JANUARY	6,228	3,518	4,817	5,264	5	232	2,641	1,513	179,809	183,962
FEBRUARY	5,630	0	6,765	572	10	460	2,641	377	178,777	181,795
MARCH	21,905	217	21,433	636	7	819	2,650	849	177,538	181,037
APRIL	40,110	7,197	39,806	7,722	9	1,374	2,693	1,154	175,639	179,486
MAY	137,452	0	103,440	238	420	1,460	3,011	35,166	173,941	212,118
JUNE	26,550	5,092	61,716	2,458	172	988	3,030	0	175,586	178,617
JULY	32,223	9,713	32,224	9,221	-2	1,355	3,064	0	174,723	177,787
AUGUST	48,348	11,359	48,345	6,714	-5	1,780	3,127	2	177,588	180,718
SEPTEMBER	27,966	9,310	27,969	7,195	-2	1,224	3,156	-1	178,479	181,635
OCTOBER	14,176	9,231	14,187	7,474	3	916	3,166	-11	179,320	182,475
NOVEMBER	4,542	5,484	4,534	5,585	0	507	3,167	-3	178,712	181,875
DECEMBER	3,971	8,607	4,004	6,723	0	87	3,168	-37	180,509	183,640
ANNUAL	369,718	69,727	369,240	59,803	617	11,202				

Cooperative Programs with the State of New Mexico

In February 2007, a new Cooperative Agreement was executed between the New Mexico Interstate Stream Commission (NMISC) and Reclamation to provide funding for water salvage work on the Middle Rio Grande Project. Work funded under this Agreement includes Elephant Butte Temporary Channel maintenance, as well as other river maintenance projects and irrigation

drain improvements with water salvage potential.

The new Agreement provided funding in the amount of $1,140,900, and a balance of $33,340 was also carried over from the previous 2004 Agreement. Additional funds in the amount of $1,960,000 have been added by modification to the Agreement for a new total of $3,100,900. A modification was executed at the end of fiscal year 2009 for carryover of funds to fiscal year 2009. As of December 31, 2009, the balance of unspent funds was $1,854,000.

Elephant Butte Temporary Channel History

River disconnection has been an issue at the headwaters of Elephant Butte Reservoir since the early 1950s. The contributing factors for the occurrence of disconnection are many: the valley slope is very slight, the incoming sediment load is high, the clay deposits are highly cohesive, and vegetation growth is extremely aggressive. During drought periods when the reservoir pool decreases rapidly, all of these factors make it difficult for the river channel to maintain a connection with the reservoir pool (Photo 1). The latest incidence of disconnection began in the late 1990s, and construction of the Temporary Channel began in 2000. The channel was constructed in three phases:

- Temporary Channel 2000: This reach was constructed from 2000 to 2004 and is 7 miles in length, beginning at River Mile (RM) 58 and ending at Nogal Canyon (RM 51.5). This reach has a high flow channel with an average width of 250 feet and a smaller channel within the larger channel to carry low flows. The low flow channel width is approximately 75 feet.

- Temporary Channel 2002: Constructed from 2003 to 2004, a length of 11 miles, beginning at Nogal Canyon (RM 51.5) and ending just downstream of the Elephant Butte Narrows (RM 41). The average width for this reach is 150 feet.

- Temporary Channel 2004: Construction began in 2004, and approximately 3 miles has been constructed to date. This channel begins at RM 41 and will be extended downstream as needed in response to future retreat of the reservoir. The average width for this reach is 75 feet.

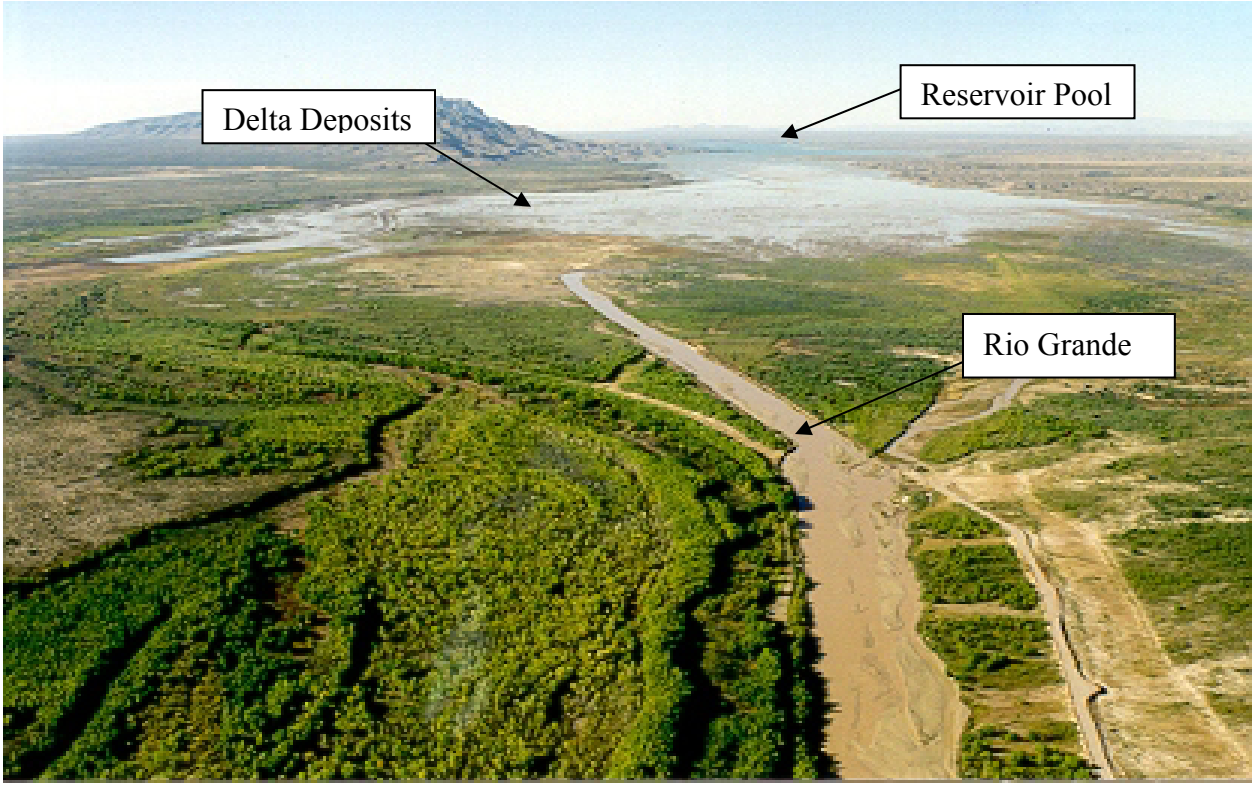

Photo 1: Headwaters of Elephant Butte Reservoir, prior to construction of the Temporary Channel (1998)

Elephant Butte Temporary Channel—2009 Maintenance

The majority of work performed in 2009 was on the Temporary Channel 2002 reach, as a sediment plug formed just downstream of the Red Rock Staging Area during the 2009 spring runoff. The plug was discovered in early June during a river flight by Reclamation. The plug initiated in the vicinity of RM 46.3, approximately 1.6 miles downstream of the Red Rock Staging area. It initiated in the same location as the 2008 sediment plug, and grew in the upstream direction to a length of 2 miles. Several miles of channel upstream of the solid plug was also partially filled with sediment and berms were breached in numerous places on the east and west side of the channel. Photo 2 shows the plug area from the air and Photos 3 and 4 from the ground.

Reclamation's Socorro Field Division began excavating a pilot channel, approximately 25 feet in width, through the sediment plug in early August and completed the pilot channel in mid October. Work continued on repair of berm breaches and widening of the pilot channel until October 21st. NMISC's contractor took over the berm repairs in December, and that work is still in progress.

During 2009, Reclamation crews also performed access road repairs and mowing of vegetation along the shoulders, as well as maintenance and repair of the equipment used for Temporary Channel maintenance. The most significant repairs completed in 2009 included: major pontoon repairs for one of the amphibious excavators and installation of new tracks on two others.

Photo 2: 2009 Temporary Channel sediment plug, looking downstream with Red Rock Staging Area approximately in the center of the photo (August 2009, Gonzales)

Photo 3: Temporary Channel sediment plug, taken just downstream of Red Rock Staging Area, looking downstream (September 2009, Rolland)

Photo 4: Excavation of pilot channel through Temporary Channel sediment plug. Taken approximately ½ mile downstream of Red Rock Staging Area, looking upstream (September 2009, Rolland)

Reclamation continues to perform river channel and species monitoring work mandated by the January 25, 2008, Biological Opinion from U.S. Fish and Wildlife Service, providing for Temporary Channel maintenance through 2012. NMISC and Reclamation are also working together to meet one of the Reasonable and Prudent Measures (RPM) from the Biological Opinion which requires a Southwestern Willow Flycatcher habitat mitigation project. Potential project areas include Selden Canyon, Caballo Dam, Percha Dam, and the Fort Craig area. Development of a project to fulfill the RPM within the New Mexico State Parks' Broad Canyon Ranch acquisition is currently being investigated. In March 2010, Reclamation received notification from the U.S. Fish and Wildlife Service requesting re-initiation of ESA, Section 7, consultation for Temporary Channel activities.

Irrigation Drain Improvements

The following work was accomplished in 2009 under the Cooperative Agreement:

- Escondida Drain: Improvements to this drain have been ongoing for the last 3 years, with work divided into two phases. Phase II work was completed in 2009, and included mowing of the drain prism and reestablishing the outfall into the Rio Grande, which had filled with sediment. Reclamation awarded a contract to Stoven Construction Inc. for the Phase II work, with NMISC contributing $100,000 of Agreement funds for the project. See Photo 5.

Photo 5: Recently excavated Escondida Drain outfall channel, looking west towards the Rio Grande (December 2009, Everetts)

- Elmendorf Drain: A corrugated metal culvert which conveys drain flows under an arroyo collapsed in 2007, and was removed. The culvert was located within Bosque del Apache National Wildlife Refuge (BDANWR) and was replaced in 2009 as a joint venture, with partners including Reclamation, NMISC, Middle Rio Grande Endangered Species Collaborative Program, and BDANWR. NMISC contributed $20,000 of Agreement funds for the project. Reclamation's Socorro Field Division completed the work, with dewatering assistance from BDANWR. Work began in June 2009, and was completed in November 2009. See Photos 6 and 7.

Photo 6: Elmendorf Drain culvert replacement in progress, looking south (August 2009, Gonzales)

Photo 7: Elmendorf Drain culvert replacement, showing the new 84-inch diameter concrete pipe, looking downstream (October 2009, Everetts)

River Maintenance

Reclamation has authorization for river channel maintenance of the Rio Grande from Velarde, New Mexico, south to the headwaters of Caballo Reservoir, as specified by the Flood Control Acts of 1948 and 1950. Project purposes include ensuring effective water delivery, transporting sediment, protecting riverside facilities and property, and preventing flooding. Reclamation prioritizes river maintenance based on public safety, property damage risk, and potential for reduction of water delivery.

River Maintenance Priority Sites

Reclamation is actively pursuing work at 23 priority sites along the Middle Rio Grande Project reach where bank erosion or reduced channel capacity could cause levee failure resulting in shallow overland flooding, reduction of water delivery, or destruction of canals and drains. These sites are described below. Reclamation's efforts on addressing river maintenance work at these 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, and construction maintenance.

Work to address the backlog of river maintenance priority sites along the project reach has involved completion of a total of 13 sites since 2004. Of the 23 priority sites, six require an annual review of channel capacity and possibly maintenance due to sediment accumulation. These six are the Bosque del Apache sediment plug, the Bosque del Apache levee, the Tiffany and San Marcial levees, the Tiffany sediment plug, the Truth or Consequences reach, and the Temporary Channel, which—although it is discussed in the State of New Mexico Cooperative Programs section—is also a priority site.

San Ildefonso Pond

This priority site is located at River Mile (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. Eight buried rock vanes were placed with this project and were intended to become functional as bankline erosion progressed. To further stabilize the site, Reclamation worked with the Pueblo de San Ildefonso to plant 150 cottonwood and Goodding's willow poles throughout the project site during the winter of 2008.

The primary concern at the San Ildefonso Pond priority site is the close proximity of the east bank of the Rio Grande to the berm surrounding the pond. A line of dense vegetation north of the project site provided additional protection to the pond through recent spring runoffs (2005, 2007, and 2008), despite the active bank erosion seen on the bend immediately upstream of the pond. During the spring runoff of 2009, however, the channel eroded through this line of dense vegetation, resulting in the loss of about 80 feet of bankline in portions of the previously constructed project area (Photo 8).

This bank erosion exposed three of the buried rock vanes and currently threatens to flank the buried rock vanes. Reclamation is working with the Pueblo de San Ildefonso to construct a temporary solution prior to the 2010 spring runoff. This temporary protection will provide

flanking protection and additional bankline stabilization for the previously placed rock vanes, providing time for the development and permitting of a longer term solution.

Photo 8: San Ildefonso bankline erosion and exposure of previously buried rock vanes (October 2009, AuBuchon)

Cochiti Priority Sites

There are two priority sites on the Pueblo of Cochiti: one, at RM 231.3, is on the west side of the Rio Grande about 1 mile downstream of Cochiti Dam, and the other, at RM 228.9, is on the east side, about 3 miles downstream of the dam. At RM 231.3, the west bank of the channel is very close to a road and some agricultural fields (Photo 9). At RM 228.9, a secondary channel was slowly, but steadily, migrating eastward toward the levee and riverside drain (Photo 10).

Construction at both sites was completed by Reclamation's Socorro Field Division during the summer of 2008. While poles were planted as part of the bioengineered bankline, additional planting may still be required in the areas disturbed by construction activities. A site review in August 2009 revealed that native vegetation was already returning to the site, so Reclamation and the Pueblo de Cochiti agreed that for the immediate future only periodic monitoring is warranted. If future site visits reveal the need for revegetation, Reclamation will coordinate that effort with the Pueblo de Cochiti to minimize the impact on established native vegetation.

Photo 9: Bankline protection on the Pueblo of Cochiti at RM 231.3 (August 2009, AuBuchon)

Photo 10: Backwater area on the Pueblo of Cochiti constructed as part of the construction at RM 228.9 (August 2009, Maxwell)

Santo Domingo

There are currently three priority sites on the reach of the Rio Grande passing through the Pueblo of Santo Domingo (RM 225.1, RM 224.6, and RM 223.9). At these sites, bankline erosion on the west side of the river is cause for concern because of the close proximity to the levee and riverside drain. Priority Site No. 2 (RM 224.6), which is across from the confluence of the Rio Galisteo, is shown in Photo 11, and Site No. 3 is shown in Photo 12. A Data Collection and Confidentiality Agreement was executed between the Santo Domingo Tribe and Reclamation in August 2007, to allow collection of design data for the three priority sites. An evaluation of design alternatives has been completed for each of the sites and the preferred alternatives have been presented to Santo Domingo for their approval. Construction may begin late in 2010 if a consensus is reached with Santo Domingo.

Photo 11: Santo Domingo Priority Site No. 2 (RM 224.6), looking southwest (October 2009, Padilla)

Photo 12: Santo Domingo Priority Site No. 3 (RM 223.9), looking west (October 2009, Padilla)

San Felipe

There are currently nine river maintenance priority sites on the Pueblo of San Felipe. Current conditions at these sites could lead to damage of levees, irrigation infrastructure, roads, and a residential area of the Pueblo. In late 2006, Reclamation obtained permission from the Pueblo to collect cross-section and bed material data for use in designs to address these sites. Construction is anticipated to begin at four of the sites in 2010. Photo 13 shows the site at RM 213.4.

Photo 13: Downstream view of eroding terrace at Priority Site 213.4, San Felipe (July 2009, Donnelly)

Santa Ana River Mile 208.4

Reclamation's tasks associated with a large scale river maintenance project at Santa Ana Pueblo are complete. The work at this site extended from RM 208.4 to 207.2, with major features including river realignment and construction of a gradient restoration facility completed in 2002 by Reclamation's Socorro Field Division. In the spring of 2007, riprap was installed at the upstream end of the gradient restoration facility, and a reinforced bankline at the Jemez River confluence was extended to protect against flanking caused by bank erosion. This construction was performed by Reclamation's Socorro Field Division.

A willow trench was constructed by the Pueblo of Santa Ana in January 2008, according to a Reclamation design that would allow natural vegetation to provide ongoing protection of the east bank once the sediment spoil piles have been removed. In October 2009, Reclamation's Socorro Field Division removed the remaining sediment spoil piles to allow increased inundation of the floodplain (Photo 14). Planting of native vegetation on the redistributed sediment will be accomplished through an existing 638 contract in place with the Pueblo of Santa Ana.

Photo 14: Looking downstream at location of sediment spoil pile on the Pueblo of Santa Ana after sediment has been removed. Flow in the Rio Grande is approximately 500 cfs (October 2009, AuBuchon)

Santa Ana River Mile 205.8 (formerly known as Tamaya)

An additional priority site was added within the Pueblo of Santa Ana, on the east bank of the Rio Grande across from the Tamaya Resort special events tent, following the 2008 spring runoff. For many years, the bankline had been stable and followed the jetty jack line. Prior to the 2008 runoff, the bankline migrated beyond the jetty jack line; further erosion occurred during the 2008 spring runoff.

Due to the close proximity of the spoil levee and the amount of bankline erosion observed during 2008, this site was elevated to the status of a priority site. The Corps of Engineers, through their 1135 project authority, undertook an island and bar lowering project on the Rio Grande through the Pueblo of Santa Ana, a portion of which was adjacent to this priority site (Photo 15). Observations from the 2009 spring runoff indicate that this project helped reduce the active bank erosion at this site (Photo 16). Reclamation is currently working with the Pueblo of Santa Ana to develop a preferred protection strategy.

Photo 15: Corps of Engineers' bar lowering at the Pueblo of Santa Ana across from the Santa Ana RM 205.8 priority site (March 2009, AuBuchon)

Photo 16: Looking downstream at the bend erosion at the Santa Ana RM 205.8 priority site (March 2009, AuBuchon)

Corrales Siphon

The Corrales Siphon river maintenance site is located at RM 199.8, about 600 feet downstream of the Arroyo de la Barranca confluence (which is also the site of the Rio Rancho wastewater treatment outfall). At this site, an inverted siphon operated by MRGCD conveys irrigation water to the Corrales Main Canal by passing under the Rio Grande channel. During the high flows of the 2005 spring runoff, the bank experienced erosion primarily associated with undercutting. In late 2006, a preferred alternative for the project, consisting of installation of a bio-engineered bankline with a rock toe and coir fabric encapsulated soil, was selected. Preliminary designs were completed in 2007.

However, in early 2008, Reclamation became aware that the inverted siphon consists mostly of a wood pipeline that was constructed in the 1930s. Because of concerns about the stability of the wood pipeline when subjected to the loading and vibration of construction equipment, vibration testing and video examination of the pipe were performed. While the video was inconclusive, the vibration testing indicated that equipment should stay approximately 50 feet from the pipe to avoid damaging it. In addition, conditions at the site have changed, as deposited sediment and high flow side channels cut in the bar on the opposite bank by the Pueblo of Sandia, have alleviated some of the pressure at the higher discharges (Photo 17).

Reclamation is currently considering designs on a reduced scale that would further stabilize the upstream sediment deposition, thereby protecting the undercut bank.

Photo 17: Corrales Siphon priority site

Drain Unit 7 Extension

This priority site is located at RM 116.2, approximately 500 feet upstream of San Acacia Diversion Dam, on the west bank of the Rio Grande (Photo 18). This site has been problematic for many years, as the river has been actively eroding the embankment of a spoil levee that protects the Drain Unit 7 Extension irrigation structure. Riprap was placed during the 2005 spring runoff to help protect the embankment, and again just prior to the 2007 spring runoff. A complete analysis of potential alternatives was completed in 2008, and placement of larger gradation riprap was determined to be the most appropriate solution for this site. Construction was completed by Reclamation's Socorro Field Division in April 2009.

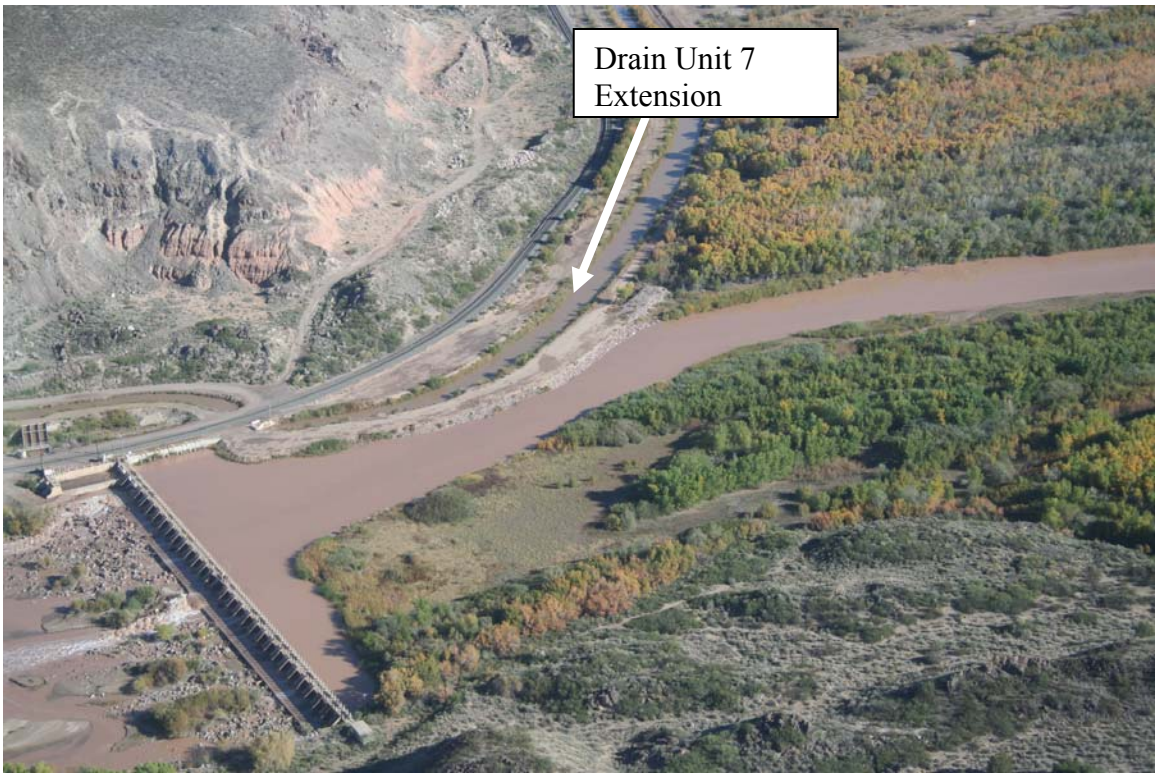

Photo 18: Completed Drain Unit 7 Extension priority site, looking north, with San Acacia Diversion Dam at lower left (October 2009, Gonzales)

San Acacia River Miles 114 and 113

Reclamation's Socorro Field Division completed earthwork at the River Mile 114 and 113 priority sites, approximately 2 miles downstream of San Acacia Diversion Dam in April 2007. Channel incision, lateral channel migration, and bank erosion previously threatened the integrity of the levee system in this area. This project involved moving the levee and LFCC approximately 1,500 feet to the west, away from the river (Photo 19). The project is currently being monitored to document the amount of reseeding and weed control that is needed.

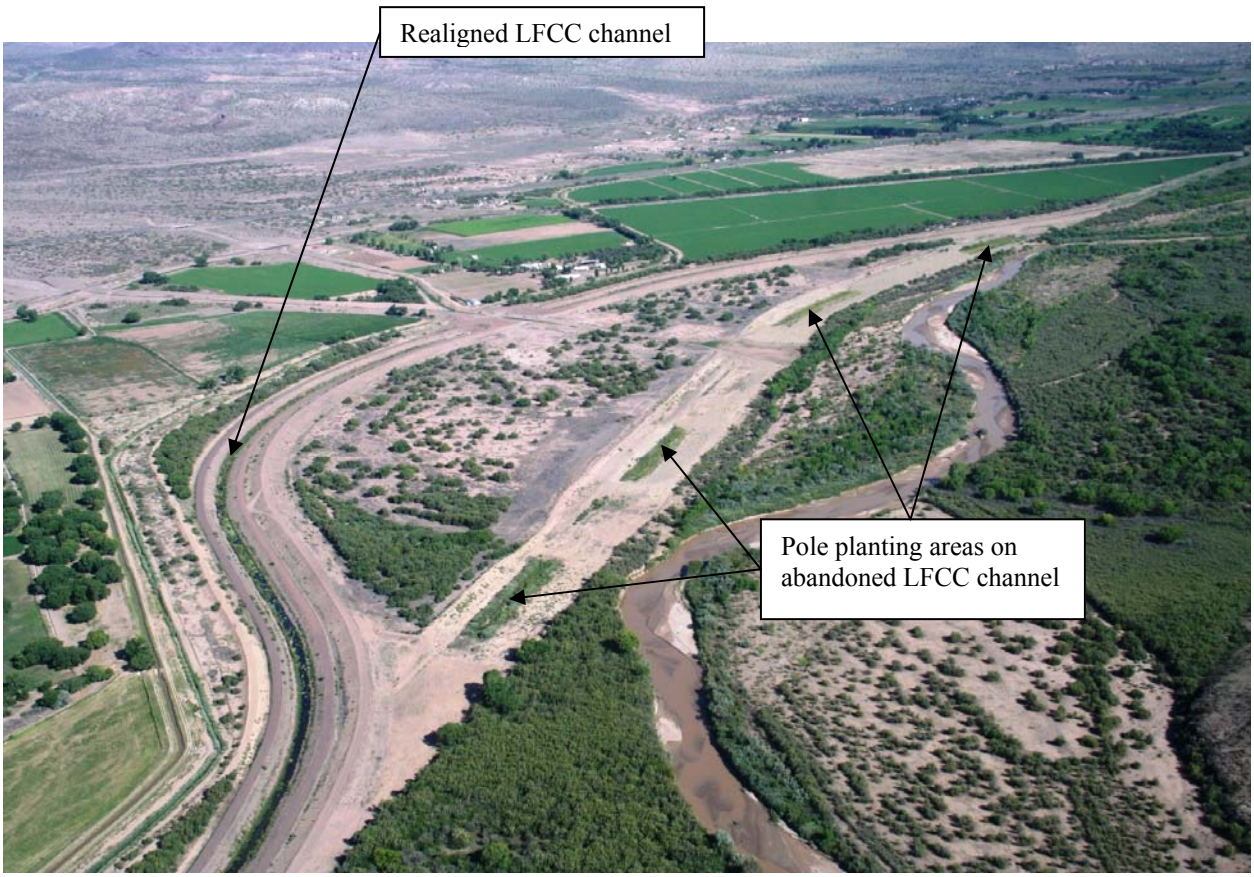

Photo 19: Looking upstream at the completed RM 114/113 construction (August 2009, Gonzales)

San Acacia River Mile 111

The San Acacia River Mile 111 priority site is located on the west side of the Rio Grande, approximately 5.5 miles downstream of the San Acacia Diversion Dam. The concern at this site is river channel migration and the fast migration rate of the bank erosion towards the levee, which protects the Low Flow Conveyance Channel (LFCC). A self-launching riprap windrow was placed in 2006 to provide temporary protection while awaiting the completion of a research project in the area.

Construction by Reclamation's Socorro Field Division at this site was completed in August 2009. This project involved moving the levee and LFCC to the west, away from the river (Photo 20). The project also incorporated two permanent stockpile sites for Reclamation to replace the stockpile sites eliminated by the RM 111 and the RM 114/RM 113 projects. The project is currently being monitored to document the amount of reseeding and weed control that is needed.

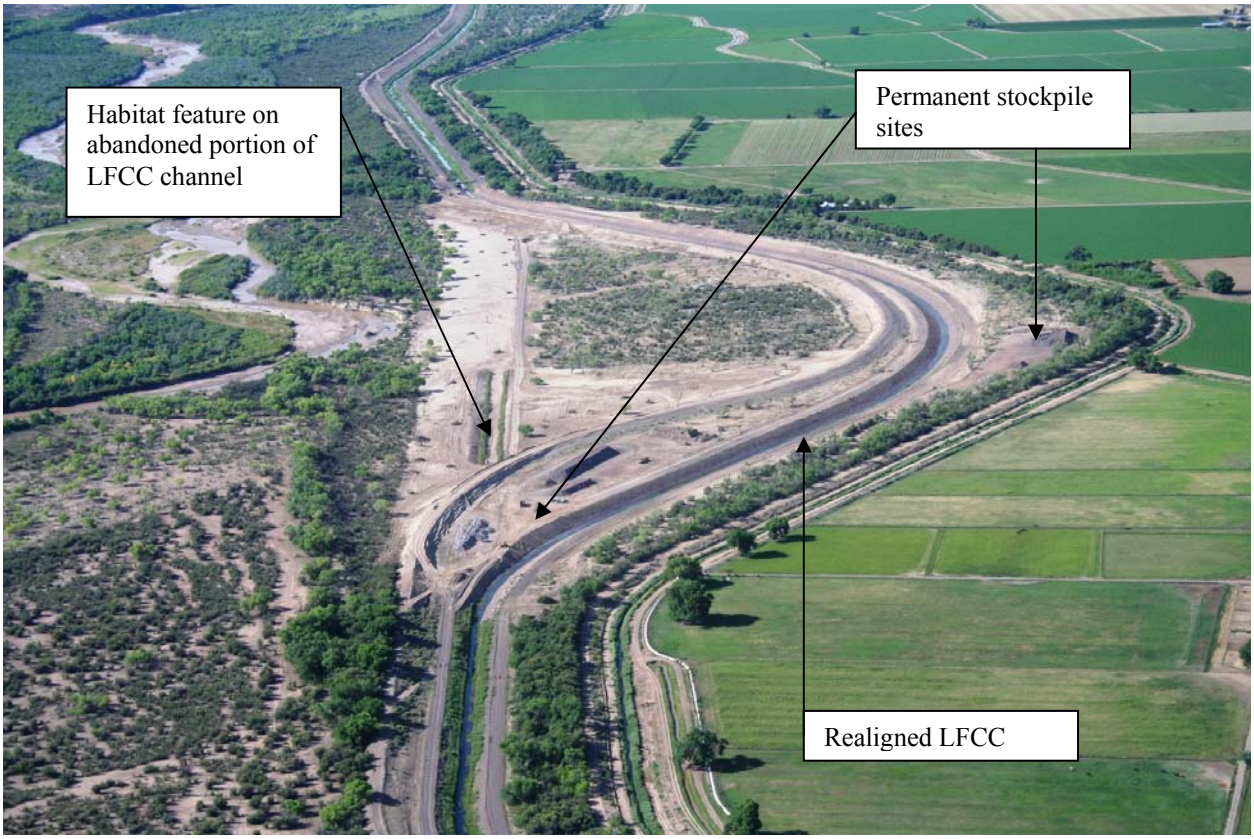

Photo 20: Looking downstream at the completed RM 111 construction (August 2009, Gonzales)

Arroyo de las Cañas

This river maintenance site is located at RM 95.5 on the west bank of the Rio Grande, upstream of Arroyo de las Cañas. When the site was identified in 2005, the bankline was less than 100 feet from the levee toe, and the thalweg was along the outside of the bend nearest the levee. While the bankline was eroded during the 2005 runoff, subsequent years (2006 and 2007) saw extensive deposition at this site. Spring runoff conditions in 2008 and 2009, along with a fire that burned a majority of the vegetation in the area in the early part of 2009 (Photo 21), have again raised concerns that this site may be susceptible to erosion. Additional geomorphic investigations and site analyses are being undertaken to help determine the status of this river maintenance site and if proactive bank stabilization on depositional features should be taken to help reduce the risk of erosion in the future.

Photo 21: Aerial photograph looking downstream showing deposition at the mouth of the Arroyo de las Cañas and the burned vegetation on the west bank in the vicinity of the priority site (October 2009, Padilla)

Bosque del Apache Sediment Plug

During the 2008 spring runoff a sediment plug formed in the main channel of the Rio Grande at RM 81, within the Bosque del Apache National Wildlife Refuge (BDANWR), forcing river flows into the floodplain. The plug was first identified during a river flight on May 17, and growth of the plug continued during the remainder of the runoff, to a length of approximately 1.5 miles. Reclamation and NMISC partnered for a pilot channel excavation project and that work was completed in October 2008. Reclamation monitored this site closely after completion of the 2008 pilot channel. While the pilot channel area remained open, the river channel remained partially plugged upstream of the pilot channel area, extending several miles.

Overbanking began near the North Boundary, BDANWR, in early April 2009 at river flows just over 1,000 cfs. At that time it was determined that a high probability existed for formation of another sediment plug during the 2009 spring runoff, and Reclamation began preparation of a Biological Assessment (BA) that would allow for pilot channel excavation, if needed, beginning in September 2009. The BA was submitted to the U.S. Fish and Wildlife Service in May 2009 but withdrawn after the runoff, as a sediment plug did not form.

Reclamation continues to monitor the 2008 sediment plug area, and is in the process of analyzing sediment plug potential in the general reach of river from RM 89 (2 miles upstream of the U.S. Highway 380 Bridge) to RM 80. Evaluation of alternatives for addressing sediment plugs is also in progress, and Reclamation may submit a new BA and 404 application in May 2010, to provide for a means of addressing a sediment plug if one does form during the 2010 spring runoff. The

area thought to currently have the greatest potential for sediment plug formation is shown in Photo 22.

Photo 22: The reach of river currently considered most prone to sediment plug formation, taken from just north of the North Boundary BDANWR, looking south (August 2009, Gonzales)

Bosque del Apache Levee

The Bosque del Apache Levee is located on the west side of the Rio Grande from approximately RM 87 to 74, and is a spoil levee that was formed during excavation of Reclamation's Low Flow Conveyance Channel (LFCC) in the 1950's. The portion of the levee from approximately RM 85 to 80 has become an area of concern in recent years due to the amount of sediment deposition in the river, and of particular concern during the 2008 spring runoff, when a sediment plug formed in the river channel in the vicinity of RM 81. The sediment plug caused a rise in water surface against the levee and prompted emergency work on a portion of the levee during the runoff.

In 2009, Reclamation requested American Recovery and Reinvestment Act (ARRA) funds for improvements to the levee, and received $2 million. The improvements include raising low areas and widening narrow areas within a three mile stretch of levee where conditions are of greatest concern. This work was awarded to Stoven Construction, Inc., by a task order under the 2009 Simplified Acquisition of Basic Engineering Requirements (SABER) contract. Contract work included loading and hauling 126,000 tons (approximately 81,300 cubic yards) of Government-furnished borrow material from the Valverde borrow site to the levee. Reclamation's Socorro Field Division shaped the material on the levee after it was dumped by the contractor.

Because of schedule limitations imposed by the BDANWR due to their migratory bird season,

construction for this project was divided into two periods of performance. The first period ran from October 26, 2009, to November 10, 2009, and provided approximately 52,200 tons (33,700 cubic yards) of material on the levee. The remaining contract hauling will begin in March 2010. The Reclamation crew is currently working on a portion of the levee north of BDANWR.

Photo 23: A staff gage installed on the east slope of the Bosque del Apache Levee for monitoring the water surface during the 2008 spring runoff. Foreground is the top of the levee (May 2008, Rolland)

Photo 24: A completed section of the 2009 Bosque del Apache Levee ARRA improvements (October 2009, Rolland)

Tiffany Sediment Plug

During the 2005 spring runoff, a sediment plug formed in the vicinity of RM 70 (approximately 1.5 miles upstream of the San Marcial railroad bridge), and then grew in the upstream direction to a length of over 3 miles. In a joint effort between NMISC and Reclamation, the plug was removed in 2005. Reclamation has continued to monitor this site closely, and has evaluated alternatives for solutions to the problem. However, a recent evaluation indicates that channel degradation in this reach of the river in the last few years has increased the channel capacity and therefore lowered the risk for formation of another sediment plug at this site. Reclamation may eventually implement a project for channel work to reduce the probability of future plugs in this area, but it has become a lower priority due to the recent degradation.

Fort Craig Bend

This site is located on the west bank of the Rio Grande, approximately 4.5 miles downstream from the San Marcial railroad bridge. It is also approximately 0.25 miles upstream of the Fort Craig Pump Site, where water is pumped from the LFCC to the river during the dry summer months. The active bankline is currently approximately 30 feet from the toe of the San Marcial Levee, which protects the LFCC from the river (Photo 25). The levee road also provides the only access to 9.5 miles of the river downstream of this site, including the upper 3.5 miles of the Elephant Butte Temporary Channel.

The river bend at this site has been fairly stable in past years, but became active during the 2008 runoff, with even more erosion activity during the 2009 runoff. There is considerable potential for the bankline erosion to impact the levee road during the 2010 runoff, and the site will be

monitored closely.

Photo 25: Fort Craig Bend priority site, looking west (October 2009, Gonzales)

River Mile 60

This site is located at RM 60, on the west bank of the Rio Grande, approximately 8.5 miles downstream from the San Marcial Railroad Bridge. The river makes a sharp bend to the west just upstream of the site, and then is forced to make another very abrupt bend to the south when it encounters the San Marcial Levee road embankment (Photo 26). The river then flows parallel to this road for a length of approximately 1,500 feet, with the right bank of the channel and left slope of the road embankment being one and the same. This site is considered to be the downstream end of the San Marcial Levee, although the levee is not protecting the LFCC in this area. However, the road does provide access to 5.5 miles of river downstream of the site, including the upper 3.5 miles of the Elephant Butte Temporary Channel.

The site has been an area of some concern for many years but erosion has become more aggressive since 2005 due to river channel degradation through this reach. The upstream end of the site has been monitored closely in recent years because of a deep scour hole caused by the abrupt bend, and the possibility for undercutting of the riprap that protects the road embankment. The upstream end of the site has been fairly stable in the last two years, but a significant amount of bankline erosion has occurred at the downstream end, where the road is not protected by riprap. There is a fairly high probability the road could be impacted during the 2010 runoff. The site will be monitored closely and the road will likely be closed during the runoff due to safety concerns.

Photo 26: River Mile 60 priority site, looking southwest (October 2009, Padilla)

Tiffany and San Marcial Levees

These two levee segments are located along the western edge of the Rio Grande floodplain, from the South Boundary of Bosque del Apache National Wildlife Refuge (RM 74) to the Ft. Craig area (RM 60). They are non-engineered spoil levees, created during excavation of the Low Flow Conveyance Channel (LFCC), and serve to protect that structure. The conveyance capacity of these levees has been monitored closely in the past, but that capacity has increased significantly in the last few years, due to degradation in this reach of the river. The levees currently meet or exceed the target conveyance capacity that has been established for river maintenance purposes (8,500 cfs with a 2-foot freeboard allowance), and the levees are now considered monitored sites and not priority sites. The conveyance capacity analysis determines the short duration peak discharge that can be conveyed by the levees, but does not provide an indication of the suitability of the levees for containing flows for durations longer than several days.

Truth or Consequences

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. During periods of non-release, Reclamation installs a dike in the river to raise the stage for the benefit of hot spring bathhouse owners in Truth or Consequences. Owing to the interaction between the river and the hot spring aquifer, the increased stage within the river floodway increases water temperatures and the flow of water at hot spring sites.

Sediment excavation was performed in 2009 at arroyo mouths and various reaches of the river channel, with a total volume of 14,500 cubic yards removed.

Middle Rio Grande River Maintenance Plan

The Middle Rio Grande River Maintenance program is undertaking an effort to develop 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. The Plan's main objective is to provide a technical guide for Reclamation's future river maintenance activities, to meet the original project authorization (core mission) purposes and environmental compliance needs.

Part 1 of the Plan provides documentation of the authority and necessary maintenance actions, including legal requirements, water delivery needs, endangered species needs, current river and LFCC conditions, historical changes in these conditions, and potential river and LFCC realignment strategies downstream of the San Marcial railroad bridge. This Part 1 report was completed in May 2007. Part 2 of the report addresses future maintenance strategies, conditions, and needs, and is scheduled for completion in April 2010. Combined, the two parts of this maintenance plan are envisioned to be 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.

Preparation for 2010 Spring Runoff

As of January 2010, it appears that the spring runoff will be near normal on the Rio Grande, with some potential for erosion damage to riverside facilities. In preparation, Reclamation is assessing riprap availability for potential emergency placement and analyzing levee capacity and the need for levee work prior to the runoff. Specific attention will be given to the Bosque del Apache Levee, due to the potential for sediment plug formation in that reach of the river. Additionally, periodic monitoring by aerial flights and levee patrols will occur during high flow periods, and rates of bankline erosion will be monitored at selected sites as necessary. Discharge reported by gages on the Rio Grande and its tributaries will be monitored daily. If flow predictions become above normal as the spring runoff period approaches, Reclamation will coordinate with other flood control agencies to facilitate efficient reporting of river maintenance needs and issues.

Middle Rio Grande Endangered Species Act Collaborative Program

The Middle Rio Grande Endangered Species Collaborative Program (Program) brings diverse groups together, as an alternative to litigation, to address serious environmental issues along the Middle Rio Grande (MRG). The Program is comprised of Federal, State, local, and tribal governments; nonprofit institutions, and other nongovernmental entities working collaboratively to protect and improve the status of endangered listed species along the MRG and to simultaneously protect existing and future regional water uses, while complying with state and federal laws, including Rio Grande Compact delivery obligations. The Program implements activities required by the March 2003 Biological Opinion (2003 BiOp), as amended, and additional activities that contribute to recovery of the Rio Grande silvery minnow (silvery minnow) and the Southwestern willow flycatcher (flycatcher).

The Program has embraced the need for new Endangered Species Act (ESA) Section 7 consultation, and in 2009 decided to become a Recovery Implementation Program (RIP) based on a Long-Term Plan (LTP) linked to the silvery minnow and flycatcher endangered species Recovery Plans. This will be done in a manner that benefits the ecological integrity, where feasible, of the MRG riverine and riparian ecosystem, and allows for creative and flexible options so that existing water uses continue and future water development proceeds in compliance with applicable federal and state laws.

During FY2009 on behalf of the Program, Reclamation awarded approximately $12,700,000 to: acquire and manage water; captively propagate and rear silvery minnow; plan, construct, and monitor habitat restoration projects; monitor the status of the silvery minnow and the flycatcher; conduct biological and hydrological studies; and rescue silvery minnow during river drying. All of these activities meet BiOp requirements or address recovery goals.

Habitat Restoration Projects

Program-funded habitat restoration projects restore and enhance habitat in the MRG by increasing backwaters, oxbows, and overbank flooding to enhance native vegetation and regenerate stands of cottonwoods and willows for the flycatcher; producing shallow, low velocity habitats over a wide range of instream flows to increase habitat available for the silvery minnow; and providing for fish passage upstream of diversion dams. The following briefly describes habitat restoration work accomplished during FY 2009.

NMISC Albuquerque and Isleta Reach Riverine Restoration Projects

The *Phase II Albuquerque Reach Riverine Restoration and Habitat Improvement for the Rio Grande Silvery Minnow* project has several components that have been implemented on the ground beginning in 2007. In 2009, construction of a 5-acre backwater and refugial habitat at an old irrigation diversion structure, named the Atrisco Diversion, was accomplished. The channel has been lowered and widened to be a backwater at spring runoff conditions for silvery minnow spawning and recruitment. During times of severe drought and river drying, this backwater can

be used as a refugial habitat for the silvery minnow using groundwater as a water source. The NMISC has obtained a water rights permit from the New Mexico State Engineer for diversions and consumptive uses at this project.

In the fall of 2009, an additional 20 acres of river bankline, islands, and bank-attached bars were modified by lowering and sculpting to create new floodplain habitats that inundate during spring runoff flows.

The *Phase I Isleta Reach Riverine Restoration and Habitat Improvements for the Rio Grande Silvery Minnow and Bosque Ecosystem* project began planning and environmental compliance in 2008 and construction occurred in the winter/spring of 2009. Approximately 24 acres were modified along banklines, islands, and bank-attached bars to create new floodplain habitat. The new habitat features include a large off-channel backwater in a low-lying area of the bosque. Depletions offset for any features outside the river channel have been addressed and will be accounted for with the State Engineer. Environmental planning and design work began in 2009 for Phase II of this project.

Santo Domingo Pueblo Habitat Restoration Project

Phase IV of this project was initiated in 2009. This phase includes invasive species removal and channel restoration over three areas totaling 58 acres.

City of Albuquerque (City) Habitat Restoration Project

This project includes clearing non-native vegetation, planting native vegetation, excavation of embayments and ephemeral side channels on an island and bar south of Rio Bravo, jetty jack removal, and the development of moist soil areas. This project has sites that are both north and south of the Rio Bravo bridge, on the east side of the river. The goals of the project are to increase measurable habitat complexity and facilitate migration of the river during various flows that will 1) promote egg retention, larval rearing, young-of-year, and over-wintering habitat for the silvery minnow, and 2) restore native riparian vegetation for the benefit of the flycatcher.

During February 2009, a second phase of the project constructed a third shallow depression north of Rio Bravo, removed an additional 140 jetties, re-treated 20 acres of re-sprouting non-native vegetation, and planted 40 cottonwoods, 250 black willows, and 4,000 sedges and rushes. The City, SWCA, and the University of New Mexico Bosque Ecological Monitoring Project (BEMP) are working together to coordinate monitoring efforts. Fisheries, vegetation, wetlands, and geomorphology effectiveness monitoring was conducted in 2009 for all treated areas. This project has resulted in long-term positive changes to all three project areas, affecting a total of 58.3 acres.

Habitat Restoration Project Effectiveness Monitoring Plan (EMP) Development

During 2009 the Program formed an ad hoc work group to develop a consistent, coordinated plan for determining the effectiveness of the Program's various habitat restoration (HR) projects. The broad goal of the EMP is to evaluate HR effectiveness in a cost-effective and scientifically sound way. The draft EMP focuses on data judged to be most useful for assessing the quality, extent, and longevity of created habitats and their use by the silvery minnow and flycatcher.

In developing detailed sampling plans for different components of the EMP, several factors that affect the cost and rigor of monitoring were considered. These include the number of HR techniques evaluated; number of variables measured; complexity, cost, and precision of individual measurements; number of sites sampled; frequency and duration of sampling; and the degree to which current scientific knowledge facilitates interpretation of monitoring data. Based on tradeoffs among these factors, a variety of different monitoring approaches were chosen to evaluate different aspects of HR effectiveness. A contract is expected to be awarded in early 2010 to conduct the first year of monitoring for the pilot EMP.

Fish Passage at San Acacia Diversion Dam

This Reclamation project, a required activity per the 2003 BiOp, is presently in the planning and design stage. Studies continue to gather information about silvery minnow longitudinal movement. Engineering level designs were prepared in 2009 for the preferred alternative, a baffled roughened channel fishway. An independent oversight review of designs and cost estimates (DEC review) was completed. The purpose of the review is to support successful project accomplishment, ensure high quality, and maintain credibility with stakeholders. The findings of the DEC review were documented in a report prepared under the direction of Reclamation's Senior Advisor, Design, Estimating and Construction. The first recommendation to be completed is an update of the project's contract and non-contract construction cost estimates. Other recommended actions will take place during 2010 and 2011. The earliest date that construction could begin is FY2013.

MRGCD's proposed La Joya Siphon project is part of the "related works" that are being analyzed in the same environmental assessment as San Acacia Fish Passage. The other project included in the EA is repair of the downstream rip-rap apron at San Acacia Diversion Dam. The three projects are in the same geographic area, construction is anticipated to occur about the same time, and siphon operations may impact how much water is available for operating the fish passage.

Additional Habitat Restoration Projects Funded in 2009

In addition to those projects mentioned above, the Collaborative Program provided funding for:

- U.S. Army Corps of Engineers (USACE), Alleviating Rio Grande Silvery Minnow Entrapment planning
- USACE, Rio Grande Nature Center Habitat Restoration Project Monitoring
- SWCA, Los Lunas Habitat Restoration Project Monitoring
- Ohkay Owingeh, Two Rivers Flycatcher Habitat Expansion
- Ohkay Owingeh, Three Falls Habitat Restoration

Captive Propagation

Rio Grande Silvery Minnow Sanctuary (Sanctuary)

Reclamation, the U.S. Fish and Wildlife Service (Service), the Middle Rio Grande Conservancy District (MRGCD), and the City of Albuquerque (City) cooperated in the development of the off-channel Sanctuary for the silvery minnow at a site in Albuquerque. The Sanctuary will serve as one of the two additional refugia required by the 2003 BiOp. Construction of the Sanctuary

has now been completed and the Service will be operating and maintaining the facility.

The Sanctuary will operate year-round and consume little or no water. A constant flow of 10 to 15 cubic feet per second (cfs) will be supplied from the Albuquerque Riverside Drain. After flowing through the Sanctuary, water will be returned to the drain or to the river. Gates and fish screens will allow fish and eggs to be held in the channel and eventually released directly back into the river. Releases will be timed according to river conditions.

Other Ongoing Water Management and Water Quality Related Projects

Upper Rio Grande Water Operations Model (URGWOM)

Funding has been provided to support collaborative URGWOM modeling efforts since FY 2006. In 2009, the URGWOM planning model continued to be enhanced to allow evaluation of various water management scenarios, with different target flows and various water management tools, to support the new ESA, Section 7, consultation for MRG water operations, river maintenance activities, and USACE flood operations. The planning model has been updated to reflect current water operations practices and calibrated to be consistent with observed conditions during low flow periods. The model was further refined using historic data from 2003 to 2007, to better represent the amount of supplemental water needed to meet flow targets and manage multiple river recessions. Five synthetic 10-year hydrologic sequences, representing a range of conditions from very wet to very dry, were developed for use as URGWOM inputs. Eleven water management scenarios were developed and run through the planning model for all five hydrologic sequences. Initial screening of alternatives was performed. The results of the model runs will be utilized to evaluate and further refine water management options for upper Rio Grande operations.

U.S. Geological Survey (USGS) Groundwater/Surface Water Interaction in the MRG Valley

The monitoring network presently consists of 162 groundwater piezometers on both sides of the Rio Grande, from I-25 to the Paseo del Norte bridge crossings, and 14 surface water staff gages. The majority of these components are equipped with data loggers, which monitor water level and temperature at regular intervals. FY2009 was the sixth year of funding by the Program. This project has been successful in the collection of continuous data sets and the posting of data on the USGS website, http://nm.water.usgs.gov/bosque.html.

A USGS Scientific Investigations Report is expected to be published in 2010 which summarizes the data collection program and includes calculations of river leakage based on water elevation measurements. The report will also evaluate the effect that water temperature has on ground water viscosity and flow. In a presentation given to the Program's Species Water Management workgroup in May 2009, the project's principal investigators concluded that: 1) the hydraulic conductivity of the Inner Valley alluvium ranges from 30 to 80 feet per day; 2) heat transport in the riparian zone is limited below 20 to 30 feet in depth and that, above that depth, flow is primarily horizontal; 3) rates of groundwater flow range from 0.1 to 0.8 feet per day; 4) infiltration from the Rio Grande is highest and reaches its greatest depths at the Paseo Del Norte and Montano East cross sections; and 5) fining of sediments in the Rio Bravo area likely results

in lower rates of river leakage.

USGS MRG River Gage Operation and Maintenance (O & M)

This project has been funded by the Program since FY2002. The USGS 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 of these gages are funded by the Program. Data from the river gages help MRG water management agencies meet the needs of water users, fulfill the requirements of the Rio Grande Compact, maintain sufficient water in storage for future needs, maintain adequate water in the river to support the silvery minnow, and provide 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 the web address: http://waterdata.usgs.gov/nm/nwis/current/?type=flow.

Decision Support System (DSS) for the MRGCD

This project is an on-going cooperative effort since FY2003 to support the implementation of efficient rotational water delivery in the MRGCD irrigation system. The DSS will allow irrigation demands to be met with reduced diversions from the Rio Grande, which could extend the irrigation season in water-short years. The DSS is a network of interlinked models that compute demand information at the farm and lateral level and then use that information to recommend water delivery schedules. During 2009 the DSS was expanded to include the Cochiti division, in addition to the previously completed models for the Albuquerque, Belen, and Socorro divisions. FY2009 funding was used to implement DSS in the Belen division.

New Mexico Environment Department Water Quality Monitoring

This water quality monitoring study has concluded with a final report received by Reclamation in 2009. The report was provided to the U.S. Fish and Wildlife Service for use with their on-going work on fish/silvery minnow health monitoring.

Endangered Species

Programmatic Water Operations and River Maintenance ESA, Section 7, Consultation

On March 17, 2003, the Service issued the 2003 Biological Opinion (2003 BiOp) on the effects of actions associated with the "Programmatic Biological Assessment of Bureau of Reclamation's Water and River Maintenance Operations, 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 flycatcher based on the biological needs of the species. The RPA elements address some of the long-term recovery 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 minimum water flows under different hydrologic scenarios that are needed to alleviate jeopardy to both species.

Reclamation remains in compliance with the 2003 BiOp. The Service made a determination that average year flow targets would be in effect for the 2009 irrigation season. A good spring runoff and effective post-runoff water management led to significant silvery minnow recruitment in all reaches below Angostura Diversion Dam. No river drying occurred in the river reach between Isleta and San Acacia diversion dams. The Rio Grande was allowed to dry in isolated locations from San Acacia Diversion Dam downstream from Brown Arroyo to the south boundary of Bosque del Apache National Wildlife Refuge. Water pumped from the Low Flow Conveyance Channel (LFCC) maintained flow in the river channel south of the refuge. Incidental take was identified as 1,611 individuals.

As of November 15, 2009, the Service had conducted rescue and salvage activities on 19.4 unique miles of the Rio Grande in the San Acacia Reach between the south boundary of Bosque del Apache National Wildlife Refuge and 1.0 mile upstream of the Neil Cupp pumping station, on 25 days between July 16 and October 20, 2009. A total of 15,190 silvery minnow > 30 mm SL were salvaged, transported, and released alive to a continuously flowing site of the Rio Grande approximately 1.0 miles downstream of the San Acacia Diversion Dam. In addition, a total of 10,972 either were too small to salvage (< 30 mm SL), died during transport, were too sick to salvage, or were found dead during secondary drying not attributable to water operations. These mortalities count towards the Service permit and do not count towards incidental take.

Reclamation ended the year with 26,619 ac-ft in storage (12,429 in El Vado and Abiquiu, and 14,190 leased and waivered in Heron), with the prospect of up to 14,690 ac-ft more in potential leases for 2010/2011 (from 2010 SJC allocations). In 2009, a BiOp "average" year, 22,113 ac-ft of supplemental was released for endangered species purposes.

Efforts by the Conservation Breeding Specialist Group and the Service to develop a silvery minnow population viability (PVA) model were expanded in 2009 with the support of Montana State University and the Middle Rio Grande Conservancy District in the development a second, bayesian biological model. The Collaborative Program's ad hoc PVA Work Group is moving forward in a coordinated process to develop both models and work to address science matters cooperatively.

Rio Grande Silvery Minnow

The Rio Grande silvery minnow (silvery 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 endangered (Fish and Wildlife 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.

In compliance with the 2003 BiOp, the Rio Grande was allowed to dry in isolated locations from Brown Arroyo downstream to the south boundary of Bosque del Apache National Wildlife Refuge (Refuge) in 2009. Water pumped from the LFCC maintained flow in the river channel south of the refuge. Native flow reconnected the river following the end of irrigation season, and all LFCC pumping ceased on October 30, 2009, for the year.

Reclamation conducted two periods of Rio Grande fish monitoring during 2009. The winter electrofishing survey was carried out from February 18 through February 26, 2009. Surveys were conducted at nine sites between Escondida and Santa Clara. Species frequently caught included common carp, channel catfish, flathead chub, river carpsucker, longnose dace, white sucker, and Rio Grande silvery minnow (silvery minnow). Silvery minnow were most commonly detected at the Montaño, Los Lunas, San Acacia, and Escondida sites, comprising 44%, 33%, 65%, and 76% of species composition, respectively.

Summer electrofishing sampling was conducted in late August 2009. Species composition was slightly different, with the most frequently detected species being gambusia, red shiner, flathead chub, channel catfish, and silvery minnow. There were seven survey sites between Bernalillo and just below the sediment plug that formed at the Refuge. Silvery minnow were most commonly detected at the Bernalillo Restoration, Bernardo, and above the Sediment Plug at the Refuge, comprising 34%, 23%, and 100% of species composition respectively.

Figure 5 shows silvery minnow population monitoring trends from 2001 through 2009, based on annual October population monitoring seine haul survey results. The silvery minnow population has fluctuated since 2003, with increases observed in three of six years in the Angostura and Isleta Reaches, and four of six years in the San Acacia Reach. Table 9 shows the total numbers of silvery minnows captured and the number of sample sites (in parentheses), by reach, during October surveys between 2001 and 2009.

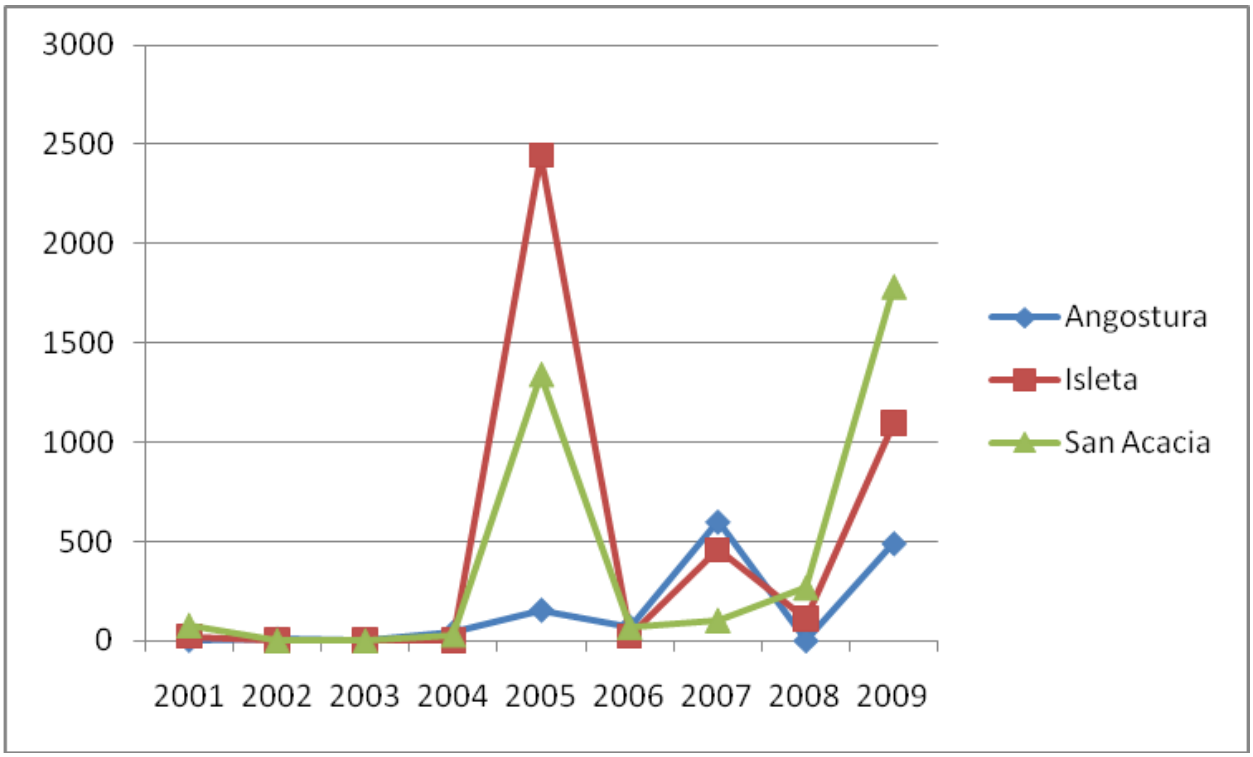

Figure 5: October Rio Grande Silvery Minnow Survey Results by Reach

Table 9: Total Numbers of Rio Grande Silvery Minnow from October Surveys, 2001 - 2009, by Reach, with Number of Sample Sites in ()

Year	Angostura (5)	Isleta (6)	San Acacia (9)	Total
2001	3	23	77	103
2002	9	2	1	12
2003	1	1	0	2
2004	44	4	30	78
2005	155	2444	1340	3939
2006	73	24	68	165
2007	601	458	102	1161
2008	0	111	266	377
2009	492	1098	1781	3371
Grand Total	**1378**	**4165**	**3665**	**9208**

Captive silvery minnow populations include Albuquerque Biopark and Dexter National Fish Hatchery. Two additional silvery minnow facilities, the Interstate Stream Commission's Los Lunas Silvery Minnow Refugium and the U.S. Fish and Wildlife Service's (Service) Minnow Sanctuary are expected to begin operations in 2010. The Service reintroduced silvery minnow into Big Bend National Park, Texas, in 2008 and 2009, and is currently monitoring for survival quarterly. Establishment of sustainable populations outside the Middle Rio Grande is essential for downlisting the species to threatened status.

Southwestern Willow Flycatcher

The southwestern willow flycatcher was listed endangered by the Service effective March 29, 1995. Critical habitat was designated, effective August 21, 1997, in some areas of New Mexico and other states throughout the species' range. The Rio Grande was not designated as critical habitat for the flycatcher at that time, and 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 now includes portions of the Rio Grande in New Mexico. The final rule designating critical habitat was issued October 19, 2005, and includes four sections of riparian forest in the Middle Rio Grande valley: from the Taos Junction bridge to the north boundary of San Juan Pueblo, from the south boundary of the Pueblo of Isleta to the north boundary of Sevilleta National Wildlife Refuge (NWR), from the south boundary of Sevilleta NWR to the north boundary of Bosque del Apache NWR, and from the south boundary of Bosque del Apache NWR to the powerline crossing of the Rio Grande near Milligan Gulch. Since 1995, Reclamation has been in consultation with the Service, pursuant to Section 7 of the ESA, over numerous actions, mainly operations and river maintenance activities along the Rio Grande.

During the summer of 2009, Reclamation conducted surveys and nest monitoring of the flycatcher in eight distinct reaches along approximately 200 kilometers of the Rio Grande in New Mexico, between Velarde and Elephant Butte Reservoir. Surveys were performed to

contribute to current baseline population data of the flycatcher along the Middle Rio Grande, and also to meet Reclamation's ESA compliance commitments. In 2008, there were 480 resident flycatchers documented in 287 territories and forming 193 breeding pairs. In 2009, there were 633 resident flycatchers documented in 367 territories and forming 264 breeding pairs. As in previous years, the San Marcial reach of the river was by far the most productive, containing 235 territories and 168 pairs in 2008, and 319 territories and 224 pairs in 2009.

In 2009, nest monitoring was conducted at all sites where nesting pairs were detected. Nests were monitored for success rates, productivity, and Brown-headed cowbird (*Molothrus ater*, cowbird) parasitism. The San Marcial reach proved most productive, producing 293 nests and fledging more than 250 SWFL young.

Other studies were continued in 2009. These include: 1) cowbird point counts, 2) livestock grazing study, 3) flycatcher nesting hydrology study, and 4) vegetation/habitat mapping. These studies are designed to provide further insight into potential threats to and habitat requirements of flycatcher populations.

Table 10: Southwestern Willow Flycatcher Territories – Middle Rio Grande Project, 2000 - 2009 Breeding Seasons

	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Velarde	0	0	0	1	0	1	0	0	1	2
Frijoles	1	1	0	0	0	0	0	0	0	0
Belen	3	4	10	1	4	0	0	1	0	0
Sevilleta	18	31	14	21	17	19	17	13	11	8
San Acacia	1	2	0	0	0	0	0	0	0	0
Escondida	0	1	0	1	0	0	0	4	0	0
BDANWR	20	5	7	4	0	1	3	3	0	0
Tiffany	5	8	4	9	3	16	4	3	0	0
San Marcial	319	235	197	142	107	113	86	63	25	23
TOTAL	367	287	232	179	131	150	113	87	37	33

Elephant Butte Reservoir

In 2009, the flycatcher population grew in the area from the Bosque del Apache NWR to the south. At Elephant Butte Reservoir, flycatchers have occupied habitat to the south end of the Narrows section, just at the north end of the south pool. As reservoir levels decreased during the

late-1990s and early-2000s, vast expanses of primarily native habitat have developed on the western side of the floodplain, and by 2009 had developed as far south as the north end of the south reservoir pool. This habitat consists of dense Goodding's and coyote willow of various age classes, with water provided by the LFCC outfall. During this same period, degradation and lower flows within the Rio Grande caused habitat upstream of the reservoir pool in the San Marcial reach to decline in quality. Due to these factors, the vast majority of flycatcher territories within this reach, and the study area as a whole, are located within the reservoir pool. Habitat modeling throughout the Middle Rio Grande has shown that there is 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 more a cause of their site fidelity. It is likely that, in the absence of serious changes to the habitat or some random event, this large population within Elephant Butte Reservoir will continue to expand into suitable habitat within the reservoir.

The LFCC provides water to much of the high quality flycatcher habitat on the western side of the floodplain. Large portions of the western area of the reservoir are continually flooded, even with low flows in the LFCC. In the future, as the dynamics of the reservoir cause water levels to rise and fall, it is likely that breeding habitat will continue to be created and destroyed. It is this type of dynamic system that flycatchers depend on for breeding habitat. From year to year there may be net gains and losses of habitat, but as a whole this population should persist and be a valuable source population for the surrounding areas into the foreseeable future.

Future Conditions at Elephant Butte Reservoir

Elephant Butte Reservoir currently holds just under 30% of its total storage capacity as a result of prolonged drought. When moisture returns to the Rio Grande valley in New Mexico, it is anticipated that Elephant Butte Reservoir will again hold more water. When water levels rise, due in part to the way in which the reservoir is operated by the Reclamation, the flycatcher population at Elephant Butte Reservoir will be affected. Reclamation met with the Service, Rio Grande Compact Engineer Advisors, and other interested parties on April 28, 2005, to discuss the need to undergo ESA Section 7 consultation over possible rising reservoir levels and impacts to flycatchers. Reclamation and the Service agreed that Reclamation did not need to consult at that time, but in March 2009 all parties agreed to consult on the Elephant Butte Reservoir Five-Year Operational Plan. The Service provided a draft Biological Opinion in August 2009, which is being reviewed by Reclamation. The consultation used existing pool levels as of 2008 and models to assess reservoir water levels in the next five years under three runoff scenarios (dry, average, wet), and to assess the impacts to habitat and flycatchers from a rising reservoir level during the five year time period. Reclamation will coordinate with stakeholders prior to a final decision on acceptance of the draft Biological Opinion.

Rio Grande Silvery Minnow v. Keys Litigation

In November 1999, environmental groups collectively filed suit against Reclamation and the Corps for alleged Endangered Species Act (ESA) and National Environmental Policy Act (NEPA) violations. The Middle Rio Grande Conservancy District (MRGCD), State of New Mexico, City of Albuquerque, and Rio Chama Acequia Association subsequently intervened. The plaintiffs identified the central issue as the scope of discretionary authority that Reclamation

and the Corps have over the Middle Rio Grande and San Juan-Chama Projects' water deliveries and river operations.

The District Court of New Mexico (District Court) issued a final judgment and memorandum opinion in this case on November 22, 2005, and dismissed portions of the case. Judge Parker denied all motions to vacate his 2002 rulings regarding Reclamation's discretion over water operations. The judge ruled that in future consultations under the ESA, Reclamation must consult with the U.S. Fish and Wildlife Service over the full scope of Reclamation's discretion concerning Middle Rio Grande Project operations. The San Juan-Chama Project water-related claims were dismissed as moot with prejudice. Judge Parker's reasoning included the fact that the December 2004 "minnow rider" enacted by Congress removed Reclamation's discretion to use San Juan-Chama Project water to meet ESA requirements. Federal defendants, the State of New Mexico, and MRGCD have appealed Judge Parker's November rulings to the 10th Circuit Court of Appeals. Reply briefs were filed by all parties in 2006 for this continuing litigation.

In MRGCD's cross-claim against the United States in the *Minnow v. Keys* lawsuit, MRGCD seeks to quiet title to certain Middle Rio Grande Project properties. The United States' position in this cross-claim is that MRGCD conveyed these Middle Rio Grande Project properties to the United States and that these properties remain in the name of the United States until, among other things, Congress authorizes title transfer. The repayment contract also stays in effect until such time.

Judge Parker ruled in favor of the United States on July 25, 2005. Ownership of all properties necessary for MRG project operations, including El Vado Dam and San Acacia and Angostura diversion dams, was declared to be in the United States. In September 2005, MRGCD and the City of Albuquerque appealed Judge Parker's decision in the quiet title cross-claim. The Federal defendants' motion to dismiss or abate MRGCD's appeal was denied. MRGCD's appeal of the quiet title decision has been consolidated with the *Minnow v. Keys* appeals described above. A hearing was conducted on May 22, 2007, in Oklahoma City for both the combined cases.

There is nothing new to report in 2009.

RiverEyes

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

RiverEyes monitoring for the 2009 irrigation season monitored channel drying along the Rio Grande from Cochiti Reservoir to Elephant Butte Reservoir from July 10, 2009, through October 31, 2009. The total river miles dried during the 2009 RiverEyes monitoring period was 19.25 miles. The first occurrence of channel drying was recorded on July 19, 2009; the last occurrence

of channel drying was observed on October 18, 2009. River drying was restricted to two river segments within the San Acacia reach. The first segment involved about 17.75 miles of river drying, extending south from a point about 1.5 miles upstream of Neil Cupp to a point just upstream of the south boundary of the Bosque del Apache National Wildlife Refuge. This segment had repeated and varied responses of drying affected by local and regional storm events. The second segment of river drying lasted less than one full day and included about 1.5 miles adjacent to Fort Craig.

Temporary Pumping Program – San Acacia to Fort Craig Reach

During the irrigation season, flows in the Rio Grande between San Acacia Diversion Dam and the headwaters of Elephant Butte Reservoir can drop to a level that may potentially 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 Temporary Pumping Program also helps Reclamation comply with the continuous river requirements stipulated by Reasonable and Prudent Alternatives E, H, and L. The pumps have also been effective in allowing Reclamation to maximize the effectiveness of supplemental water releases made for ESA purposes.

In an effort to help maintain a minimum flow within this reach of the Rio Grande and comply with the Reasonable and Prudent Alternatives of the 2003 BiOp and prior biological opinions, Reclamation has installed portable pumps with flow measurement devices at strategic locations to move water from the LFCC into the Rio Grande. Discharge data for the pumping sites is now posted in orange boxes on the Reclamation ET Toolbox web site within the MRGCD Rio Grande Silvery Minnow Operations schematic pages. The URL of the referenced site is:

www.usbr.gov/pmts/rivers/awards/Nm2/rg/riog/schematic/SCHEMATICsouth.html

The total available pumping capacity for all pump locations is approximately 200 cfs, although the maximum total combined rate is limited to 150 cfs by the 2003 permit granted by the New Mexico Office of the State Engineer.

Due to the low water levels in the Rio Grande, the pumps located at Neil Cupp, North Boundary, and South Boundary pumping sites were started on July 15, 2009, and were turned off on October 30, 2009. Table 11 below summarizes the acre feet used by each pumping site for the year.

Table 11: 2009 Pumping Volume by Site

	Neil Cupp	North Boundary	South Boundary	Ft. Craig
Total Per Pumping Site For The Year	950 ac-ft	802 ac-ft	6323 ac-ft	0 ac-ft

As table 11 illustrates, the pumps located at the South Boundary site were used primarily, and the pumps located at the Ft. Craig pumping site were not used during the 2009 irrigation season. The total supplemental flows for the 2009 irrigation season provided by the pumping effort is 8075 ac-ft.

New Middle Rio Grande Water Management Biological Opinion

Reclamation has been successful in meeting the requirements of the 2003 Biological Opinion (BO), in part, through supplemental water acquisition and management with willing lessors, mainly San Juan-Chama Project (SJCP) contractors. In the future, the availability of these imported water supplies will be limited, contributing to the hydrologic unsustainability of the 2003 BO. In addition, the term of the 2003 BO expires prior to the 2013 irrigation season. In 2009, the Executive Committee of the Middle Rio Grande Endangered Species Collaborative Program (Program) decided to move forward with transitioning the Program to a "Recovery Program" based on a Long-term Plan (LTP) linked to endangered species recovery plans. ESA Section 7 consultation is needed to provide both federal and non-federal coverage. For these reasons, Reclamation and the U.S. Army Corp of Engineers (USACE) are proactively working with the Program to draft biological assessments (BA) of the effects of discretionary Middle Rio Grande water management actions and river maintenance on the Rio Grande silvery minnow and Southwestern willow flycatcher. Consultation goals are to establish comprehensive and stable ESA compliance through a hydrologically viable BO that maintains the biologic integrity of listed species. A water management strategy must be developed that optimizes management of native water and allows for carryover of leased SJCP supplemental water for dry years.

A new multi-agency, programmatic BO will be established with the LTP for the Program leading to both the road map to recovery and the Reasonable and Prudent Alternatives and Measures to avoid jeopardy. The BO would remain in effect as long as sufficient progress is being made toward recovery. The Upper Colorado and San Juan River Recovery Programs are being used as models as the Program develops its own approach to recovery. A joint federal/non-federal ESA consultation team has been established to develop a schedule and support the consultation efforts of Reclamation, the USACE, and the U.S. Fish and Wildlife Service (FWS). Current scheduling milestones include BA submittal by September 30, 2010, and a final BO by March 1, 2011. The federal agencies will initiate government-to-government consultation with the pueblos and tribes based on this approach.

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 7). 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. EBID operates and maintains the three diversion dams in New Mexico under a contract with Reclamation. In September 2003, Reclamation completed work to remove Riverside Diversion Dam and the adjacent Coffer Dam, both in Texas. Riverside Diversion Dam had been inoperable since 1987, when flooding on the Rio Grande caused the structure to fail.

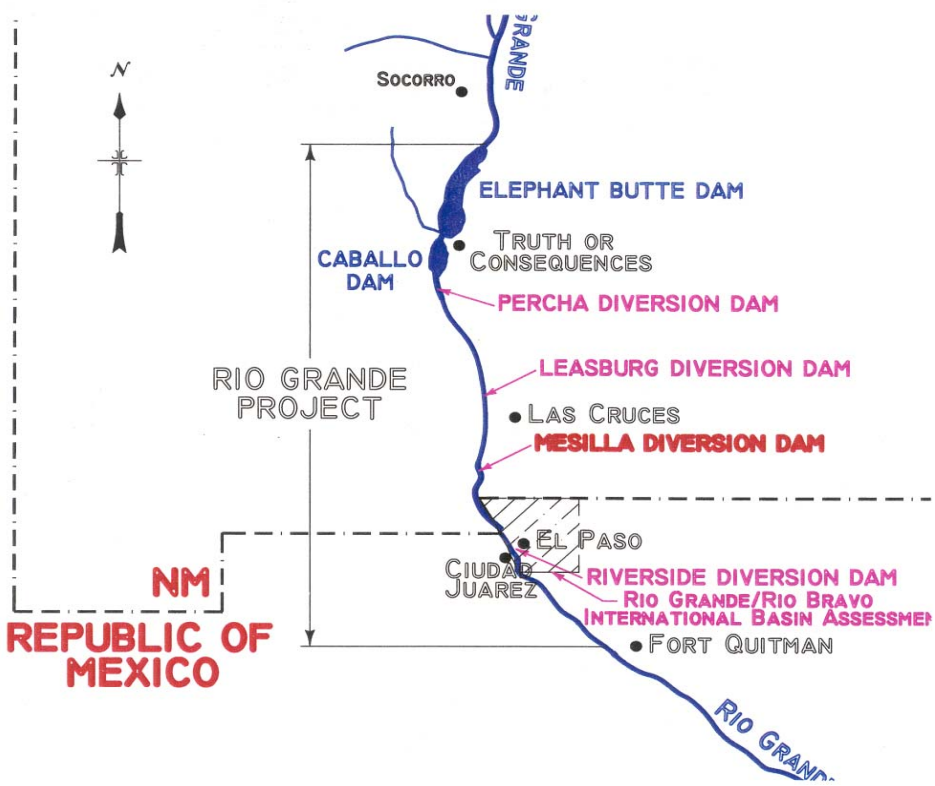

Figure 7: Area Map of the Rio Grande Project

Water Supply Conditions

Inflow into Elephant Butte Reservoir during 2009 as measured at the Rio Grande Floodway (FW) plus the Low Flow Conveyance Channel (LFCC) at San Marcial (FW+LFCC) was 661,600 ac-ft, which is 77.33% of the 97-year average annual flow at the San Marcial stations (FW+LFCC). The 97-year average annual flow at San Marcial (FW+LFCC) is 855,604 ac-ft. The actual 2009 March through July runoff, measured at San Marcial (FW+LFCC), was 431,900 ac-ft, which was 75.38% of the 30-year average of 573,000 ac-ft. During the period from 1996 to 2008, the spring runoffs (March-July) at the San Marcial gauging stations have consistently been below average, with the exception of 1997, 2005, and 2008, which were 120%, 129%, and 119% of average, respectively. The 1996, 2000, 2002, 2003, and 2006 spring runoffs have been near-record low volumes, with the 2003 spring runoff volume being the ninth lowest on record at the San Marcial gauging stations. During 2009, 764,380 ac-ft of water was released from Elephant Butte Reservoir. There was a release of 693,289 ac-ft to meet the irrigation requirements of Project water users from Caballo Reservoir.

The January through June Natural Resources Conservation Service and National Weather Service (NRCS and NWS) coordinated forecasts received for the 2009 March through July runoff season are presented in Table 12.

Table 12: Summary of 2009 Rio Grande Coordinated Spring Runoff Forecasts

Month	Forecasted Otowi Runoff (ac-ft)	Percent of 30-Year Average	Forecasted San Marcial Runoff (ac-ft)	Percent of 30-Year Average
Jan 1	915,000	121	730,000	127
Feb 1	890,000	118	710,000	124
Mar 1	760,000	100	590,000	103
Apr 1	650,000	86	480,000	84
May 1	650,000	86	480,000	84
June 1	615,000	81	360,000	63
Actual Runoff	683,681	90	662,600	75

Combined total storage for Elephant Butte and Caballo Reservoirs was 549,170 ac-ft on December 31, 2009. This combined storage was 23.33% of the total capacity of both reservoirs. In 2010, 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, or 2,224,520 ac-ft during the winter (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 on August 12, 2009. On January 18, 2010, Compact usable water in Project storage went above 400,000 ac-ft, removing the Compact's Article VII restriction on upstream storage in post-1929 reservoirs. The Compact Credit used was 126,600 ac-ft.

On January 1, 2009, total Compact credit waters in Elephant Butte Reservoir for both Colorado and New Mexico increased based on available data concerning deliveries in 2008. However, Compact usable water in Project storage remained above 400,000 ac-ft. The 2010 figures have yet to be finalized.

A final allocation to the Rio Grande Project water users of 88.97% of a full supply was declared by Reclamation in December 2009 for the irrigation season. The initial allocation to the Rio Grande Project water users (declared on Febuary 5, 2009) started at only 54.73% of a full supply. Initially, 2009 seemed promising but proved to fall short of an average year.

For the 2010 irrigation season initial allocation, a less than full allocation (30.56% of a full supply) was declared on January 12, 2010. Based on the February 1st NRCS/NWS spring runoff forecast at the San Marcial gauging stations and present hydrologic conditions, Reclamation anticipates a full supply for irrigation during 2010 for the Rio Grande Project.

The 2010 coordinated forecasts from the NRCS and NWS for the 2010 March through July runoff season is presented in Table 13.

Table 13: 2010 Rio Grande Coordinated Spring Runoff Forecasts

Month	Otowi Runoff (ac-ft) (Mar-Jul)	Percent of 30-Year Average	San Marcial Runoff (ac-ft) (Mar-Jul)	Percent of 30-Year Average
Jan 1	695,000	92	520,000	91
Feb 1	785,000	104	605,000	106

Project Irrigation and Drainage Systems and Title Transfer

In 1992, Congress authorized the transfer of title to certain irrigation facilities to the Districts. The official transfer of the irrigation and drainage rights-of-way and facilities to the Districts was completed on January 22, 1996. In 2009, the irrigation and drainage system continued to be owned, operated, and maintained by Elephant Butte Irrigation District in the New Mexico portion of the Rio Grande Project and by El Paso County Water Improvement District No. 1 in the Texas portion of the Project. Reclamation continues to own and administer the lands and rights-of-way activities of the reservoirs and diversion dam areas.

Reclamation retains title and operation and maintenance responsibilities for Elephant Butte and Caballo Dams and Reservoirs. Operation and maintenance of the diversion dams are performed by the Districts under contracts with Reclamation. Reclamation retains the rights-of-way and title of the diversion dams and their associated reserved works. The Districts performed flow measurements at canal headings, river stations, and lateral headings during 2009. Reclamation coordinated and maintained central control of releases, river operations, and water accounting.

To accomplish the water allotment accounting, the Districts collected field flow measurements and coordinated 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 2009. The International Boundary and Water Commission (IBWC) continued to own, operate, and maintain the American Diversion Dam and the American Canal during 2009 in accordance with the International Treaties with Mexico (1906 and 1933). In addition, the IBWC operated the International Diversion Dam which diverts irrigation waters into the Acequia Madre headgates operated by Mexico.

Drainage waters from the Rio Grande Project lands provide a supplemental irrigation water supply 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 was charged for drainage water from the Project between March 1 and September 30 which amounted to 102,071 ac-ft in 2009.

Water flows measured by IBWC on the Rio Grande at Fort Quitman Station, downstream of the Project and HCCRD boundaries, amounted to 103,430 ac-ft during 2009.

Elephant Butte Reservoir and Powerplant

Elephant Butte Reservoir reached a minimum storage of 448,250 ac-ft (elevation 4,336.59 ft) on September 30, 2009. A maximum storage of 705,250 ac-ft (elevation 4,354.77 ft) was reached on February 17, 2009. Storage levels in Elephant Butte Reservoir did not enter into the 50,000 ac-ft prudent flood control space in 2009.

Net power generation for 2009 was 55,309,413 kilowatt-hours which was 75.4 percent of the 69-year average (1940 through 2008) of 73,397,441 kilowatt-hours.

The power plant releases were utilized to meet downstream irrigation demand and manage Caballo Reservoir storage levels. The balanced valves were utilized to help meet peak releases during 2009. Two balanced valves were utilized between the months of February through March. One balanced valve remained open at various times of the year (April 1 to March 1, May 18 to May 25, June 11 to July 5, and July 22 to August 2). The amount of water released through the balanced valves during 2009 was 195,676 ac-ft, or roughly 25% of total releases. Reclamation anticipates that all three turbines will be available for generation and discharge by the spring of 2010.

The 2009 summer monsoon season was relatively mild, and did not produce any flood events or sediment discharges into the Rio Grande below Elephant Butte dam. There was a sediment discharge at an unnamed east bank arroyo downstream of the Truth or Consequences Wastewater Treatment Plant that required emergency sediment removal, as it might have caused the river to shift to the west bank, which could have caused erosion damage to unpaved South Riverside Drive. The Storage Division at Elephant Butte Field Division performed this work in August 2009.

Elephant Butte Dam Facility Review and Safety of Dams Programs

During the FY2009, the Elephant Butte Field Division implemented and completed the following recommendations:

- Late in 2008 a new Stage Discharge Recorder (SDR) was installed at the Elephant Butte Reservoir. This new SDR was installed in November of 2008 and set to a rod and level elevation survey. This survey turned out to be off and subsequently was showing an increase in elevation of approximately one foot. This threw off the end of year accounting for New Mexico Interstate Stream Commission (NMISC). The error was not truly noticed until this accounting occurred. As this error was a surveyor's mistake, in March of 2009 a new survey was done with a TopCon Total Station and the elevation was set correctly. This solved any future errors. The elevations from November to March that were off had to be adjusted by Nabil Shafike of NMISC and Wayne Treers of El Paso Field Division. Since this event, the lake elevation was being read on a weekly basis until last month. We are currently doing total station surveys once a month and checking them against the SDR at the dam stilling well. Our tolerance for lake elevation survey vs. SDR is +-0.05 ft. This was agreed upon by Reclamation and NMISC.
- In conjunction with AAO, a Zebra and Quagga Mussel monitoring program for Elephant Butte Reservoir and Caballo Reservoir was established. This program consists of the use of substrata traps that will give a physical indication of the invasive species. Reclamation distributed flyers that explain the impact of the mussel, and placed four billboard signs at the main docks at Elephant Butte and Caballo Reservoirs. The program goals are to keep people informed and to do occasional boat inspections. Personnel from New Mexico State Parks are trained in boat inspections. Currently several BOR employees are trained at level one mussel detection, which consists of knowing about the mussel and being able to do a boat inspection to identify any mussel on the boat. There is support for level two training that will consist of having the proper procedure to decontaminate a boat.
- Performed the 2005 CFR O&M recommendation to test service and sluice gates in balanced and unbalanced conditions. All gates operated as expected and did not show any major problems in the overall operation. The sluice gates could not be fully tested in the unbalanced condition because of the under-designed air vents in the conduit. Overall, the sluice gates operated as expected. The service gates operated excellent, both in balanced and unbalanced conditions, with no sticking of hydraulic pressure spikes.
- The lower balanced valve no. 1 malfunctioned at Elephant Butte early in 2009 and the exact cause was not entirely known at the time. After the main demand for reservoir releases passed, repair of the valve began. The repair took an extensive, collaborative effort between many of the EB Field Office's employees, but they were finally able to repair the old valve and return it to working condition.
- The power plant has been working with the Reclamation's Denver office to comply with all NERC/WEC compliance regulations. Several important breaker and safety relay tests have been completed. Designs for the station service breakers have been completed by Denver's TSC. Statement of Work and purchase of security upgrades for power plant and Elephant Butte Dam have been completed; the security equipment has been purchased and received.
- Accomplishments in 2009: Facility Rating Review and annual site exams were completed

on both Elephant Butte and Caballo dams with no major issues.

Caballo Dam and Reservoir

Caballo Reservoir reached a minimum storage of 21,410 ac-ft (4,137.96 ft) on January 1, 2009. A maximum storage of 75,770 ac-ft (4,152.03 ft) was reached on July 6, 2009.

According to Court Order No. CIV-90-95 HB/WWD of October 17, 1996, which resulted from a negotiated settlement with the Districts, the Caballo Reservoir storage level is targeted not to exceed 50,000 ac-ft (4,146.44 ft) 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's plan for operation of Caballo Reservoir during February 1 through September 30, 2009, was to maintain storage levels such that they would not exceed 50,000 ac-ft in February, not exceed 65,000 ac-ft in June, and not be less than 20,000 ac-ft by the end of September. Operating Caballo Reservoir at these storage levels during the 2009 irrigation season allowed Reclamation to:

- Reduce evaporative losses between Elephant Butte and Caballo Reservoirs,
- Provide sufficient operational hydraulic head at Caballo Reservoir for irrigation demand releases,
- Serve as a reserve pool in case releases were interrupted from Elephant Butte Dam and minimize changes to release rates from Elephant Butte Dam,
- Compensate for loss in discharge capacity from Elephant Butte Dam power plant due to the penstock guard gate repair work.

Caballo Reservoir's operating plan for October 1, 2009, through September 30, 2010, has not yet been finalized. However, Reclamation projects that Caballo Reservoir should not exceed 65,000 ac-ft during February 2010, not exceed 70,000 ac-ft during June 2010, and not be less than 50,000 ac-ft in September 2010. Reclamation will finalize its operating plan in the spring of 2010. The 2010 operations plan will reflect accommodations for the minimization of evaporation differences between Elephant Butte and Caballo Reservoirs, and maintenance of some reserve water in Caballo Reservoir for emergency purposes.

Caballo Dam Facility Review and Safety of Dams Programs

During the FY2009, Elephant Butte Field Division implemented and completed the following recommendations:

- The cableway at Caballo Gauging station was repaired and new five foot gauging marks were put on with assistance from Steven Gonzalez from Socorro Field Division. These actions were a result of Elephant Butte Irrigation District concerns about the river flow measurements at the Caballo Gauging station. The new marks are more representative of the five foot distances required for river gauging.

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 (USDC) 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, but further ordered that should it become 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.

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: This "stream adjudication" was originally filed by Elephant Butte Irrigation District (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. The most recent meetings were held on October 8, 2009 and December 8, 2009. Subsequent information exchange has worked to promote understanding of the 2008 Rio Grande Project Operating Agreement and how it will comply with any offer from the state in the stream adjudication.

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. The Investigation Report was completed under Phase 1. Phase 2 calls for evidentiary hearings in which claimants present evidence to support the validity of their claims. 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, Elephant Butte Irrigation District (EBID), and El Paso County Water Improvement District No. 1 (EP#1) agreed to, finalized, and signed a new operating agreement for the Rio Grande Project. This is very significant in that the first negotiations of a draft operating agreement started almost 30 years ago. This historic document (and its accompanying operations manual finalized in August 2008) provides detailed procedures for operating the Rio Grande Project between Reclamation, EBID, and EP#1 while recognizing and fulfilling the terms of the 1906 Convention Treaty with Mexico to supply up to 60,000 ac-ft of irrigation water from the Rio Grande Project.

The most important items of 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 EP#1 and adjusting the allocation procedures to mitigate the allotment for EP#1; and 3) an incentive for EBID and EP#1 to carry over their respective unused allotments each year with a maximum carry over provision for each District of 60% of their respective historical full allocation. This carry over 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 two irrigation seasons under the 2008 Operating Agreement and began the third irrigation season on the first week in March 2010. EP#1 ended the 2009 irrigation season with 232,915 ac-ft on their allocation account and EBID ended the season with 40,343 Ac-Ft on their allocation account. In compliance with the Operating Agreement, which limits the carryover account to 60% of a full allocation and allows for any carryover water exceeding the limits to be transferred to the other district if they are under their limit, 82,044 ac-ft of water was transferred from EP#1's account to EBID's account.

The technical team for the Rio Grande Project, which consists of representatives from EBID, EP#1, and Reclamation, met on January 12, 2010, to review and approve amendments to the operations manual. The amendments further detailed how delivery charges toward the allocation accounts are to be calculated, and also clarified the responsibilities of the United States. Specifically, when only one district is receiving water that district shall be charged for water needed to make the delivery to their diversion point. This has always been the method of accounting, and had been accepted by both districts. The amendments also established the beginning and ending dates for the allocation, and prohibit unilateral changes to the manual.

The 2008 Operating Agreement has not affected total usable Project storage. The project has released less than 700,000 ac-ft in both years that the agreement has been in effect, although more than 232,000 ac-ft of Project water was available in storage. All water released is counted as Project water, even though a portion of the water may have been from a carryover account.

The 2009 allocation procedure followed the same process as the 2008 allocation procedure. The release to delivery ratios were very similar, at about 0.98 in both years, and show that we are still operating in a drought scenario. Reclamation continues to work with each district to account accurately for water released from Caballo and water delivered at each diversion point. The wet winter that we are experiencing may provide the Project with a higher release to delivery ratio to

start the irrigation season and help all project water users to achieve a full allocation and allow carry over into 2011.

Elephant Butte and Caballo Reservoir Vegetation Management Cooperative Agreement

Under this Agreement, Reclamation performs maintenance of previously managed vegetation primarily by mowing to limit the nonbeneficial 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 5,433 acres have been sprayed at both reservoirs over the past 6 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. During 2009, no additional funds were available for these studies.

2009 Summary

During FY09, Reclamation completed mowing and/or grubbing on 2,963 acres of phreatophytic vegetation occurring at Caballo reservoir. Additionally, 839 acres of saltcedar were treated with herbicides at Caballo reservoir utilizing the carpet roller applicator and fixed wing aircraft. Aerial application costs were paid for by the Bureau of land Management (BLM), under range improvement.

El Paso Field Division Planning Studies and Interaction with the New Mexico - Texas Water Commission

The New Mexico-Texas Water Commission (Commission) was created as a result of the voluntary court settlement in the El Paso vs. Reynolds (563 F. Supp. 379 D.N.M. 1983) groundwater appropriation case. The Commission seeks to implement the best management practices for the water resources of the west Texas and southern New Mexico area (Figure 9). The following sections summarize studies that are being performed through the cooperation of Reclamation and the Commission.

Elephant Butte and Caballo Reservoir Water Quality Assessments

Reclamation and the USGS are partners in the reservoir water quality assessments of Elephant Butte and Caballo Reservoirs. These assessments consist of monitoring temperature, dissolved oxygen, and pH profiles throughout the year, in addition to investigations into the generation and potential mitigation of hydrogen sulfide gas (H_2S) releases at the Elephant Butte power production facility. The release of H_2S poses a potential health risk to the employees in the power plant, and falls under the purview of Occupational Safety and Health Act (OSHA) regulations. Dissolved H_2S below Elephant Butte is also detrimental to the cold water trout population present in the tailwaters. This effort is being managed by Reclamation's Upper Colorado Regional Office. The actual measurements are being conducted by personnel from New Mexico State University.

Rio Grande/Rio Bravo International Basin Assessment/Border Regional Environmental Workgroup

In July 2000, the Department of the Interior and Mexico's Secretariat of Environment and Natural Resources (SeMARNAT) agreed to conduct a bi-national water and natural resources assessment of a portion of the international reach of the Rio Grande / Rio Bravo. A Memorandum of Understanding was signed whereby an information exchange program was initiated. Data on cultural and natural resources were inventoried and exchanged with SeMARNAT under the leadership of the International Boundary & Water Commission. The focus is on data and reports for the Lower Rio Grande/Rio Bravo Basin.

Various groups have designated the subsections of the river differently. For the purposes of this assessment, the Lower Rio Grande / Rio Bravo is the reach between El Paso, Texas, and Amistad Reservoir. Major U.S. cities located along the Lower Rio Grande include El Paso, Laredo, Brownsville, and McAllen, Texas. Major Mexican cities along the Rio Grande are Juarez, Chihuahua, and Nuevo Laredo and Matamoros, Tamaulipas.

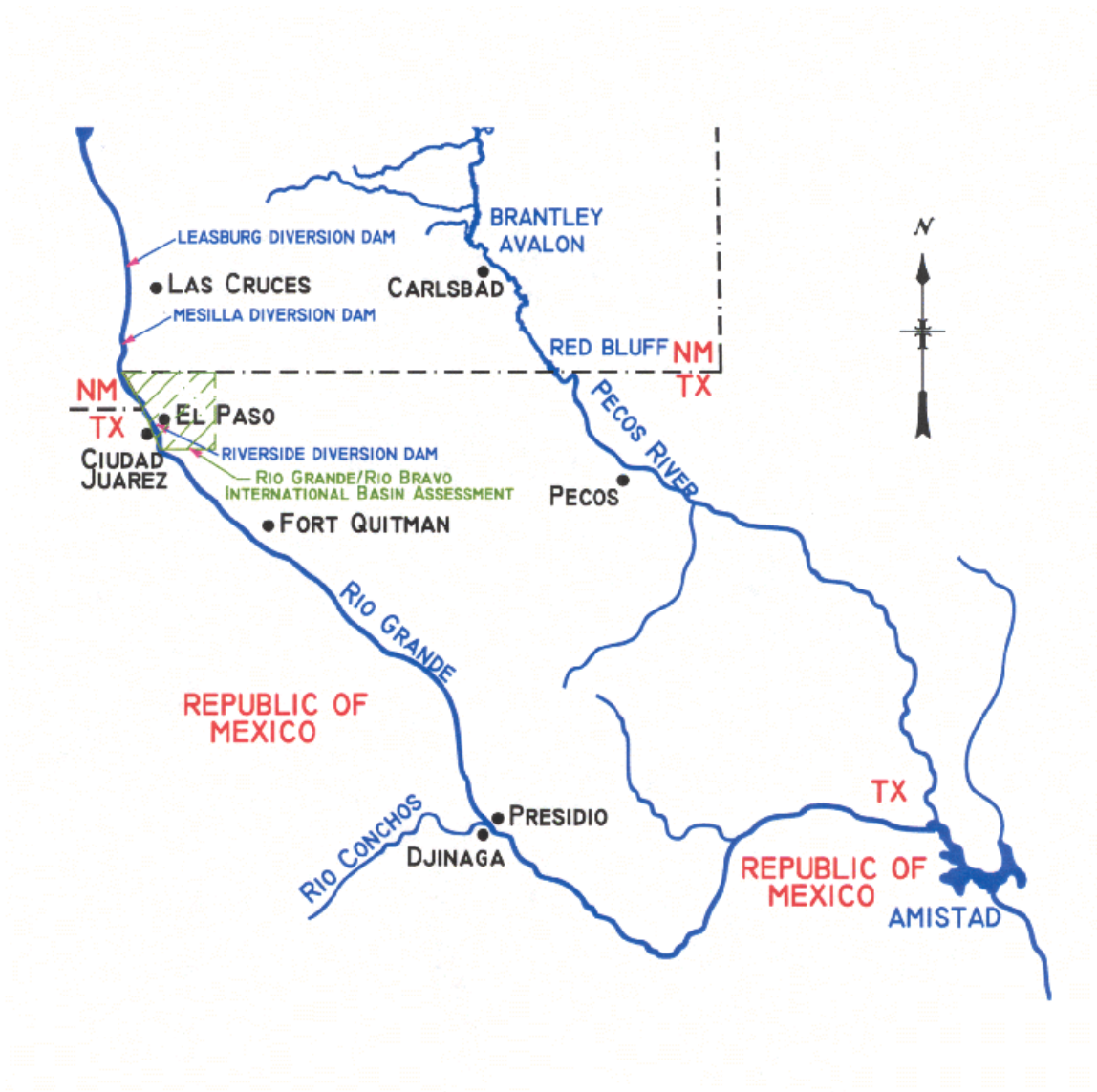

Figure 8: Area Map of the Rio Grande/Rio Bravo International Basin Assessment

The Joint Resolution signed at the bi-national Rio Grande / Rio Bravo Symposium on June 14, 2000, listed eight objectives to be accomplished to protect the ecological integrity of the Rio Grande / Rio Bravo in the reach between Fort Quitman and Amistad Dam. Subsequently, meetings have been held between federal and state agency representatives (the organizing committee) to develop a strategy to move forward with initiatives to satisfy the intent of the Joint Declaration. Under a phased completion, Phase 1 enabled implementation of four of the eight objectives listed in the Joint Declaration, (1: form a bi-national task force; 6: undertake research on biological and hydrologic conditions of the region; 7: develop and exchange compatible information systems; 8: facilitate public participation in developing strategies for environmental sustainability). This program was unfunded during the previous administration and may be reinstituted.

Current Activities

Under the leadership of the International Boundary & Water Commission, partnerships for funding are being formulated to focus on a common border riparian problem of saltcedar control. A partnership with the International Boundary & Water Commission, Bureau of Reclamation, National Park Service, U.S. Department of Agriculture – Agricultural Research Service, and the Texas Department of Agriculture exists to identify two pilot project sites for biological control of saltcedar. A bi-national transboundary aquifer study is currently being conducted along the border areas of Texas, New Mexico, and Arizona.

Environmental Health in the US-Mexico Border Region

Rapid population growth, economic development, and land-use changes are pushing the limits of environmental sustainability and quality in the US-Mexico border region. To allow for continued economic growth while protecting the area's natural resources and fostering a high quality of life, the United States and Mexico need an improved understanding of the threats posed by these anthropogenic changes. The USGS has initiated a project to provide an earth and biological resources database within a geographic framework using an internet map service (IMS) to further our understanding of the condition of the physical environment in the border region. Although the project is planned to ultimately encompass the entire US-Mexico border, initial efforts have focused on the lower Rio Grande basin from Falcon Reservoir to the Gulf of Mexico. An IMS for that study area is now available via the internet at http://borderhealth.cr.usgs.gov/.

Reports

A population study and observation of peregrine falcon nests in Big Bend National Park indicated that nest productivity rates were alarmingly low. This project evaluated the impacts of environmental contaminants on the Big Bend peregrine falcon during the 1997 breeding season by analyzing contaminants in potential avian and bat prey items. Preliminary research indicates that mercury, selenium, and DDE may be contributing to low reproductive rates. The published report is available through the USGS: *Survey of In-Stream and Riparian Zone Natural Resources and Ambient Water-Quality Conditions of the Rio Grande/Rio Bravo from Big Bend Ranch State Park near Redford, Texas, to the End of the Wild and Scenic River Segment at Foster's Ranch, Texas.*

Databases

The report and database entitled *Standardized Watersheds Database for the Lower Rio Grande/Rio Bravo, Texas USGS Open-File Report 00-065*, describes the creation of a large-scale watershed database for the lower Rio Grande/Rio Bravo Basin in Texas. The watershed database includes watersheds delineated to a 1:24,000-scale, mapped stream confluences and other hydrologically significant points, selected watershed characteristics, and hydrologic derivative data sets.

Caballo Mercury Study

Reclamation, in conjunction with the New Mexico State University's Department of Fishery and Wildlife Sciences and the USGS Biological Resources Division, has established the only mercury deposition network site in the southwestern United States. Unique to this site is the

measurement of both dry and wet deposition of atmospheric mercury.

Mercury is deposited on both a regional and global scale, and the inorganic mercury which lands in the watershed of the Rio Grande eventually washes into the river and reservoir areas. Under anaerobic conditions, bacteria may transform inorganic mercury into the toxic organic form, methylmercury (MMHg). MMHg has profound ecological effects because it is one of the few metals known to bioconcentrate, bioaccumulate, and biomagnify in aquatic food chains. The biomagnification is predominantly responsible for the elevated levels of mercury present in the fish populations at Elephant Butte and Caballo Reservoirs. The primary route of MMHg accumulation in wildlife and humans is through the ingestion of fish. The State of New Mexico has issued an advisory concerning the consumption of fish from these reservoirs. The long-term prognosis of mercury accumulation in our reservoirs is unknown, which is the primary reason for undertaking this project.

The goals of this study are to identify the transport, fate, and effects of mercury in an arid environment. Ultimately, the results of this investigation may lead to a better understanding of the potential for mercury contamination in lakes and reservoirs in both arid and wetter climates across the globe. The direct results of this research may expand this investigation to cover other Reclamation reservoirs throughout the Southwest, including Lake Powell, Lake Mead, Lake Havasu, and Roosevelt Lake.

Snow-Melt Runoff Modeling

Monitoring snow-melt runoff within the Rio Grande Basin is critical to the management and operation of the Rio Grande Project. The Rio Grande Project system of dams and reservoirs is designed for flood control and for the storage and delivery of irrigation and municipal waters. The crucial factors for determining Rio Grande Project storages, diversions, and releases are the flows within the river, and expected flows from runoff predictions. Currently, this runoff assessment is made from specific NRCS Snowpack Telemetry (SNOTEL) sites coupled with information from the National Weather Service. A Snow-Melt Runoff (SMR) model, utilizing satellite imagery and data from SNOTEL points, could greatly enhance predictive capabilities for runoff forecasts. Implementation of this SMR model is an important step towards more effectively predicting the amount of runoff expected to drain into the Rio Grande Basin. Reclamation is partnering with the Center for Applied Remote Sensing in Agriculture, Meteorology, and Environment, a cooperative effort of the College between Agriculture and Home Economics and the Physical Sciences Laboratory at New Mexico State University, and the U. S. Army Research Laboratory at White Sands Missile Range.

Other Reclamation Programs

Department of the Interior's Water for America Initiative (Formerly the Water 2025 Initiative)

In 2008, the Water for America Initiative replaced the Water 2025 Initiative. The Department of the Interior's Water for America Initiative is a plan for working with communities, irrigation districts, and states to help resolve and avert water supply crises in the West. The Rio Grande has been identified as among the most likely areas in the West to experience the kinds of water-related conflicts that Water for America is addressing. Water for America goals are being accomplished primarily through competitive award of challenge grants to irrigation districts, communities, and states. Through the Challenge Grant Program, Reclamation provides 50/50 cost-share funding for projects focused on water conservation, efficiency, and water marketing. The focus is on projects that can be completed within 24 months. The following projects are currently being funded under the Water for America Initiative.

Through 2009, Reclamation has awarded a total of $3.3 million to MRGCD for system automation, water measurement, and canal lining. In addition, Reclamation provided technical assistance to MRGCD. Recently funded or completed activities along the Albuquerque, Belen, and Socorro Divisions of MRGCD include installation of Langemann and Lopac gates, installation of five large water control structures, telemetry, and associated hardware.

Reclamation is also cooperating with MRGCD on NEPA compliance for a cross-river siphon proposed for the La Joya area. The proposed siphon would convey water directly from the Lower San Juan Riverside Drain to Drain Unit 7, which connects directly with the Socorro Main Canal North at San Acacia.

Reclamation's Water Conservation Field Service Program

Through the Water Conservation Field Services Program, Reclamation provides cost-share funding and technical assistance to a number of water management entities in New Mexico and Texas. The Water Conservation Field Services Program seeks to promote water use efficiency through support of outreach efforts, research projects, and technical assistance to water users.

Reclamation continued to support conservation outreach aimed at increasing public and industrial awareness of water issues during 2009, and completion of a water conservation plan for Santa Fe County. Promoting the nation's largest Xeriscape Conference, irrigation water management workshops were co-sponsored by Reclamation, the Office of the New Mexico State Engineer, and the New Mexico Water Conservation Alliance. Funding was provided to the New Mexico Association of Conservation Districts to support the Rolling Rivers Educational Trailers throughout New Mexico. Outreach demonstrations are generally held at the State and County Fairs, public and private schools, teacher workshops, water conferences, and other outreach activities. Funding was provided for children's water festivals in Albuquerque, Santa Fe,

Artesia, Carlsbad, Lovington, and Las Cruces, and to the Waste-Management Education and Research Consortium for workshops and community water training.

Funding and technical assistance is being provided to the City of Las Cruces to promote and demonstrate a "Lush and Lean" garden. Las Cruces hopes this showcase activity will lead through example.

The Office of the State Engineer secured a grant to produce a DVD series titled "Living on Less: A Guide to Water-Efficient Landscaping in New Mexico," which has been well received in the xeriscape community.

Title XVI Water Reclamation and Reuse Projects

Under the authority of Public Laws 102-575 and 104-266, Reclamation is/was participating with the cities of Albuquerque, New Mexico, and El Paso, Texas, in the construction of water reclamation and reuse projects. Reclamation has also participated in a Title XVI feasibility study with the City of Espanola.

City of Española

The City of Española completed its Title XVI feasibility study in 2006. The City continued to investigate and consider its water supply options during 2009. The diversion project necessary to supply the filtration facility authorized in P.L. 108-354 is still on hold pending a final decision by the City on how to divert and utilize its current San Juan-Chama Project contract allocation of 1,000 acre-feet. The authorization contained in P.L. 108-354 for federal appropriations to construct the filtration facility expired on September 30, 2009.

City of Albuquerque

In 1999 Reclamation entered into agreements with the Albuquerque Bernalillo County Water Utility Authority (ABCWUA – formerly the City of Albuquerque) that provide the framework for participation and cost sharing in their $67 million non-potable water reclamation and reuse project. Up to 25 percent federal cost share was authorized for construction of the project, not to exceed $20 million.

<u>North I-25 Industrial and Non-Potable Surface Water (Northside) Project</u>

The northside project diverts San Juan-Chama project water directly from the Rio Grande using horizontal wells, then blends it with reclaimed water from industrial recycling, and delivers this water to turf irrigation customers in the northern portions of Albuquerque. ABCWUA has completed the construction of this project and all users are connected. In FY09 this project beneficially (consumptively) used approximately 2,783 acre-feet. ABCWUA also completed a pilot aquifer storage and recovery project on Bear Canyon arroyo. The combined consumptive use for these projects in 2010 is anticipated to be 3,000 acre-feet of San Juan-Chama project water.

<u>Southside Municipal Effluent Reuse Project</u>

The southside municipal effluent reuse project will design and construct an expanded treatment

system at the Southside Water Reclamation plant to include a clearwell/chlorine contact tank, two pump stations, a 1.9 million gallon storage reservoir, and associated distribution pipelines. Design and permitting of this project is complete. Construction began in December 2009, and is projected to take approximately one year to complete. The project is being bid in four phases, with two phases of pipelines followed by the new reservoir and the treatment plant and pump station projects. The project will be operational in fall of 2010, and will provide about 2,500 acre-feet per year of polished municipal effluent. This project also received American Recovery and Reinvestment Act funding in FY2009 to accelerate construction of the southside distribution pipeline that will facilitate delivery of about 3 million gallons per day of reclaimed waters treated at the southside municipal effluent polishing facility. Reclaimed water will be used primarily for turf irrigation by various municipal, industrial, and commercial customers along the pipeline route.

Arsenic Pilot Demonstration Project

The Arsenic Pilot Demonstration Project started operating in 2008. The project removes arsenic from two wells on the west side of Albuquerque (College No. 1 and No. 2), and provides about 5 million gallons per day of drinking water that meets or exceeds the EPA drinking water MCL for arsenic.

Alameda Trunk Arsenic Project

The feasibility study began in 2008 to evaluate a new treatment system for existing wells where water quality is impaired due to naturally-occurring arsenic. Water from the wells will be piped to a central treatment facility to remove arsenic from the groundwater prior to distribution to service area customers. NEPA compliance is anticipated to begin in 2010, with construction estimated for the summer of 2011. Design and construction of the project are contingent upon receiving federal matching funding. Facilities construction is currently estimated at an additional $15 million.

Town of Chimayo

In October 2004, P.L. 108-354 was enacted, which authorized up to $3 million for emergency water supply development assistance for the Town of Chimayo. In Fiscal Year 2010, Congress provided a $233,000 earmark for the construction of storage tanks, extension of domestic water lines, and development of additional ground water supplies for the Town which will be awarded by the end of September. The Greater Chimayo Mutual Water Users Association is the project sponsor.

City of El Paso

The City of El Paso has been using recycled water since 1963. Reclamation has contributed to El Paso's efforts since 1996 through Title XVI. El Paso currently recycles 950 million gallons (2850 AFPY) of water per year through 40 miles of purple pipe. This recycle program has cost the City $56 million dollars, with Reclamation's contribution of $14.4 million. Future plans are to extend the recycled water program to Fort Bliss, which would add an additional 10 million gallons of water per day and require an additional 12 miles of pipe. There was no progress on the Fort Bliss extension during 2009.

The recycled water has been applied to some sites not suited for this water, resulting in damage

to vegetation. The City of El Paso, in conjunction with Texas A&M, has proactively implemented a best management program to help water users to better prepare their sites and select vegetation better suited for recycled water. Reclamation has contributed more than $50,000 to aid El Paso's best management practices program.

Reclamation was working with the El Paso Water Utilities-Public Service Board (EPWU-PSB) to conduct a pilot plant study for utilizing the Montoya Drain flows during the non-irrigation season (October – March). Plans are to use reverse osmosis and nano-filtration technology to reduce total dissolved solids levels (up to 2000 ppm) from the Montoya Drain to augment potable supplies. Consequently, the removal of sodium from the brine may render what has normally been a reverse osmosis waste product into a viable soil amendment that is rich in calcium and magnesium. This would eliminate the disposal costs associated with brine production as the "useful" salts would be discharged directly into the existing irrigation works of the Rio Grande Project. If this pilot study proves successful, a full sized production plant may be installed at the existing Canal Street surface Water Treatment Plant. This work has been on hold while the EPWU-PSB has concentrated on repair and upgrades to their infrastructure since the flooding in 2006.

Upper Rio Grande Water Operations Model

The Upper Rio Grande Water Operations Model (URGWOM) is a set of daily time step, river-reservoir models for the Upper Rio Grande basin that utilize a numerical computer modeling software (RiverWare) developed by the Center for Advanced Decision Support for Water and Environmental Systems (CADSWES) at the University of Colorado at Boulder. URGWOM is capable of simulating the river and reservoir hydrology, water accounting, and operational policy on the Rio Grande from the Colorado-New Mexico state line to Elephant Butte Reservoir in New Mexico. URGWOM also models flood control operations from Elephant Butte Dam to American Dam, which is located in El Paso, Texas. The URGWOM models are used in flood control operations, water accounting, and for the evaluation of short and long-term water operation alternatives.

Since 2002, the URGWOM accounting model has been the primary tool used by Reclamation for San Juan-Chama and Rio Grande Compact accounting. The Nambé Falls Accounting Model was added to the Accounting Model workspace, but was not linked to the rest of the model, and continued to be operated as a separate model independent of the main URGWOM Accounting Model through 2009. URGWOM's water operations module was used to develop the 2009 Middle Rio Grande Annual Operating Plan, and to evaluate operational scenarios for the Middle Rio Grande Biological Assessment.

URGWOM development during 2009 primarily concentrated on connectivity of RiverWare to other applications for preparation of reports and data transfer to other applications, application of new methods for modeling the groundwater and surface water interactions within the middle valley, continued improvement, documentation and clean-up of the water operations ruleset, and improvements to the Accounting Model and HDB interface. The URGWOM Technical Team and Sandia National Laboratory continued to work cooperatively during 2009 on refinements of

a monthly time step model using the Sandia Powersim simulation software.

Planned work for 2010 will concentrate on implementing the many new improvements and capabilities of RiverWare in URGWOM. These include improvements to the user interface and model run setup, the shallow groundwater - surface water interaction simulation capability, and improvements to the Daily Water Operations Model to better simulate daily water operations, including meeting in-stream flow targets and functionality for daily use. Modeling work is also anticipated for the new Biological Assessment/Opinion. The Accounting Model improvements and documentation that were completed in 2007 have improved reporting efficiency and accuracy in 2008 and 2009. Additional work to improve data storage, security, and reporting efficiency is also anticipated. Reclamation may also link the Nambé Falls Accounting Model to the main URGWOM Accounting Model in 2010.

Additional information about URGWOM and the RiverWare modeling software can be found at the Corps of Engineers' web site: http://www.spa.usace.army.mil/urgwom/default.asp.

Water Accounting Reports Projects

2009 Rio Grande Compact Water Accounting

The Rio Grande Compact accounting process (raw data→RiverWare URGWOM Accounting Model→Excel® spreadsheet→Excel tables printed) was used for all official water accounting during 2009. A new RiverWare URGWOM Accounting Model→HDB→Crystal Reports® method comparison by Reclamation for 2009 achieved favorable results. Reclamation will propose the adoption of this method for future water accounting and reporting.

Excel Based Water Accounting Spreadsheet

Reclamation completed the development and testing of a fully functional Excel Spreadsheet/DSS version of the Lotus spreadsheet/DSS Annual Water Accounting Report in 2007. The two spreadsheets were operated in parallel all year to test the logic and import/export functions of the Excel spreadsheet in comparison to results generated using the current Lotus spreadsheet. The Excel version uses the same DSS generated text files that were used as input for the Lotus spreadsheet. Improved documentation, in the form of internal notes, was incorporated within the Excel spreadsheet as it was developed. This project helped achieve Reclamation's policy directive to make Microsoft® Excel the standard spreadsheet software.

While the new Excel version of the Lotus spreadsheet was comparable to the Lotus spreadsheet, additional development in the RiverWare URGWOM Accounting Model itself has yielded data objects which now allow all accounting to occur and be saved directly in the RiverWare URGWOM Accounting Model. Excel is only used to format the data tables – no calculations are performed in Excel. An extensive written technical review of this new method was performed, and is available as a separate document. The review documents the sources of minor discrepancies between the Accounting Model and the Lotus/Excel spreadsheets, mostly due to rounding in the spreadsheets.

This new RiverWare URGWOM Accounting Model→Excel® reporting method is viewed by

Reclamation as an interim step in a process to achieve a RiverWare URGWOM Accounting Model→HDB→Crystal Reports® reporting method, where accounting model data is stored in HDB, and Crystal Reports is used to query HDB for the data, and format data tables for annual reports.

Water Accounting Documentation

A copy of the research and documentation for the new RiverWare URGWOM Accounting Model→Excel® report production method was provided to the Engineer Advisers at the annual meeting on February 25-26, 2008. The new RiverWare URGWOM Accounting Model→Excel® report production method was used for 2009.

URGWOM Accounting Module enhancements in 2009 included implementation of additional accounts in several reservoirs to better track and display individual account data, and the ability to track San Juan-Chama – Rio Grande borrow/payback at the Albuquerque Bernalillo County Water Utility Authority (ABCWUA) diversion. A Caballo Reservoir object was also added to the Accounting Model.

The new RiverWare database data management interface (DBDMI) code and logic was documented by a Reclamation contractor in early 2009. The documentation was distributed to the USACE, USGS, and ISC, but no comments were received. The documentation will greatly assist future improvements to model data loading and the HDB interface.

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, DSS, and models such as RiverWare. HDB was developed at the University of Colorado, Center for Advanced Decision Support for Water and Environmental Systems (CU-CADSWES). HDB is now maintained by contract with Sutron Corporation. HDB has been customized by independent Reclamation consultants and Reclamation 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. Several other Reclamation offices, including the Albuquerque Area Office (AAO), depend on HDB installations for the purposes of data storage and retrieval. The AAO instance of HDB is located in the Salt Lake City Regional Office.

Development of water accounting and reporting functionalities for the Albuquerque Area Office's HDB installation continued during 2009. Water accounting data is now directly transferred from the RiverWare URGWOM Accounting Model to HDB via a new HDB/RiverWare Direction Data Connection interface. Further improvements to DECODES, the Computation Processor, the Calculation Application, Compedit, and the MetaData Application were accomplished to improve data storage and availability in 2009. Reclamation performed side-by-side comparisons of 2009 accounting tables generated with Excel® and Crystal Reports® as evidence of equivalent performance and acceptability. Table data was the same, with the exception of numerous instances where Excel® rounding caused a difference of 1 unit when

compared to the Crystal Reports® table data. Reclamation upgraded to Crystal Reports® 2008 version in 2009.

Reclamation's contractors have provided detailed documentation of all calculations, as well as the mapping of URGWOM and Nambé Falls Accounting Model data slots, to the annual report tables to the NMISC. The generation of water accounting report tables using the RiverWare URGWOM Accounting Model→HDB→Crystal Reports® method will allow data to be stored securely outside the model, and will open many potential new data distribution options for Reclamation, such as daily/weekly/monthly automated email/pdf and/or internet-based html-coded reports. All accounting data remains visible and transparent in the new Accounting Model report tables, so HDB access is not required to review the data throughout the year.

Planned work for 2010 includes continued work on DECODES, the Computation Processor, the Calculation Application, Compedit and the MetaData Application. Additional Crystal Reports (Version 2008) accounting table reports for internal use and external reporting will also be developed.

RiverWare®

The use of the new RiverWare® URGWOM Accounting Model Data Objects allows for all compact accounting and accounting report table data to be derived within and acquired directly from the RiverWare® based URGWOM Accounting Model. Using Excel® as the report table generator allows the report tables to exactly reflect the Accounting Model contents, but does not allow for secure data storage, automated data reporting, and occasional rounding errors affect table column totals. The URGWOM Accounting Model Data Objects easily allow Reclamation to check the current status of individual or multiple accounts. Reclamation used the RiverWare URGWOM Accounting Model→HDB→Crystal Reports® method of data table report generation to confirm Excel® report tables in 2009. Reclamation has moved the Albuquerque Area Office (AAO) implementation of HDB (ALBHDB) to the Upper Colorado Regional Office in Salt Lake City, UT, for improved function (faster server), support, and database management. In conjunction with the movement of ALBHDB to Salt Lake City, the AAO is supporting the use of the Upper Colorado Regional Office as the data source for its modeling in addition to the current practice of receiving hydrologic data from the Albuquerque District Office of the Corp of Engineers.

Through Reclamation's current contract with the Center for Advanced Decision Support for Water and Environmental Systems (CADSWES) at Colorado University-Boulder, CADSWES has developed functionality that allows RiverWare to directly export data to HDB through a new direct data connection. CADSWES also developed the capability to directly annotate and link to external documents within RiverWare®, facilitating model documentation and annotation of water accounting transactions directly within RiverWare®, eliminating the functional need for a paper document "Green Book". Reclamation continued to maintain paper documentation while experience was gained with the new functionality in 2009.

Evapotranspiration (ET) Toolbox Decision Support System

Reclamation and others have determined a need for rapid improvement in measuring and predicting both daily open water evaporation, and daily riparian and crop water use in the Rio Grande Basin. Reclamation has developed an ET Toolbox for estimating these daily water use requirements at a resolution useful for implementation in URGWOM.

The primary purpose of the ET Toolbox project is to supply water managers within and outside of Reclamation with accurate, real-time ET predictions via a dedicated website, while making the real-time ET dataset (daily riparian and crop water use estimates, open water evaporation estimates, and rainfall estimates) available to URGWOM for daily water operations model runs. 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. The initial development work focused on the middle Rio Grande area from Cochiti Dam to San Marcial, which is just south of the Bosque del Apache National Wildlife Refuge in New Mexico. ET Toolbox coverage has now been extended 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 via the Internet at the URL http://www.usbr.gov/pmts/rivers/awards/Nm2/riogrande.html.

Development in 2009 focused on maintaining data availability and improving delivery of ET and related information. A number of new pages were under development in 2009, to be completed in 2010. Links to these pages, which are still under development, are available from the ET Toolbox home page (above), by clicking on the links under "**Stream Flow Data Under Development:**."

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, the Water for America Initiative, water rights settlements, and special projects funded through Congressional write-ins.

As part of Reclamation’s Native American and other programs, assistance was given to various Pueblos to improve irrigation system efficiency. Some of the items funded or purchased included concrete lining of farm ditches, terracing, laser leveling, check structures, pipes, and turnouts. Reclamation is working with the U.S. Department of Agriculture, Natural Resources

Conservation Service (NRCS), on additional irrigation improvements at several Pueblos. The NRCS is providing funding and design review, while Reclamation is providing surveying, design, and inspection. Reclamation is also working with the Bureau of Indian Affairs (BIA) in a similar way on irrigation system improvements. The BIA is providing funding which is being passed through to some pueblos via Reclamation. Reclamation will then provide surveying, design, and inspection, while the BIA will provide design review.

The Omnibus Public Land Management Act of 2009, Public Law 111-11, authorized up to $4,000,000 in federal appropriations to conduct a study of the eighteen Rio Grande Pueblos' irrigation infrastructure and to develop and prioritize a list of projects for repair, rehabilitation, reconstruction, or replacement. The focus will be to obtain increased water efficiency through infrastructure improvements. Construction is authorized up to $6 million per year through Fiscal Year 2019, not to exceed $60 million. In Fiscal Year 2009, Congress did not appropriate any funding to accomplish the project.

Work proceeded on a negotiated settlement of the Abouselman adjudication on the Rio Jemez involving Jemez, Zia, and Santa Ana Pueblos. Agreement has been reached at the local level on a proposed settlement of the Abeyta adjudication, which includes Taos Pueblo. Work is ongoing in settling the Aamodt adjudication, which includes Pojoaque, Tesuque, Nambe, and San Ildefonso Pueblos. The local parties are working with the New Mexico Congressional delegation to develop and pass settlement legislation.

Emergency Drought Program

Congress provided supplemental appropriations in Fiscal Year 2007 for emergency drought relief in the Reclamation states. In the Rio Grande basin, Reclamation, through an interagency agreement with the U.S. Indian Health Service, is providing drought relief by providing drinking water wells for the Pueblos of Acoma, Nambe, Isleta, and San Felipe. Acoma Well #8 was completed in May 2009. No work was performed for Nambe, Isleta, and San Felipe during 2009.

Wells for Eunice, Hagerman, and Brazos in New Mexico were completed in 2009. The well for Carlsbad, New Mexico, should be completed in January 2010. Wells for the communities of Wildlife West (Edgewood, New Mexico), Colonias, Regina, Capitan, and Cannon in New Mexico will be drilled in January of 2010. The wells for Capitan and Cannon are "re-drills" due to the poor quality of water and other issues at the previous wells. Reclamation provided funding for the previous wells at Capitan and Cannon.