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Surface Water Management: Working within the Legal Framework

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There are six major reservoirs in New Mexico upstream of the Middle Rio Grande. This article provides some background on how those reservoirs are operated within the current legal framework and how those operations meet various purposes and needs within the Middle Rio Grande.

Between the Colorado-New Mexico state line on the north and Elephant Butte Reservoir on the south, four major tributaries join the Rio Grande, including the Rio Chama, the Jemez River, the Rio Salado, and the Rio Puerco. The Rio Chama is the primary tributary, heading in the San Juan Mountains of southwest Colorado and joining the Rio Grande just north of Española. Other significant tributaries include the Red River, Rio Pueblo de Taos, Embudo Creek, and Galisteo Creek flowing out of the Sangre de Cristo Mountains; the Jemez River flowing out of the Jemez Mountains; and the Rio Salado and Rio Puerco, which join the Rio Grande just above San Acacia. With the exception of the Rio Chama and the larger streams originating in the Sangre de Cristos, these tributaries are ephemeral, flowing only during snowmelt runoff or in response to heavy precipitation events.

The six major reservoirs described here are Heron, El Vado, and Abiquiu on the Rio Chama; Cochiti on the Rio Grande; Galisteo on Galisteo Creek; and Jemez Canyon on the Jemez River. Reservoir storage is usually discussed in units of acre-feet, which is the amount of water that it takes to cover one acre to a depth of one foot, or approximately 326,000 gallons.[1]

RIO GRANDE RESERVOIRS

Heron Reservoir

Heron Reservoir is located on Willow Creek just above its confluence with the Rio Chama in northern Rio Arriba County. It was constructed in 1971 with a storage capacity of 401,000 acre-feet and is owned and operated by the U.S. Bureau of Reclamation.[2] Heron is the

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1. GEORGE A. GOULD & DOUGLAS L. GRANT, WATER LAW, CASES AND MATERIALS (5th ed. 1995).

2. JEFF B. LANGMAN & SCOTT K. ANDERHOLM, EFFECTS OF RESERVOIR INSTALLATIONS, SAN JUAN-CHAMA WATER, AND RESERVOIR OPERATIONS ON STREAMFLOW AND WATER QUALITY IN THE RIO CHAMA AND RIO GRANDE, NORTHERN AND CENTRAL NEW MEXICO, 1938-2000 (U.S. Geological Survey, Scientific Investigations Report 2004-5188, 2004), *available at* http://pubs.

storage reservoir for the San Juan-Chama Project, a federally authorized diversion project that brings roughly 100,000 acre-feet per year of water across the Continental Divide from the San Juan River basin and into the Rio Grande basin.[3] That water flows through a series of tunnels into Willow Creek and then into Heron Reservoir. Heron is allowed to store only San Juan-Chama water; it is not authorized to store native Rio Grande water (water that originates as runoff within the Rio Grande basin). San Juan-Chama water is contracted to several different water users throughout the Upper and Middle Rio Grande including multiple municipalities, the Jicarilla Apace Nation, the Pueblo of Ohkay Owingeh (formerly San Juan), and two irrigation districts.[4] The city of Albuquerque and the Middle Rio Grande Conservancy District (MRGCD) are the two largest project contractors. San Juan-Chama Project water is managed and accounted for separate from native Rio Grande water.

El Vado Reservoir

El Vado Reservoir is located on the Rio Chama just a few miles below Heron Reservoir. It was constructed in 1935 by the MRGCD and has a storage capacity of 180,000 acre-feet.[5] Both San Juan-Chama water and native Rio Grande water are stored in El Vado. The U.S. Bureau of Reclamation currently operates El Vado primarily to provide supplemental irrigation supplies to the MRGCD by agreement with the district. Native water is stored pursuant to New Mexico Office of the State Engineer permit number 1690, issued in 1930[6] (at press time, ownership of El Vado Dam and Reservoir and state engineer permit 1690 were the subjects of a legal dispute between the MRGCD and the U.S. Bureau of Reclamation). The federal government also stores and releases water from El Vado Reservior to the prior and paramount lands of the six Middle Rio Grande pueblos during

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usgs.gov/sir/2004/5188/sir2004-5188.pdf.

3. Act of June 13, 1962, Pub. L. No. 87-483, 76 Stat. 96 (authorizing the Secretary of the Interior to construct, operate, and maintain the Navajo Indian irrigation project and the initial stage of the San Juan-Chama project as participating projects of the Colorado River storage project, and for other purposes).

4. U.S. BUREAU OF RECLAMATION, ENVIRONMENTAL ASSESSMENT, SAN JUAN-CHAMA WATER CONTRACT AMENDMENTS WITH CITY OF SANTA FE, COUNTY OF SANTA FE, COUNTY OF LOS ALAMOS, TOWN OF TAOS, VILLAGE OF TAOS SKI VALLEY, AND CITY OF ESPAÑOLA (2006), *available at* http://www.usbr.gov/uc/albuq/envdocs/ea/sanjuanchama/index.html.

5. U.S. ARMY CORPS OF ENG'RS, REEVALUATION OF THE RIO GRANDE OPERATING PLAN, ALBUQUERQUE DISTRICT (1980).

6. Application for Permit No. 1690 to Appropriate the Public Waters of the State of New Mexico, filed by the Middle Rio Grande Conservancy District, May 27, 1930, approved by the New Mexico State Engineer Aug. 20, 1930.

times of low flow on the Rio Grande. Those lands have senior water rights to any other MRGCD lands.

Abiquiu Reservoir

Abiquiu Reservoir is located on the Rio Chama approximately 30 miles downstream of El Vado and about 30 miles upstream of the confluence of the Rio Chama with the Rio Grande. Abiquiu Reservoir was built in 1963, is owned and operated by the U.S. Army Corps of Engineers, and has a maximum capacity of 1,200,000 acre-feet at the top of the spillway crest.[7] The reservoir was initially authorized as a flood and sediment control reservoir, but in 1981 Congress authorized the reservoir to store up to 200,000 acre-feet of San Juan-Chama water.[8] In 1988 Congress authorized Abiquiu to store up to 200,000 acre-feet of native Rio Grande water, provided that the storage space is not needed for San Juan-Chama water.[9]

Cochiti Reservoir

Cochiti Reservoir was built in 1975, is owned and operated by the U.S. Army Corps of Engineers, and has a maximum capacity of 590,000 acre-feet at the top of the spillway crest.[10] Cochiti is located approximately 50 miles upstream of Albuquerque and is the major flood control reservoir for the Middle Rio Grande valley.[11] It is also the only reservoir on the mainstem of the Rio Grande above Elephant Butte Reservoir in New Mexico. Cochiti was initially authorized as a flood and sediment control reservoir.[12] In 1964 Congress authorized the formation of a permanent recreation pool for Cochiti Reservoir of roughly 50,000 acre-feet, which is maintained with San Juan-Chama water.[13]

Galisteo Reservoir

Galisteo Reservoir is located on Galisteo Creek approximately ten miles above its confluence with the Rio Grande near Santa Domingo Pueblo.

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7. U.S. ARMY CORPS OF ENG'RS, ABIQUIU DAM AND RESERVOIR WATER CONTROL MANUAL, RIO GRANDE BASIN, NEW MEXICO, APPENDIX A TO RIO GRANDE BASIN MASTER CONTROL MANUAL, ALBUQUERQUE DISTRICT (1996).

8. *Id.*

9. *Id.*

10. U.S. ARMY CORPS OF ENG'RS, COCHITI LAKE WATER CONTROL MANUAL, RIO GRANDE BASIN, NEW MEXICO, APPENDIX C TO RIO GRANDE BASIN MASTER CONTROL MANUAL, ALBUQUERQUE DISTRICT (1996).

11. *Id.*

12. *Id.*

13. *Id.*

Owned and operated by the U.S. Army Corps of Engineers, it was constructed in 1970 for flood and sediment control[14] and has a maximum capacity of about 90,000 acre-feet at the top of the spillway crest.[15] Galisteo is different from the other reservoirs in that its releases are uncontrolled below 5,000 cubic feet per second.[16] There are no outlet control works, so what comes in essentially equals what goes out. Water becomes temporarily stored if inflow exceeds 5,000 cubic feet per second, so most of the time the reservoir is completely dry.

Jemez Canyon Reservoir

Jemez Canyon Reservoir is located on the Jemez River a few miles above its confluence with the Rio Grande. Owned and operated by the U.S. Corps of Engineers as a flood and sediment control reservoir,[17] it was constructed in 1953 and has a maximum capacity of about 100,000 acre feet at the top of the spillway crest.[18] Jemez Canyon is similar to Galisteo Reservoir in that it is also operated as a dry reservoir.[19] However, flow out of the reservoir is controlled by outlet works that allow release of flood waters at a desirable rate.

LEGAL AUTHORITIES

All of the major reservoirs in the basin are operated in accordance with various federal and state laws that constrain or limit those operations to specific purposes or functions. The most important of these is the Rio Grande Compact.

The Rio Grande Compact

The Rio Grande Compact, an interstate agreement that apportions the waters of the Rio Grande between the states of Colorado, New Mexico,

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14. U.S. ARMY CORPS OF ENG'RS, GALISTEO DAM AND RESERVOIR WATER CONTROL MANUAL, GALISTEO CREEK, NEW MEXICO, APPENDIX B TO RIO GRANDE BASIN MASTER CONTROL MANUAL, ALBUQUERQUE DISTRICT (2001).

15. *Id.*

16. *Id.*

17. U.S. ARMY CORPS OF ENG'RS, JEMEZ CANYON DAM AND RESERVOIR, JEMEZ RIVER, NEW MEXICO, APPENDIX D TO RIO GRANDE BASIN MASTER CONTROL MANUAL, ALBUQUERQUE DISTRICT (1994).

18. *Id.*

19. *Id.*

and Texas, was executed in 1938 and became effective in 1939.[20] Under the Compact, New Mexico is allowed to consume on average roughly twice as much water as Colorado and three times as much as Texas.[21] New Mexico's share includes the amount of water it is entitled to consume between the Colorado-New Mexico state line and the Otowi gage, the amount in the Middle Rio Grande valley between Otowi gage and Elephant Butte Reservoir (including all tributary inflow and San Juan-Chama Project water), and the amount in the Elephant Butte Irrigation District below Elephant Butte in the Lower Rio Grande.[22]

There are a number of Compact restrictions that have an impact on reservoir operations and surface water management in the Middle Rio Grande valley. The most important is Article VII, which prohibits increasing storage of native Rio Grande water in any upstream reservoir constructed after 1929 when the combined storage in Elephant Butte and Caballo reservoirs, not including credit and San Juan-Chama Project water, is below 400,000 acre-feet. All of the major reservoirs are subject to this restriction except Heron because it does not store native Rio Grande water.[23]

The Article VII storage prohibitions can have a major impact on water management in the middle valley, particularly on El Vado Reservoir, which primarily stores irrigation water for the MRGCD. Article VII was invoked in 2002 for the first time since 1979 and was in effect until May of 2005.[24] Since that time it has gone into and out of effect as water storage has fluctuated at Elephant Butte and Caballo reservoirs. Article VII storage restrictions also impact McClure and Nichols reservoirs on the Santa Fe River, two relatively small reservoirs with a combined capacity of slightly less that 4,000 acre-feet that provide a significant portion of the city of Santa Fe's water supply.[25]

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20. Rio Grande Compact between Colorado, New Mexico, and Texas, Executed March 18, 1938, passed by Congress as Public Act No. 96, 76th Congress, approved by the President May 31, 1939.

21. *Id.* arts. III, IV, VII, X; Contract between Elephant Butte Irrigation District and El Paso County Water Improvement District 1, Feb. 16, 1938.

22. *Id.* arts. III, IV, VII, X; Contract between Elephant Butte Irrigation District and El Paso County Water Improvement District 1, Feb. 16, 1938.

23. U.S. ARMY CORPS OF ENG'RS, *supra* note 5.

24. ANNUAL REPORTS OF THE ENGINEER ADVISERS TO THE RIO GRANDE COMPACT COMMISSIONERS (Feb. 21, 2003 & Mar. 3, 2006) (on file with author).

25. McClure Reservoir was constructed in 1926 with 561 acre-feet of capacity and was later modified after 1929 to its current capacity of 3,257 acre-feet. The original 561 acre-feet capacity of McClure Reservoir plus 500 acre-feet of storage capacity from the city's decommissioned Two Mile Reservoir (1,061 acre-feet total), previously transferred to McClure Reservoir, is not subject to the Article VII storage prohibition.

WATER OPERATIONS AND MANAGEMENT

The term "reservoir operations" refers to the rate and timing at which storage or inflow into a reservoir is released or detained. The term "water operations" includes downstream monitoring to ensure that desired flows are achieved from changes in reservoir operations and management of downstream diversions of flows released from storage. There are essentially three main types of water operations that impact the Middle Rio Grande:

- Irrigation operations
- Flood control operations
- Environmental operations

The tools that are used by water managers to conduct these operations include near real-time flow and storage data provided by stream gages via satellite uplink, automatically controlled reservoir and diversion gates that can be supervised from the office, and sophisticated computer models to track water accounting and help plan operations.

One important thing to keep in mind while reading the following descriptions of specific reservoir operations is that very little of the native Rio Grande water originating within the basin is actually captured and stored in the major reservoirs. On average, roughly 100,000 acre-feet of native Rio Grande water, less than ten percent of the annual average flow at Otowi gage, has been historically held in storage (at least temporarily) upstream of Elephant Butte.[26] The vast majority of the combined storage of Heron, El Vado, Abiquiu, Cochiti, and Jemez Canyon reservoirs has historically been San Juan-Chama Project water.

Storage And Flow

Reservoir storage and stream flow are intimately related. Flow can become storage by capturing it in some type of container, such as a reservoir. Storage can become flow by releasing it from the container. (A continuous flow of one cubic foot per second for 24 hours is equal to roughly two acre-feet of storage.)

Water is stored in a reservoir for several different purposes. Water stored for later release to meet a downstream demand, such as irrigation demand when stream flows naturally become low, is termed conservation storage because it is water conserved to meet a future use. The primary purpose of El Vado Reservoir is to provide conservation storage for irrigation use. Flood control storage is water temporarily stored to prevent or alleviate downstream flooding. Permanent storage, such as the Cochiti

26. Based upon informal internal analysis of historical reservoir storage data.

recreational pool, is maintained indefinitely to provide recreational, fish, and wildlife benefits.

Water Accounting

All the water flowing through the basin is accounted in one fashion or another to ensure that its management and use is in compliance with all applicable law.[27] All reservoir storage and flows at particular gages are accounted to ensure that Colorado is meeting its Rio Grande Compact obligation to New Mexico and that New Mexico is meeting its obligation to Texas.[28] Water is also accounted on the level of individual ownership of various parties who have a right to its use such as the irrigation storage water released by the MRGCD, San Juan-Chama water moved from one reservoir to another by various parties, or supplemental water leased by the federal government for the endangered silvery minnow.[29]

Irrigation Operations

Irrigation operations primarily consist of changing the rate and timing of storage releases from El Vado Reservoir to ensure that there is sufficient flow in the Middle Rio Grande to meet the irrigation diversion needs of the MRGCD. To determine the rate of release, the MRGCD evaluates the amount of native flow moving downstream in the Rio Grande at Embudo and the amount of native flow contributed by the Rio Chama and other tributaries and compares that amount with their estimated future diversion demand. Diversion needs must be estimated two or three days into the future in order to determine how much storage to release from El Vado Reservoir to supplement the natural flow, as it takes that much time for those releases to reach the middle valley. Diversion needs fluctuate with weather conditions and the day of the week. Irrigation storage is released only when the natural flow is insufficient to meet the MRGCD's irrigation needs. The only times in which natural flow is sufficient to meet that need are usually early and late in the irrigation season, during the snowmelt runoff and during periods of heavy monsoon activity.

Flood Control Operations

Flood control operations adjust the rate and timing of releases or detention of inflow at the Corps of Engineers' flood control reservoirs:

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27. *E.g.*, Rio Grande Compact, *supra* note 20; New Mexico Water Code, common law, and individual federal authorizations for each reservoir.

28. Rio Grande Compact, *supra* note 20, art. II.

29. *Id.*

Abiquiu, Cochiti, and Jemez Canyon reservoirs.[30] Releases at the fourth flood control reservoir – Galisteo – are uncontrolled. The four reservoirs are operated as a system to ensure that flow levels at critical downstream points are not exceeded.[31] Flood control operations usually occur during snowmelt runoff when the mountain snowpack is heavier than normal and during heavy summer monsoon seasons.[32] The snowmelt runoff of 2005 was the most recent major period of flood control operations, when approximately 75,000 acre-feet of flood control storage was detained in Abiquiu and 45,000 acre-feet in Cochiti. That water was released once runoff flows receded and it was safe to do so.

Article VII storage restrictions do not impact flood control operations at Abiquiu, Cochiti, or Jemez Canyon. In addition, in accordance with federal law, when the natural flow during the tail end of the snowmelt runoff drops to a level that is insufficient to meet MRGCD's diversion needs, any floodwater in storage is retained until after the irrigation season ends to ensure that the Rio Grand Project receives the water it would have if the flood control reservoirs did not exist.[33]

Environmental Operations

Environmental operations for the endangered silvery minnow have had the most impact on the Middle Rio Grande in recent years. Since 1996 the U.S. Bureau of Reclamation has been leasing water from willing parties to provide supplemental flows for the minnow in the middle valley.[34] Since 2001 that supplemental water has been used to meet legally established levels of flow for the minnow as required by the Endangered Species Act.[35] This water is leased and stored in Heron, El Vado, or Abiquiu reservoirs and released during times when the natural flow of the river becomes too low to maintain certain levels in specific reaches of the Middle Rio Grande.

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30. U.S. ARMY CORPS OF ENG'RS, *supra* note 5.

31. *Id.*

32. *Id.*

33. Flood Control Act of 1960, Act of July 14, 1960, Pub. L. No. 86-645, 74 Stat. 480 (authorizing the construction, repair, and preservation of certain public works on rivers and harbors for navigation, flood control, and for other purposes).

34. U.S. BUREAU OF RECLAMATION, SUPPLEMENT TO THE RIO GRANDE SUPPLEMENTAL WATER PROGRAMMATIC ENVIRONMENTAL ASSESSMENT AND FINDING OF NO SIGNIFICANT IMPACT, ALBUQUERQUE AREA OFFICE (2006), *available at* http://www.usbr.gov/uc/albuq/envdocs/ea/riogrande/index.html.

35. U.S. FISH & WILDLIFE SERV., BIOLOGICAL AND CONFERENCE OPINIONS OF 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, ALBUQUERQUE, NEW MEXICO (2003).

A significant amount of management and coordination between the federal, state, and local water management agencies is necessary to successfully accomplish these operations. It is particularly difficult to efficiently provide relatively small flows to the lower end of the system at San Marcial by release of supplemental water stored in reservoirs on the Rio Chama when it takes five-plus days for those releases to travel that distance.