MISSION STATEMENTS

The mission of the Department of the Interior is to protect and provide access to our Nation’s natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

2006 Middle Rio Grande Annual Operating Plan

Prepared by

Dwight Slaugh, Hydraulic Engineer
Water Management Division
Albuquerque Area Office
Albuquerque, New Mexico
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Introduction

The 2006 Middle Rio Grande Annual Operating Plan was developed in coordination between the Albuquerque Area Office and the El Paso Field Office of the United States Bureau of Reclamation (Reclamation) and the Albuquerque District Office of the United States Army Corps of Engineers (Corps) with additional input from the Middle Rio Grande Conservancy District (MRGCD). Necessary data was compiled by the interested agencies and water operations were modeled in order to estimate actual operations from the present throughout the remainder of the year. Several assumptions were made and results were presented to respective agency staff as well as to the public. Albuquerque Reclamation and Corps staff presented the 2006 Middle Rio Grande Annual Operating Plan at a Public meeting in Albuquerque on April 17, 2006. The 2006 Middle Rio Grande Annual Operating Plan was presented by Reclamation at public meetings in Chama and Taos on April 19, 2006 and April 20, 2006, respectively. Specifics of the Rio Grande Project Annual Operating Plan were presented by Reclamation’s El Paso Field Division in Truth or Consequences on May 17, 2006.
Definitions

Due to the complicated nature of water operations in the Rio Grande Basin, several terms need to be defined. Several items that pertain to water operations in the Rio Grande Basin are defined below.

Native/Natural Rio Grande Water

Native/natural Rio Grande water is water that comes directly from the Rio Grande Basin. It is subject to the Rio Grande Compact.

San Juan-Chama Water

San Juan-Chama water is water that is imported into the Rio Grande Basin from the San Juan Basin through the San Juan-Chama Project which includes a network of diversion dams and transmountain tunnels.

Rio Grande Compact

The Rio Grande Compact is an agreement between the States of Colorado, New Mexico, and Texas that apportions Rio Grande water between the three states. Certain clauses in the agreement dictate how certain operations are carried out. Mexico is entitled to a certain amount of Rio Grande water by international treaty.

Article VII of the Rio Grande Compact

Article VII of the Rio Grande Compact dictates storage in reservoirs that were constructed after 1929. Article VII states that if usable water in Rio Grande Project storage is less than 400,000 ac-ft, no storage of Rio Grande water can take place at El Vado Reservoir except to satisfy Native American needs.

Rio Grande Project Storage

Rio Grande Project storage is the combined usable storage in Elephant Butte and Caballo Reservoirs. New Mexico credit water, Colorado credit water, and San Juan-Chama contractor water remaining in Elephant Butte or Caballo does not count as part of the usable project storage and must be subtracted from the total combined storage of the two reservoirs.
Summary of Rio Grande Storage Facilities

Several dams and Reservoirs in the Rio Grande Basin are used for operation and storage of Rio Grande and San Juan-Chama water. These reservoirs, along with which agency operates them and operational aspects of the facility are summarized below in Table 1.

Table 1: Summary of Rio Grande Facilities

<table>
<thead>
<tr>
<th>Facility</th>
<th>Operating Agency</th>
<th>Water Supply</th>
<th>Recreation</th>
<th>Flood Control</th>
<th>Sediment Control</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reclamation</td>
<td>Corps</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heron</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>El Vado</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abiquiu</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Nambe Falls</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Galisteo</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Cochiti</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Jemez Canyon</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Elephant Butte</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Review of 2005 Water Operations

New Mexico and Colorado experienced a relatively wet winter and spring in 2004-2005 and as a result experienced relatively high runoff flows in the Rio Grande Basin. New Mexico began 2005 under Article VII storage restrictions and Reclamation was unable to store Rio Grande water until May 17 when usable storage in Elephant Butte and Caballo Reservoirs passed the 400,000 ac-ft level as the result of the high 2005 spring runoff. The timing of the runoff and ending of Article VII restrictions greatly impacted water operations during 2005. Water operations during 2005 for each of the major reservoirs in the Rio Grande Basin are summarized below.

2005 Heron Reservoir Operations

The modeled storage and the actual storage in 2005 were relatively consistent. Small differences can be ascribed to the runoff forecast volume being higher than what was actually experienced. 2005 Heron Reservoir operations are illustrated below in Figure 1. Heron storage capacity is 401,000 ac-ft. The constant drop in storage during November and December was the release of the City of Albuquerque’s San Juan-Chama water which takes place at the end each year.

![2005 Heron Operations](image-url)

Figure 1: 2005 Heron Reservoir Operations
2005 El Vado Reservoir Operations

In 2005, Reclamation expected to fill El Vado Reservoir due to the large forecast runoff volumes. El Vado storage capacity is 180,000 ac-ft. The forecasted volume varied from what was actually experienced, and differences between modeled and actual storage in El Vado Reservoir occurred due to the timing of the runoff and the capture of water. Since Reclamation was still under Article VII storage restrictions until the middle of May, Rio Grande water could not be stored until after usable Rio Grande Project storage in Elephant Butte and Caballo Reservoirs passed 400,000 ac-ft. Once that volume was reached, storage in El Vado Reservoir began. Article VII storage restrictions were lifted a week or so later than originally predicted resulted in a fairly large amount of water that could not be stored in El Vado. A comparison of modeled and actual 2005 El Vado Reservoir operations is shown in Figure 2.

Figure 2: 2005 El Vado Reservoir Operations
2005 Abiquiu Reservoir Operations

Abiquiu Reservoir is mainly a flood control reservoir, but storage space is available for the storage of San Juan-Chama water. The San Juan-Chama water supply storage capacity in Abiquiu is 182,000 ac-ft. Actual reservoir capacity is much higher than this, but only for flood control purposes. A comparison of the modeled and actual storage in Abiquiu Reservoir in 2005 is illustrated below in Figure 3. The main reasons that account for the difference in the modeled and actual storage are due to the volume and timing of the runoff. Actual runoff volumes were higher than expected and the forecast predicted. Abiquiu Reservoir was operating for flood control during the 2005 spring runoff because of the high flows. During this time, releases from Abiquiu Reservoir were monitored closely and there was a time when the Rio Chama Acequias were suffering from erosion problems and Abiquiu releases were decreased to allow for repairs. Since the Rio Chama below Abiquiu Reservoir had not seen such high flows for several years, the increases in reservoir releases had to be closely monitored to ensure that major problems were avoided. Another reason for the difference was the model runs did not account for New Mexico credit water in storage in Elephant Butte Reservoir, which directly affects the usable volume of water and the timing of coming out of Article VII storage restrictions. This omission was discovered and corrected in subsequent water operations models.

Figure 3: 2005 Abiquiu Reservoir Operations
2005 Cochiti Reservoir Operations

Cochiti Reservoir is not operated as a storage reservoir but mainly for flood control. Cochiti Reservoir must also maintain a fairly constant reservoir surface area of 1,200 acres (approximately 50,000 ac-ft) for recreation. Since no storage takes place in Cochiti Reservoir, water that flows in flows out almost immediately. As was the case during the spring runoff period in 2005, Cochiti Reservoir operated to control flooding. The maximum release from Cochiti Reservoir during 2005 was managed to not exceed a flow of approximately 7,000 cfs, at Albuquerque. The flow was managed slowly by making increases every few days and monitoring to see how certain areas would respond. Large scale erosion was taking place in several areas downstream of Cochiti during the runoff of 2005 and problem areas were closely monitored to ensure that reservoir releases were not too high. The maximum daily mean flow at Albuquerque in 2005 was approximately 6,500 cfs and was experienced in early June. 2005 modeled and actual Cochiti Reservoir operations are compared in Figure 4.

![2005 Cochiti Operations](image-url)

Figure 4: 2005 Cochiti Reservoir Operations
Current Snow Conditions

The 2005-2006 winter has been extremely dry in New Mexico. Prior to the month of March, snow levels dropped to near record lows throughout most of the region and the runoff outlook was looking bleak. Due to some much needed precipitation during March, snowpack levels have increased but are still well below normal. Prior to March, snow levels were at or below the levels that were experienced during 2002, which is the lowest snowpack experienced in recent times. Figure 5 through Figure 8 shows current snow conditions at SNOTEL measurement sites that directly affect the runoff volumes that reach the Rio Grande and the Rio Chama. Each figure shows the current precipitation and snow water equivalent information and compares it to the average conditions. As can be seen by examining the plots of each site, it becomes apparent that the current precipitation and snow water equivalent levels are well below average and that some of the sites that provide runoff volume to the basin are already melted out.

![Figure 5: Current snow conditions at the Cumbres SNOTEL site -- Rio Chama](image)
Figure 6: Current snow conditions at the Chamita SNOTEL site -- Rio Chama

Figure 7: Current snow conditions at the Wolf Creek Summit SNOTEL site -- Rio Grande
Figure 8: Current snow conditions at the Upper Rio Grande SNOTEL site -- Rio Grande
Annual Operating Plan Modeling Information

Major Assumptions
Several assumptions were made prior to performing the water operations model to estimate water operations for the remainder of 2006. The basic assumptions are summarized immediately below and if necessary, additional information is provided later in this report.

Forecast
The April 1 50% most probable runoff forecast volumes provided by the United States Department of Agriculture, Natural Resources Conservation Service (NRCS) were used in the water operations modeling.

ESA Flows
Dry year ESA flow requirements as defined under the current Biological Opinion were assumed for the water operations modeling in development of the Annual Operating Plan. According to the Biological Opinion, a dry year classification requires certain flow targets at certain locations along the Rio Grande. The Rio Grande at Central Avenue in Albuquerque must have 100 cfs throughout the entire year. Continuous flows are required all the way to San Marcial through June 15th and then sections of the river can be dried downstream of Isleta Diversion Dam.

Monsoon Conditions
Dry monsoon conditions were assumed for modeling the Annual Operating Plan.

River Recession
According to the Biological Opinion, certain sections of the Rio Grande can be dried after June 15th. The Biological Opinion states that four miles of river can be dried per day per reach so that Rio Grande silvery minnow rescue efforts can take place to salvage eggs and fish. In order to ensure that the rate of river drying is not too high, the plan is to manage the recession in 10 cfs incremental decreases and responses are monitored.

Recruitment Flows
In past years, recruitment flows, formerly characterized as “spawning spikes” were managed to ensure that the silvery minnow spawned so the fish population could propagate. Releases of supplemental water supplies were not needed to generate a recruitment flow in 2005 because of the already high runoff flows in the river. Due to the lack of water this year, a recruitment flow in 2006 was not anticipated and was not modeled as part of the development of the Annual Operating Plan.

Drought Storage
Since it was assumed that Article VII storage restrictions would be in effect during the runoff period, it was assumed that water would be stored under the Emergency Drought Water Agreement for Reclamation and the MRGCD.
Runoff Volumes

March through July runoff volumes at several forecast points for the April 1 forecast were determined by the NRCS. Monthly forecast volumes and the annual runoff volume forecasts for Lobatos were provided by the State of Colorado. March through July (except for Lobatos annual total) forecast volumes are summarized below in Table 2. The State of Colorado did not provide a 90% exceedance probable forecast for Lobatos.

Table 2: Runoff Volumes Based on NRCS April 1 Forecast

<table>
<thead>
<tr>
<th>Forecast Point</th>
<th>Most Probable (acre-feet)</th>
<th>70% Exceedance (acre-feet)</th>
<th>90% Exceedance (acre-feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lobatos</td>
<td>62,125</td>
<td>41,700</td>
<td>--</td>
</tr>
<tr>
<td>Lobatos Annual</td>
<td>143,280</td>
<td>119,000</td>
<td>--</td>
</tr>
<tr>
<td>Red River below Fish Hatchery</td>
<td>14,100</td>
<td>10,900</td>
<td>7,300</td>
</tr>
<tr>
<td>Rio Pueblo de Taos below Los Cordovas</td>
<td>6,000</td>
<td>3,200</td>
<td>2,400</td>
</tr>
<tr>
<td>Embudo Creek at Dixon</td>
<td>10,400</td>
<td>6,100</td>
<td>2,500</td>
</tr>
<tr>
<td>Rio Grande at Otowi Bridge</td>
<td>265,000</td>
<td>210,000</td>
<td>151,000</td>
</tr>
<tr>
<td>Santa Fe River above Cochiti</td>
<td>470</td>
<td>410</td>
<td>370</td>
</tr>
<tr>
<td>Jemez River near Jemez</td>
<td>5,900</td>
<td>5,600</td>
<td>5,200</td>
</tr>
<tr>
<td>Jemez River below Jemez Dam</td>
<td>2,800</td>
<td>1,800</td>
<td>1,400</td>
</tr>
<tr>
<td>El Vado Reservoir inflow</td>
<td>91,000</td>
<td>76,000</td>
<td>57,000</td>
</tr>
<tr>
<td>Rio Blanco at Blanco Diversion</td>
<td>34,000</td>
<td>30,000</td>
<td>24,000</td>
</tr>
<tr>
<td>Navajo River at Oso Diversion</td>
<td>42,000</td>
<td>36,000</td>
<td>29,000</td>
</tr>
<tr>
<td>Rio Grande near Del Norte</td>
<td>355,000</td>
<td>310,000</td>
<td>251,000</td>
</tr>
</tbody>
</table>

Colorado Deliveries

Monthly delivery volumes from Colorado at the state line at Lobatos were provided by the Colorado Office of the State Engineer and were based on the NRCS April 1 forecast. Estimated Colorado deliveries are summarized below in Table 3. Monthly delivery volumes based on the NRCS April 1 most probable forecast (50%) and the 70% exceedance forecast were provided, but delivery volumes based on the NRCS 90% exceedance were not provided.

Table 3: Estimated Colorado Deliveries to the State Line at Lobatos

<table>
<thead>
<tr>
<th>Month</th>
<th>Most Probable Forecast (acre-feet)</th>
<th>70% Exceedance (acre-feet)</th>
<th>90% Exceedance (acre-feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>16,900</td>
<td>16,900</td>
<td>--</td>
</tr>
<tr>
<td>February</td>
<td>15,600</td>
<td>15,600</td>
<td>--</td>
</tr>
<tr>
<td>March</td>
<td>17,700</td>
<td>17,700</td>
<td>--</td>
</tr>
</tbody>
</table>
Similar Hydrologic Year

The March through July runoff volumes for the most probable forecast (50%) summarized above were entered into the forecasting model and a similar hydrologic year was chosen by the water operations model to model the entire year. The same similar historical hydrograph was used to model the pre-forecast period (January – February) and the post-forecast period (August – December) that was determined based on the forecast period (March – July) runoff volumes.

Dry monsoon conditions are anticipated this year so the post-forecast inflow hydrograph for the Sangre de Cristo Basin was reduced by 15% to generate a more conservative baseflow scenario. Hydrologic years used in the model are summarized below in Table 4.

<table>
<thead>
<tr>
<th>Basin</th>
<th>Pre-Forecast Year</th>
<th>Forecast Year</th>
<th>Post-Forecast Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Juan</td>
<td>1989</td>
<td>1989</td>
<td>1989</td>
</tr>
</tbody>
</table>

Middle Rio Grande Irrigation Operations

Middle Rio Grande irrigation operations, diversions, return flows, etc. used in the water operations model were based on 2004 annual data. This 2004 annual data was used to model the pre-forecast, forecast, and post-forecast periods during the year.
MRGCD Demand Curve

Updated MRGCD Demand values were supplied by David Gensler of the MRGCD. The MRGCD peak demand during the irrigation season is 950 cfs. Figure 9 below shows the demand curve provided by the MRGCD.

![MRGCD Demand Curve](image)

Figure 9: MRGCD irrigation demand used to model 2006 water operations

Rio Grande Project Demand

The Rio Grande Project demand schedules for Elephant Butte and Caballo Reservoirs were provided by Wayne Treers of the Bureau of Reclamation’s office in El Paso, Texas. Project demand schedules were provided for the most probable condition and the 70% exceedance (drier) condition based on the NRCS April 1 forecast.

Supplemental Water

Several sources of supplemental water are available to meet the needs of the endangered Rio Grande silvery minnow. Supplemental water is comprised of leases of water from willing San Juan-Chama contractors and water stored under the Emergency Drought Water Agreement for Reclamation that is used to achieve the flow requirements of the current Biological Opinion.
Reclamation is also authorized to store New Mexico relinquished water under the Emergency Drought Water Agreement of 2003. This relinquished water is also used to meet endangered species needs and there is only a finite amount of water that can be captured under this agreement. The agreement expires at the end of 2006. Additional details concerning these supplemental sources of water are described below.

**San Juan-Chama Water**
Several San Juan-Chama contractors are leasing water to Reclamation to provide supplemental water to meet minimum flow targets for the silvery minnow. The anticipated San Juan-Chama leases in Heron are summarized below in Table 5. Not all of these lease contracts have been executed at this time, but this summary includes amounts that are anticipated and are currently being pursued and negotiated. San Juan-Chama contractor leases were transferred to the Reclamation pool in Heron on April 1 in the water operations model so the supplemental water would be available throughout the entire time of the water operations modeling.

<table>
<thead>
<tr>
<th>San Juan-Chama Contractor</th>
<th>Leased Volume (acre-feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jicarilla-Apache Tribe</td>
<td>6,000</td>
</tr>
<tr>
<td>San Juan Pueblo</td>
<td>2,000</td>
</tr>
<tr>
<td>Los Alamos</td>
<td>1,200</td>
</tr>
<tr>
<td>Belen</td>
<td>450</td>
</tr>
<tr>
<td>Taos</td>
<td>400</td>
</tr>
<tr>
<td>Red River</td>
<td>60</td>
</tr>
<tr>
<td>Española</td>
<td>1,000</td>
</tr>
<tr>
<td>Uncontracted</td>
<td>2,990</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14,100</strong></td>
</tr>
</tbody>
</table>

**Emergency Drought Water**
Emergency Drought Water can be captured when Article VII compact restrictions are in effect. Reclamation has a remainder of 4,934 ac-ft left to capture while MRGCD has approximately 20,000 ac-ft. MRGCD informed Reclamation that they anticipate capturing approximately 10,000 ac-ft of this amount and this volume was used in the water operations modeling. Reclamation will capture their remaining emergency drought water if there is sufficient runoff available after the capture of required P&P storage.

Emergency Drought Water is considered a source of supplemental water and Reclamation will use their current Emergency Drought Water in storage and the remainder of the water to be captured to meet the flow targets required to sustain the silvery minnow. Additional Emergency Drought Water will only be stored after storage has taken place that will meet the needs of the Six Middle Rio Grande Pueblos.
Rio Grande Project Usable Storage

Rio Grande Project storage is the combined usable storage in Elephant Butte and Caballo Reservoirs. Rio Grande Compact Article VII storage restrictions become effective when the combined usable storage drops below 400,000 ac-ft. New Mexico credit water, Colorado credit water, and San Juan-Chama contractor water remaining in Elephant Butte or Caballo does not count as part of the usable project storage and must be subtracted from the total combined storage of the two reservoirs.

New Mexico Credit Water

A volume of 37,000 ac-ft of New Mexico credit water was used in the water operations modeling scenarios. This volume was provided by the New Mexico Office of the State Engineer for inclusion in the model. New Mexico credit water must be subtracted from the total combined Elephant Butte and Caballo Reservoir storage to determine the actual usable storage.

Colorado Credit Water

A Colorado credit water volume of 4,500 ac-ft was used in the water operations modeling to. This volume was provided by the New Mexico Office of the State Engineer. Colorado credit water must be subtracted from the total combined Elephant Butte and Caballo Reservoir storage to determine the actual usable storage.

San Juan-Chama Water in Elephant Butte

A volume of 5,078 ac-ft of San Juan-Chama water currently in storage in Elephant Butte Reservoir was used in the water operations modeling in order to determine the Annual Operating Plan. This volume is subject to evaporation and constantly changes. Any San Juan-Chama water currently stored in Elephant Butte Reservoir must be must be subtracted from the total combined Elephant Butte and Caballo Reservoir storage to determine the actual usable storage.

Managed Recession

As discussed previously, drying of the river after June 15th must be managed carefully so that the drying limits outlined in the Biological Opinion are not exceeded. The plan for the managed recession determined by Reclamation, the Corps, NMISC, and the MRGCD is summarized below in Table 6. Flow targets are listed for the various locations and 10 cfs cuts are made every three days.

<table>
<thead>
<tr>
<th>Date</th>
<th>Central</th>
<th>Isleta</th>
<th>San Acacia</th>
<th>San Marcial</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 1</td>
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Water Operations Modeling Results

The 2006 Middle Rio Grande Annual Operating Plan was designed based on water operations modeling incorporating each of the assumptions and other items discussed above. Modeling results for specific reservoirs and other modeled 2006 water operations are discussed in more detail below.

Summary of Annual Operating Plan Results

The following list provides a summary of results from the water operations modeling used to determine the 2006 Middle Rio Grande Annual Operating Plan:

- Snowmelt runoff is well below normal, which greatly affects operations
- A full irrigation season for MRGCD is anticipated
- MRGCD will utilize almost all of it’s storage by the end of irrigation season
- Biological Opinion flow requirements will be met throughout the irrigation season
- Supplemental water releases began in Mid-March
- Supplemental water supplies will likely be fully utilized to meet Biological Opinion requirements (43,000 – 47,000 ac-ft will likely be required)
- Additional supplemental water supplies may be needed
- Article VII of the Rio Grande Compact is currently in effect and will remain in effect throughout the year
- Heron Reservoir inflow will be approximately 44% of average (58,000 ac-ft)
- Weekend recreational flows will be provided on the Rio Chama throughout most of the summer (July 1st through September 4th)
Proposed 2006 Heron Reservoir Operations

Storage capacity in Heron Reservoir is 401,000 ac-ft. The modeled water operations show that the lake elevation will drop from 7,145 ft to 7,128 feet by the end of the year due to reservoir evaporation and the release of 2006 San Juan-Chama contractor allocations. Current reservoir levels and projected inflows will allow for full San Juan-Chama contractor allocations in both 2006 and 2007. Reservoir levels in 2007 and beyond are a function of future snowpack and runoff conditions, and cannot be reliably forecast at this time. Figure 10 shows the proposed 2006 Heron Reservoir operations.
Proposed 2006 El Vado Reservoir Operations

The total storage capacity in El Vado Reservoir is 180,000 ac-ft. Very little storage of native Rio Grande water is projected to occur in 2006 due to the low spring runoff forecast and the storage restrictions required by Article VII of the Rio Grande Compact. Most of the storage from El Vado Reservoir will likely be released by the end of the year to meet downstream irrigation demand and the flow requirements of the current Biological Opinion. Irrigation releases from El Vado Reservoir should help to sustain rafting flows on the Rio Chama throughout most of the summer as flows on the mainstem of the Rio Grande are projected to be well below the level required to meet irrigation demands in the middle valley. Reclamation plans on using movements of leased San Juan-Chama water between Heron and Abiquiu Reservoirs to help maintain weekend rafting flows from July 1st through September 4th. Proposed 2006 El Vado Reservoir Operations are shown in Figure 11.

![Proposed 2006 El Vado Reservoir Operations](image-url)

Figure 11: Proposed 2006 El Vado Reservoir operations
Proposed 2006 Abiquiu Reservoir Operations

Abiquiu Reservoir is operated by the Corps for flood control purposes. Although the facility is operated mainly for flood control, storage space is available in the reservoir for 182,000 ac-ft of San Juan-Chama water. The model predicts that Abiquiu Reservoir will start the year at an elevation of 6,207 ft and nearly fill (in terms of water supply storage, but not flood control capacity) to an elevation of 6,220 ft. The reservoir elevation will drop to an elevation of approximately 6,207 ft due to evaporation and releases of stored San Juan-Chama water and then recover to a nearly full (water supply) elevation of 6,216 ft by the end of the year when additional 2006 San Juan-Chama contractor allocations are moved from Heron to Abiquiu Reservoir. No flood control operations are anticipated unless significant precipitation events occur during the year. Figure 12 shows the proposed 2006 Abiquiu Reservoir operations.

San Juan-Chama water owned by the City of Albuquerque as well as other San Juan-Chama contractors will be delivered to Abiquiu Reservoir and stored for future use. Reclamation will store and release leased supplemental San Juan-Chama water from Abiquiu Reservoir for achieving the flow requirements of the Biological Opinion. Released supplemental San Juan-Chama water is used by MRGCD for middle valley irrigation, and MRGCD then leaves an equivalent amount of native Rio Grande water in the river for achieving the flow requirements.
Supplemental water releases to meet Biological Opinion flow requirements for the Rio Grande silvery minnow began in the middle of March 2006 and will continue as necessary. Figure 13 shows the anticipated 2006 Reclamation releases from Abiquiu Reservoir to meet flows required by the Biological Opinion. The releases flows shown in Figure 13 include releases of Reclamation’s Emergency Drought Water from El Vado that are bypassed through Abiquiu Reservoir.

Figure 13: Anticipated 2006 supplemental minnow releases by Reclamation from Abiquiu Reservoir
Proposed 2006 Cochiti Reservoir Operations

Cochiti Reservoir is operated mainly for flood control purposes, but a recreation/fishery pool of approximately 50,000 ac-ft must also be maintained. No storage of native Rio Grande water can take place in Cochiti Reservoir and inflow of native Rio Grande water must be immediately released. No flood operations are expected during 2006 unless some large rain events occur. Figure 14 shows the proposed 2006 Cochiti Reservoir operations. Inflow and outflow plot nearly on top of each other which is how the reservoir must be operated. The MRGCD demand curve is also plotted to show that the MRGCD demand is met throughout the irrigation season through releases from Cochiti Reservoir.

Figure 14: Proposed 2006 Cochiti Reservoir operations
Estimated 2006 Hydrograph below Jemez Reservoir

Jemez Reservoir is operated as a dry reservoir with no water supply storage taking place except in the case of flood control operations. No flood control operations are anticipated during 2006 unless major storm events occur. There was very little snow in the Jemez Mountains this past winter, and this has resulted in little or no spring runoff in the Jemez River. Peak spring flows are anticipated to reach approximately 30 cfs, and these have likely already passed. Small peaks of 40 to 70 cfs are predicted in the summer and fall unless larger rains occur. Figure 15 shows the 2006 predicted hydrograph below Jemez Reservoir.

Figure 15: Predicted 2006 hydrograph below Jemez Reservoir
The extremely low snowpack in Colorado and New Mexico this year has resulted in low flows in the Rio Grande. The estimated Embudo hydrograph shows a spring runoff peak of approximately 900 cfs. This peak flow was never realized and the Rio Grande mainstem peak has likely already passed at something closer to 600 cfs. Low summer and fall baseflows at Embudo on the Rio Grande will result in more water being released from storage on the Chama to meet downstream irrigation demands and the flow requirements of the Biological Opinion. The 2006 estimated Embudo hydrograph is shown in Figure 16.
Estimated 2006 Central Avenue Hydrograph

One of the major flow requirements of the Biological Opinion is that the Rio Grande at Central Avenue in Albuquerque has 100 cfs flowing continuously. Other reaches of the river may be dried during certain times of the year, but Central Avenue must always be flowing continuously with a minimum flow of at least 100 cfs. MRGCD’s demand peaks at 950 cfs during late June and early July so large amounts of water are released from upstream storage to meet these demands. The Annual Operating Plan predicts that the Biological Opinion flow requirements for the Rio Grande silvery minnow are maintained throughout the entire year and dip to around the minimum flow of 100 cfs at Central Avenue in October 2006. Figure 17 shows the estimated Central Avenue hydrograph for 2006.

Figure 17: Estimated 2006 Central Avenue hydrograph
Estimated 2006 San Acacia Hydrograph

The Biological Opinion states that the Rio Grande must remain continuous all the way to Elephant Butte Reservoir through June 15th. After June 15th, the river can be dried as long as the rate that drying occurs does not exceed set limits. The 2006 Annual Operating Plan projects that the Rio Grande will remain continuously flowing through June 15th, after which it will be gradually dried according to the planned managed recession discussed previously. The reach between San Acacia and San Marcial will likely experience periods of drying, rewetting and then drying once more due to seasonal monsoons. Figure 18 shows the estimated 2006 hydrograph at San Acacia.

Figure 18: Estimated 2006 San Acacia hydrograph
Estimated 2006 Usable Storage and Elephant Butte Reservoir Storage

Rio Grande Project usable storage is defined as the combined storage of Elephant Butte and Caballo Reservoirs less New Mexico and Colorado credit water and any San Juan-Chama water in storage in Elephant Butte Reservoir. If the total Rio Grande Project usable storage level drops below 400,000 ac-ft, Rio Grande Compact Article VII storage restrictions become active and no storage of native Rio Grande water can take place in upstream reservoirs constructed after 1929. Storage to satisfy the needs of the Six Middle Rio Grande Pueblos, and any Emergency Drought Water Agreement credit relinquishment water yet to be stored is exempt from Article VII storage restrictions. Article VII restrictions became active on April 13, 2006 and this was reflected in the modeling results of the 2006 Annual Operating Plan. It is anticipated that Article VII storage restrictions will be in effect for the rest of 2006 and throughout 2007 unless an extremely wet monsoon season this year and a much wetter than average winter and spring in 2007 is experienced. Figure 19 shows the estimated 2006 Rio Grande Project usable storage.

![Graph showing estimated 2006 Rio Grande Project usable storage](image)

Figure 19: Estimated 2006 Rio Grande Project usable storage
Estimated 2006 Elephant Butte Reservoir Storage

According to the water operations models used in developing the 2006 Middle Rio Grande Annual Operating Plan, Elephant Butte Reservoir storage will drop to approximately 50,000 ac-ft. The El Paso Field Office of Reclamation concurs with this estimate and has stated that they anticipate a minimum reservoir volume of approximately 55,000 ac-ft in September 2006. Figure 20 shows the estimated 2006 Elephant Butte Reservoir storage.

Figure 20: Estimated 2006 Elephant Butte Reservoir storage
2006 ESA Supply/Demand Outlook

Based on the available supply of existing storage and anticipated storage of supplemental water, the needs of the Rio Grande silvery minnow are likely to be met. It will be difficult to meet the flow requirements if the volumes that are actually realized are less than the forecast volumes. A summary of the estimated supply/demand outlook for 2006 is shown in Table 7 and the breakdown of the supplies is shown in Table 8. Due to the dry winter and low runoff volumes available at this time, volumes are already nearing the high end of the demand range.

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<th>Table 8: Breakdown of supplemental water sources</th>
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<td>Emergency Drought Water in El Vado</td>
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<td>San Juan-Chama water in Abiquiu</td>
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<td>Total</td>
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