

**REPORT OF THE ENGINEER ADVISERS
TO THE RIO GRANDE COMPACT COMMISSION
FOR CALENDAR YEAR 2021**

April 22, 2022

Because of the on-going, global COVID-19 pandemic the Engineer Advisers to the Rio Grande Compact Commission met via video conference on February 2, 2022 and between February 28 and March 4, 2022 to:

- Receive reports;
- Prepare the 2021 Rio Grande Compact (Compact) water accounting;
- Discuss continuing and new issues in preparation for the 2022 annual meeting of the Rio Grande Compact Commission (Commission); and
- Prepare the Engineer Advisers' report.

The Engineer Advisers received the participation of the U.S. Geological Survey (USGS), the U.S. Bureau of Reclamation (Reclamation), the U.S. Army Corps of Engineers (Corps), the U.S. Bureau of Indian Affairs (BIA), the International Boundary and Water Commission (IBWC), and the U.S. Fish and Wildlife Service (Service) at the meetings. The agencies each presented information about their specific water-related activities in the basin during calendar year 2021.

COMPACT ACCOUNTING

The Engineer Advisers reviewed the streamflow and reservoir storage records and other pertinent data for the Upper Rio Grande Basin during calendar year 2021 and were again unable to reach a consensus on the accounting. The lack of consensus arises from a disagreement that began in 2011 amongst the Texas Engineer Adviser and the New Mexico and Colorado Engineer Advisers on the release of credit water by Reclamation from Elephant Butte Reservoir in late summer 2011. As a result, the Engineer Advisers have not reached consensus on how to finalize the 2011 through 2021 Compact Delivery accounting sheets for Colorado and New Mexico and

the Release and Spill from Project Storage accounting sheet. For 2021, as in previous years, each of the Engineer Advisers developed accounting methods described in the addenda to this report from each Engineer Adviser. At its 2021 meeting, the Commission did not approve any of the proposed accounting methods. The Engineer Advisers continued to use the accounting methods they individually prepared to carry forward Compact accounting for the 2021 calendar year. Article VII storage restrictions were in effect for all of 2021, using either accounting method, so there were no impacts to the timing of storage restrictions for calendar year 2021.

For calendar year 2021, New Mexico carried an Accrued Debit of 96,300 acre-feet, in accordance with the New Mexico Engineer Adviser's accounting methodology. Article VI of the Rio Grande Compact states in part that, "*Within the physical limitations of storage capacity of such reservoirs, New Mexico shall retain water in storage at all times to the extent of its accrued debit.*" At the beginning of calendar year 2021, New Mexico had 2,181 acre-feet of Compact Debit water remaining in storage in El Vado Reservoir after reduction due to evaporation and sedimentation during 2020. In accordance with Article VIII of the Compact, the Commissioner for Texas requested that New Mexico release remaining Debit water for delivery to Elephant Butte. The Debit water release from El Vado was completed between January 11 and January 16, 2021. Additionally, between January 16 and January 29, 2021, City of Santa Fe released 956 acre-feet of their San Juan-Chama Project (SJCP) water from storage in Abiquiu Reservoir in exchange for releasing native debit water stored in their reservoir system.

The Engineer Advisers jointly prepare their annual report based on information provided and presented by federal agencies which is the best available information at the time of report preparation. The Engineer Advisers' report is considered final upon signature by the three Engineer Advisers. The addenda to this report are the perspectives of each individual Engineer Adviser and do not receive approval from the Commission but are included for clarity.

RIO GRANDE BASIN CONDITIONS

Snowpack and snow-water equivalent (SWE) amounts were near to below average for the winter of 2020-2021. Some snow courses in the northern portion of the basin in Colorado peaked well-above average, while those farther south lagged behind. Below-average

precipitation in the spring months as well as windy conditions and very low soil moisture were factors preventing much of the SWE from reaching the rivers and streams. As a result, snowmelt runoff levels and yearly streamflow amounts in 2021 were well-below the long-term average for most areas across the basin in Colorado and in New Mexico.

Due to the low-runoff flows, Platoro Reservoir only reached a high of approximately 41 percent of capacity during early June of 2021. Usable Water in Rio Grande Project (Project) Storage was below the Article VII trigger of 400,000 acre-feet the entire year, which imposed Article VII storage restrictions on storage in post-compact reservoirs.

CONTINUING ISSUES

This section of the report summarizes new information about issues previously addressed by the Engineer Advisers. It reflects information obtained by the Engineer Advisers prior to the writing of the Engineer Advisers' report, including information obtained from the reports of the federal agencies at the 2022 Engineer Advisers meetings or otherwise reported. The terms "reported" and "indicated" herein reflect information provided by various entities without analysis or approval by the Engineer Advisers.

Middle Rio Grande Endangered Species Collaborative Program

The Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program) was authorized by the Omnibus Appropriations Act of 2009 (P.L. 111-8). The Collaborative Program continues to seek innovative and collaborative ways to support Endangered Species Act (ESA) compliance for listed species while protecting water uses in the Middle Rio Grande. Reclamation reported that their federal appropriations in federal fiscal year (FY) 2021 were \$2.78 million for Collaborative Program activities, a decrease from \$3.84 million in FY 2020. Projects funded through Reclamation remaining in the Collaborative Program currently are several long-term monitoring programs, such as silvery minnow population monitoring, genetics monitoring, and Middle Rio Grande bird surveys. Western Ecosystems Technology, Inc., originally contracted to administer the Collaborative Program, has resecured the contract with Reclamation for the next five years.

The Corps' Collaborative Program budget has been restored in the FY 2022 President's Budget to \$1.94 million and, if passed, the Corps expects to resume work on contracts halted in 2021.

WildEarth Guardian's Notice of Intent to Sue over the 2016 Biological Opinion

On June 9, 2021, WildEarth Guardians filed a Notice of Intent (NOI) to sue the Service, Reclamation, State of New Mexico, and Middle Rio Grande Conservancy District (MRGCD) for violations of the Endangered Species Act pursuant to the Endangered Species Act (ESA) regarding alleged violations of the Service's Biological Opinion issued in 2016 (2016 BO) covering Middle Rio Grande water management and river maintenance activities. The agencies are working to resolve the issues raised in the NOI.

Upper Rio Grande Water Operations Model

The Upper Rio Grande Water Operations Model (URGWOM) is a computational model developed through an interagency effort led by the Corps, Reclamation, and the New Mexico Interstate Stream Commission (NMISC). The effort includes regular meetings to discuss modeling outputs for daily water operations and accounting procedures. During 2021, URGWOM activities included:

- Developing an updated basin-wide annual operating plan (AOP) in collaboration with Reclamation and NMISC;
- Updating the database to include data from years 2019 to 2020;
- Updating the five-year plan;
- Developed new and updated versions of all of the URGWOM documentation and volumes; and
- Further development and expansion of the new aquifer objects to model deep aquifer head elevation and the groundwater movement between the shallow aquifer and the deep aquifer for the Middle Rio Grande and the Lower Rio Grande. Work in 2021 included final calibration to the MODFLOW model.

Key objectives for 2022 include:

- Preparing basin-wide AOPs for 2022;
- Develop real-time simulations with the Corps Water Management System (CWMS) and URGWOM; and
- Final integration of the new aquifer objects into the official URGWOM model.

Compliance by Federal and State Agencies with State Water Law

The NMISC continues to track habitat restoration projects implemented by various federal and state agencies, and to account and report on related depletions in the Middle Rio Grande. It coordinates with the New Mexico Office of the State Engineer (NMOSE) to determine if a permit is needed and to ensure the depletions are offset by the projects' sponsors. The NMISC reported that it continues to coordinate with the Corps on several habitat restoration projects to ensure that those depletions are offset. The NMISC also coordinates with Reclamation in using the State's Strategic Water Reserve for ESA-related water management, including offsetting depletions associated with habitat restoration and river augmentation activities. Below-average snowmelt runoff in 2021 resulted in approximately 2 acre-feet of depletions for habitat restoration projects in the Middle Rio Grande that were offset by New Mexico's Strategic Water Reserve.

Elephant Butte Delta Channel Project

The below-average snowmelt runoff and a near-average monsoon season resulted in the Elephant Butte Delta Channel (Delta Channel) successfully conveying all flows during 2021. During November and December of 2021, the NMISC construction contractor conducted regular maintenance on the Delta Channel in the middle and upper project sections above the Narrows. Since 2003, New Mexico has spent over \$20 million to construct and maintain the Delta Channel and continues to partner with Reclamation, who provides engineering support, environmental compliance, access road work and primary maintenance for the project. When the Delta Channel was constructed, NMISC and Reclamation were responsible for discrete sections of the project, however there is no such delineation during ongoing maintenance efforts.

Relinquishment Update

The total amount of Accrued Credit relinquished by Colorado since 2013 is 3,000 acre-feet. Colorado stored 329 acre-feet of relinquishment credit water in 2021. Between 2013 and 2021, Colorado stored a total of 2,885 acre-feet of relinquishment credit water in Platoro Reservoir, which leaves a balance of 115 acre-feet in Colorado's relinquishment account.

The total amount of Accrued Credit relinquished by New Mexico since 2003 is 380,500 acre-feet. No relinquishment credit water was stored in New Mexico reservoirs during the 2021 calendar year. Relinquishment-credit water storage to date totals 288,728 acre-feet, leaving a balance of 91,772 acre-feet available to be stored in future years when Article VII storage restrictions are in effect.

Article VII storage restrictions will likely be in effect for the entire 2022 calendar year although there is a slight possibility that Article VII restrictions may be lifted for a short period of time during the spring snow-melt runoff.

Gaging Station Review

The Colorado Division of Water Resources (CDWR) reported on activities at Colorado's Compact gages. The Colorado USGS reviewed CDWR gaging station records for the seven Colorado Compact gages and approved all of those records for 2021. The CDWR made an average of 28 measurements at each of these seven compact gaging stations, with the ratings of those measurements varying from excellent to poor. The records for most of these stations were rated as 'good' except for the periods of estimation, which were rated as 'poor'.

A new rating table was developed for the Conejos near Mogote gage in 2021, and an infrared water temperature sensor was installed at this location. The steel sheet-pile weir at the South Channel near La Sauses gage was repaired in 2021.

For the Rio Grande near Otowi streamflow gage (#08313000), the USGS reported that in calendar year 2021 they developed a new stage discharge rating (#42) which was implemented on February 8, 2021 and used for the remainder of 2021. The USGS reported they made a total of 11 measurements at the Otowi gage in 2021, with nine rated good, one rated fair, and one rated poor. For 2021, the USGS continued to utilize redundant primary sensors (non-contact

radar and wire weight) as well as redundant secondary reference gages (bubbler and staff gage) for gage height readings.

The USGS reported that during the 2021 calendar year, 20 measurements were collected at the Rio Grande below Elephant Butte streamflow gage (#08361000). Of the 20 measurements, 13 were rated good, five were rated fair, and two were rated poor. Aquatic vegetation growth on the streambed at the USGS gaging station section continues to cause a low bias in gaged flow during certain months. This issue has occurred for an undetermined period but began to be addressed in 2016 by utilizing an alternate section which is not impacted by vegetation growth during certain months. In 2021, the USGS also installed an electric cableway at the alternate section below the dam and will begin utilizing it in 2022. The gage records for 2016 through 2021 reflect improved precision, and the NMISC will continue to coordinate with the USGS to provide more accurate gage records in the future.

Reclamation reported that they analyzed the data for the Rio Grande Below Caballo gage, comparing the Acoustic Doppler Velocity Meter (ADVM) data with the stage-discharge data recorded for that section. Reclamation reported that the ADVM data may not be as accurate and has more variability than the stage-discharge data. They will continue to monitor and evaluate the gage data in an effort to improve the record.

The USGS also reported that they reviewed and approved the 2021 streamflow gage below Caballo (#08362500) flow records developed by Reclamation, and that all necessary documentation was provided. The USGS reported that the record accuracy looked good, in large part due to the high number of measurements made at the gage (65 in total). In 2021, Reclamation completely transitioned to ADCP measurements, while periodically performing check measurements with AA meters. There was no significant difference in these measurement results. The USGS stated once the quality control issues have been resolved, measurement quantity could be reduced by fully utilizing the ADVM installed at the site. The USGS also reported that they ran levels in cooperation with Reclamation in 2021 to verify datum at the site.

During 2021, the NMISC continued its survey of water-level elevations in Elephant Butte and Caballo reservoirs. NMISC's surveyor performed surveys alongside Reclamation staff in June and December 2021. Both the June and December 2021 results from NMISC's survey indicated that Reclamation's reservoir stage elevations were within the agreed upon threshold

criteria. Reclamation performed routine stage elevation surveys throughout 2021 and made adjustments to the stage-discharge recorder (SDR) as needed if the threshold criteria of 0.05 feet difference between the surveyed elevation and the SDR was exceeded.

In 2021, Reclamation continued to measure Elephant Butte elevation via the SDR and a bubbler. The bubbler, which is maintained in conjunction with the USGS, shows more scatter but in general more accurately reflects observed elevation when the reservoir is low. NMISC and Reclamation will continue to perform side-by-side surveys at select times during 2022 to ensure the accuracy of the reservoir elevation data.

Mass Balance Review

The NMISC conducted a mass balance analysis for the Rio Grande between the Elephant Butte and Caballo gages for calendar year 2021. The mass balance analysis indicated that the reach gained water in nine out of twelve months with a total calculated annual gain of 2,076 acre-feet. During May and June, the mass balance fluctuated substantially between reservoirs, with May seeing a gain of approximately 20,000 acre-feet and June seeing a loss of approximately 20,000 acre-feet. During this time, there was a lot of water moving between reservoirs and irrigation releases were being made from Caballo. Although there is a small net gain between Elephant Butte and Caballo for calendar year 2021, the Engineer Advisers will continue to monitor the mass balance in this reach, especially when large volumes of water are moving during irrigation season.

Gaging Station Costs

In recent years, the Engineer Advisers and Compact Commissioners have expressed concern over the large difference in costs between what Reclamation charges to operate the gage below Caballo Reservoir as compared to what the CDWR and USGS charge on average for other Compact gages. The three Compact states split the costs of their operations in support of the Compact equally, including operation and maintenance of the Compact gaging stations. Therefore, this high cost from Reclamation affects all three states.

In some recent years, Reclamation has decreased their charged amount for the gage below Caballo Reservoir. However, the cost charged by Reclamation for this coming year

increased by approximately 10% over last year's costs, with no specific reasons given for the increase. Currently Reclamation's charges are nearly twice the amount of the average cost charged per gage by CDWR and the USGS. The Engineer Advisers remain concerned with Reclamation's high cost for the operation of this gage and with the large fluctuations in the charged costs year to year and request backup information on how their gaging costs are derived.

Colorado Groundwater Regulations

In late 2015, the State Engineer of Colorado completed the development of rules and regulations concerning the use of groundwater in the Upper Rio Grande Basin in Colorado. These rules were approved by the Colorado Division 3 (Rio Grande Basin) Water Court in 2019 and went into full effect on March 15, 2021. As an integral part of these rules, the State Engineer of Colorado has also completed the development of Phase 6 of the Rio Grande Decision Support System Model. This model captures the interaction between surface and groundwater and shows the effect that wells have on senior surface water rights. The owners of non-exempt wells are required to mitigate the injurious depletions that their wells cause to senior surface-water rights and regulate the use of the confined and unconfined aquifers to maintain a sustainable water supply in each aquifer system. There are currently seven groundwater user subdistricts and multiple individual augmentation plans that have been developed as a way for the well owners to comply with the rules.

Aamodt Settlement and Pojoaque Basin Regional Water System

The Aamodt Water Rights Settlement Agreement (Settlement Agreement) was developed through multi-party negotiations, which began in 2000 between the Pueblos of Nambé, Pojoaque, Tesuque and San Ildefonso, the State of New Mexico, the United States of America (U.S.), Santa Fe, Santa Fe County, and representatives of non-Pueblo water users, to settle the Pueblos' water right claims in the Pojoaque Basin. The Settlement Agreement provides for the funding and construction of the Pojoaque Basin Regional Water System to supply treated water to Pueblo and non-Pueblo parties. As expressly stated in the Settlement Agreement, "Nothing in this agreement shall be construed to limit the authority of the State Engineer to...ensure compliance with the Rio Grande Compact," (Section 6.6.1.6). The Engineer Advisers will

continue to evaluate the project as it moves forward including evaluating potential impacts to the Otowi Index Supply.

The final Pojoaque Basin Regional Water System Environmental Impact Statement was published in the Federal Register in January 2018 and the Record of Decision was signed on September 11, 2019. Construction began on the intake area of the Regional Water System in June 2020. Additional funding and a time extension were authorized in late 2020 and the first portion of Phase I work was completed in January 2022. The next portion of Phase 1 construction is expected to begin in March 2022 and includes the installation of the raw water intake pumps for collector wells 1 and 3, completion of the intake area mechanical and electrical building, and starting construction of the water treatment plant.

In 2021, about 1.9 acre-feet were withdrawn from the completed wells for construction purposes, such as dust abatement and compaction.

Reclamation's Identification of San Acacia Reach Options

For FY 2021, Reclamation reported on progress on the Identification of San Acacia Reach Options (ISARO), which has advanced to the next stage called the Evaluation of San Acacia Reach Options (ESARO). This project addresses the lower section of the San Acacia Reach from Highway 380 bridge just above the Bosque del Apache Wildlife Refuge downstream to the Narrows of Elephant Butte Reservoir. As previously reported, this area has historically been problematic for deliveries of water and sediment downstream into the reservoir, and high losses continue to occur in this section of the river. Reclamation has engaged with the NMISC, MRGCD, Service, and local landowners on its conceptual engineering options. A 'Value Planning Study' required by Reclamation for large-scale projects was recently completed. Conversion from a two-channel system (river channel and LFCC) to a single channel, with the movement of the river into the lowest part of the valley within the Tiffany Basin, is the highest-ranking option in a Feasibility Study, but other options will continue to be evaluated as well. The study will include a technical committee that includes nonfederal partners and is expected to start in March 2022 with an estimated completion date in 2024. In addition, the operation of the LFCC from San Acacia Diversion Dam to its terminus will be part of the evaluation as requested by the MRGCD.

YEAR 2021 OPERATIONS

Closed Basin Project

The total production of the Closed Basin Project in calendar year 2021 was 11,600 acre-feet. This total includes water that was exchanged for Colorado Parks and Wildlife water to be delivered to the Blanca Wildlife Habitat Area, the Alamosa National Wildlife Refuge and to the San Luis Lakes State Wildlife Area. The amount creditable for Compact purposes from direct delivery and exchange was 8,239 acre-feet. The remainder of the water produced was delivered to various federal lands along the project to be used as mitigation for the project footprint. All the water delivered to the Rio Grande in 2021 was of sufficient quality to qualify for credit under the Compact.

Reclamation continues to address problems of biofouling in the production wells of the Closed Basin Project. During 2021, Reclamation replaced two wells, rehabilitated nineteen other wells, and installed ten new pumps. Wells will continue to be replaced as budgetary constraints allow to help maintain project production. The Closed Basin Operating Committee continues to monitor groundwater levels and groundwater production and to adjust project operations pursuant to the enabling legislation.

Reclamation's Middle Rio Grande Supplemental Water Program

Reclamation's supplemental water program is intended to provide additional water, primarily obtained through the voluntary leasing of SJCP water, for endangered species needs and compliance with the 2016 BO. In 2021, Reclamation reported a total of 10,364 acre-feet of supplemental water was released for endangered species purposes. Of that volume, 9,513 acre-feet was SJCP water Reclamation leased from 2020 and 2021 contractor allocations. The release of supplemental water began on June 19 and continued through September 29, although monsoon activity allowed the release to either be reduced or stopped entirely for much of July. Reclamation also released 851 acre-feet of water leased from Albuquerque Bernalillo County Water Utility Authority's (ABCWUA) SJCP water stored in Abiquiu Reservoir from October 8

through October 21. Reclamation ended 2021 with a total of 4,149 acre-feet of the ABCWUA lease of SJCP water in storage.

In addition to the water released by Reclamation, 325 acre-feet of SJCP water leased by Audubon New Mexico was released as needed between September 9 and September 14, 2021.

At one time, Reclamation maintained portable pumps at four strategic locations along the Low Flow Conveyance Channel (LFCC) to maintain river connectivity to the Elephant Butte Reservoir pool. Reclamation decommissioned its pumping stations that delivered water from the LFCC to the river in 2021. Therefore, Reclamation did not pump any water to the river in 2021.

The Neil Cupp pumping site, which Reclamation used to maintain, is now a permanent pumping site operated and maintained by MRGCD. MRGCD pumped 65 acre-feet from the Neil Cupp pumping site to the Rio Grande between June 16 to June 20, 2021.

Six Middle Rio Grande Pueblos Prior and Paramount Operations

BIA requested that Reclamation store 15,428 acre-feet of Rio Grande water in El Vado Reservoir for the Coalition of Six Middle Rio Grande Basin Pueblos' (Pueblos) Prior and Paramount (P&P) operations in 2021. The entire amount was stored while Article VII Compact restrictions were in place. Due to significant monsoon rains and sufficient spring runoff, none of the water stored for P&P operations in 2021 was released for irrigation purposes. The P&P water stored in El Vado Reservoir suffered 1,252 acre-feet of evaporative losses, and the remaining 14,176 acre-feet was released downstream to Elephant Butte Reservoir November 29 through December 9, 2021.

Computations for the required amount of P&P storage take place between March and early May each year. At the time of the 2022 Engineer Advisors meeting, the March 1 snowmelt runoff forecast was not available, and thus, the first official computation for 2022 P&P storage had not been made. Based on the February 2022, most-probable snowmelt runoff forecast, the BIA reported that Reclamation might have a preliminary storage target of approximately 28,000 acre-feet for their P&P operation in 2022. Additional forecasts may change this storage estimate, and the May 1 forecast produces the final storage target.

BIA reported that with El Vado Reservoir under construction during the 2022, and possibly during the 2023 irrigation season, El Vado Reservoir will not be available to store P&P

water. P&P storage has begun at El Vado Reservoir in the hopes that Reclamation will secure an alternative storage location. Possible options for alternative P&P storage include a deviation from the Corps' operations at Abiquiu Reservoir or an exchange of native water with SJCP water at Heron Reservoir. If neither of these options come to fruition, the P&P water currently stored at El Vado Reservoir may need to be released to Elephant Butte Reservoir by mid-May, and BIA reports that P&P lands would only have use of direct flow of native waters during the 2022 irrigation season.

The BIA was able to make limited funding available to the Pueblos to perform work upgrading their irrigation systems. Due to the COVID-19 pandemic, very little work was performed on Pueblo lands in 2021. The BIA also provides funds to the MRGCD to perform maintenance work on the systems which serve Pueblo lands, which continued in 2021.

The BIA reported that discussions concerning the carryover storage of P&P water in El Vado are occurring infrequently and no discussions took place in 2021.

The Engineer Advisers remain concerned about the procedures for quantifying storage, release, and delivery of water for the P&P lands of the Pueblos.

2021 Rio Chama Water Supply Conditions

Snowpack conditions in the Rio Chama Basin were well-below average during the winter of 2020-2021. The March through July native inflow to El Vado Reservoir was 123,212 acre-feet, or approximately 55 percent of average.

Beginning in early summer, flows on the Rio Chama were insufficient to meet the direct-flow irrigation needs of the Rio Chama Acequia Association (RCAA). RCAA represents 16 acequias on the Rio Chama between Abiquiu Reservoir and the confluence with the Rio Grande that have direct surface flow diversion rights. With insufficient native flows to meet their needs and the absence of sufficient leased SJCP water, the NMOSE curtailed RCAA diversions to the available natural flow of the river from summer through fall of 2021.

Rio Grande Project Operations

The 2021 Rio Grande Project (Project) water accounting amounts were approved by the respective district boards and Reclamation prior to the Engineer Advisers' Meeting. All accounting information reported by Reclamation is based on URGWOM which uses a daily timestep.

On January 1, 2021, there was 156,139 acre-feet of Usable Water in Project Storage (Elephant Butte and Caballo reservoirs combined) and 181,019 acre-feet on December 31, 2021. Usable Water reached a high of 281,016 acre-feet on May 30 and a low of 115,314 acre-feet on August 30, 2021.

Reclamation's initial allocation for calendar year 2021 for El Paso County Water Improvement District No. 1 (EP No. 1) and Elephant Butte Irrigation District (EBID), was provided in April after the 2020 water accounting had been finalized. The allocation balance from the previous year was used to determine the current year's allocation. EP No. 1 and EBID were provided updated allocations monthly as Usable Water in storage increased. The last in-season allocation was on May 26, 2021, due to below average inflows and Usable Water.

Mexico was provided an initial allocation of zero acre-feet in January 2021. Based on the provisions of the 1906 Convention for extraordinary drought, the allocations to Mexico were updated monthly, with a final in-season allocation in May 2021 of 12,129 acre-feet, which is about 20 percent of a full allocation.

The final in-season allocation was 288,822 acre-feet, including Mexico's allocation of 12,129 acre-feet. The calculated charges were: 120,659 acre-feet to EP No. 1; 57,704 acre-feet to EBID; and 12,145 acre-feet to Mexico.

Mexico is allocated Project Water for delivery during the year based on the anticipated release of Usable Water. This allocation cannot be reduced once it has been made. The actual release for the 2021 irrigation season was less than the anticipated release in May. Deliveries to Mexico during the year are made based on the most recent Project allocation. At the end of the year, Mexico's final allocation is determined using the actual annual release from Caballo Dam. If the amount of water delivered to Mexico is larger than Mexico's final allocation, the difference is charged to the two districts based on the proportion of the end-of-year 2021 allocation balances.. Reclamation refers to this as an over delivery to Mexico in their report.

Therefore, EP No. 1 and EBID were also charged with 1,390 acre-feet and 857 acre-feet, respectively. The final allocation balances for EP No. 1 and EBID were 59,430 acre-feet and 36,652 acre-feet respectively.

Reclamation reported a final 2021 release from Caballo Reservoir during the irrigation season of 229,418 acre-feet for all three Project water users: EP No. 1, EBID, and Mexico. Releases from Caballo Reservoir began on May 31 and ended on August 31. Mexico delayed their initial order by one week, and their diversions began on June 7. A total of 190,508 acre-feet of water were delivered to the Project water users.

During 2021, Reclamation's report indicates drainage flows into Hudspeth County Conservation and Reclamation District No. 1 (HCCRD) during March through September were 20,951 acre-feet. The calendar year total flow data for HCCRD was 25,020 acre-feet. Additionally, 1,149 acre-feet was delivered through the Bonita Lateral during calendar year 2021.

The USGS reported that the total annual flow volume at the gage below Elephant Butte dam was 216,751 acre-feet. Elephant Butte Reservoir storage peaked at 245,320 acre-feet on May 19, 2021, and storage at Caballo Reservoir peaked at 47,406 acre-feet on May 31, 2021. Releases from Caballo Reservoir for irrigation deliveries began on May 31 and ended on August 31, 2021, releasing 229,455 acre-feet, as measured at the Rio Grande below Caballo Dam gage.

For 2022 Project operations, Reclamation determined that the initial 2022 allocation was zero acre-feet. On December 1, 2021, the final calculated Usable Water was 148,876 acre-feet in storage which is below the range of the standard allocation equations used by the Project. Reclamation will continue to evaluate the amount of Usable Water monthly to determine the actual Project allocations.

Based on the February 2022 snowmelt runoff forecast for the Rio Grande, the current La Niña conditions for El Niño Southern Oscillation activity, and current hydrologic conditions, Reclamation anticipates a near-record low allocation for 2022 and expects a shortened irrigation season beginning around June 1 and lasting for one to three months.

ADDITIONAL FEDERAL AGENCY REPORTED INFORMATION

Representatives of USGS, Reclamation, Corps, Service, and IBWC presented additional information to the Engineer Advisers as summarized below:

U. S. Geological Survey

The Engineer Advisers received reports from the USGS on their Rio Grande Basin projects. The USGS completed a four-year WaterSMART Focus Area Study in 2019 to assess water use and availability from the headwaters in southern Colorado to Fort Quitman, Texas. Although the funding has ended, USGS continues to generate and finalize the associated reports. The study investigated spatial and temporal trends of selected water-budget components. USGS reported details of the snow and watershed modeling projects and streamflow response to potential changes in climate. Data and reports are available on the Upper Rio Grande Basin Focus Area Study website.

The USGS, in cooperation with Reclamation, has developed a model of the transboundary aquifers and interconnected surface waters of the Palomas and Mesilla basins in New Mexico and Texas and the Conejos-Médanos Basin of northern Mexico, known as RGTIHM. A Techniques and Methods Report on the MODFLOW One-Water Hydrologic Flow Model used for RGTIHM was released in 2020. Recalibration has been finalized and a Scientific Investigations Report will be published in 2022. As part of the Transboundary Aquifer Assessment Program, USGS is synthesizing binational data and has developed the first potentiometric surface map across the Mexico and United States border. Through the Mesilla Basin Monitoring Program, which is supported by several cooperators, the USGS continues to maintain an observation well network and hydrologic cross sections in the Mesilla valley, and to monitor salinity in shallow groundwater in the Mesilla Valley

Corps Rio Grande Civil Works Projects

The Corps reported on the status of Civil Works projects under the Water Resources Development Act (WRDA) of 2020, which provided reauthorization for the Rio Grande Environmental Management Program in Colorado, New Mexico, and Texas. Authorization for this program was extended through federal FY 2029. Current projects undergoing either a

feasibility study, higher-level planning, or construction include: Abiquiu Reservoir legislation, Bernalillo to Belen Levee Project, and Sandia to Isleta ecosystem restoration.

Abiquiu legislation (P.L. 116-260 (2020)) changed the limit of storage of SJCP and native Rio Grande in Abiquiu Reservoir from a total volume of 200,000 acre-feet to an elevation of 6,230 feet MSL (229,199 acre-feet), the elevation of future storage easements, to allow concurrent storage of Rio Grande and SJCP water in Abiquiu Reservoir. This would not have an affect on flood control operations at Abiquiu. The Water Control Manual must be updated, and environmental compliance completed, with a target date of the end of 2023.

The Bernalillo to Belen Levee Project, Espanola Valley Ecosystem Restoration, and Sandia to Isleta Ecosystem Restoration projects are authorized for construction under WRDA 2020 and most received funding to begin work on design and compliance contingent on executing agreements with project sponsors in FY 2022.

The Tribal Partnership Program is currently underway for San Felipe, Santa Ana, Zia, and Santo Domingo Pueblos. These projects include watershed assessments, drought resilience planning and feasibility studies for irrigation infrastructure. Efforts were initiated in FY 2020 and are expected to be completed this year.

Rio Grande Silvery Minnow

The Service reported on the 2021 monitoring results for the endangered Rio Grande Silvery Minnow (RGSM) using the October Catch per Unit Effort (CPUE) data used to report long-term trends in relative abundance.

The Service has adopted using 30 sites for evaluating RGSM take instead of the standard 20 sites. The 2021 October fish monitoring estimated an RGSM density of 0.32 fish/100 square meter (m²) for 30 sites. High spring runoff years in 2017 and 2019 had October RGSM densities of 23.2 and 3.4 fish/m². The Service expressed concern about the potential CPUE in 2022 if the Middle Rio Grande experiences similar flow conditions as in 2021. The Service stated that up through 2021, the 2016 BO has not been violated nor has Reclamation exceeded its take for RGSM.

The Service reported that 208,772 RGSM were augmented to the Middle Rio Grande in 2021, in comparison to 310,634 in 2020, and 83,635 in 2019. Fish were provided by the City of Albuquerque's BioPark, the Service's Southwestern Native Aquatic Resources and Recovery Center located in Dexter, New Mexico, and the NMISC's Los Lunas Silvery Minnow Refugium. Stocked RGSM were only partially tagged in 2020 and 2021 due to Covid-19 restrictions, so distinguishing wild and hatchery fish will not be possible until tagging of all the fish is resumed.

The Service, with assistance from the 2016 BO partners, continued to conduct rescue activities in the San Acacia and Isleta reaches. For 2021, 818 RGSM were rescued from the San Acacia and Isleta Reaches, which had 33.9 miles and 11.5 miles of unique drying, respectively.

The Engineer Advisors asked the Service about the RGSM experimental 10(j) population at Big Bend, Texas and the Service responded they were no longer pursuing the effort due to unsuccessful species recruitment but did not have any specific information regarding results. The Engineer Advisors requested the Service report on the results and conclusions of the RGSM experimental 10(j) population at Big Bend, Texas at the Compact meeting to provide information on why this effort has been suspended and potential next steps for reintroduction efforts outside the Middle Rio Grande to achieve recovery goals.

El Vado Dam Repairs

Reclamation reported that substantial degradation of the steel lining system and service spillway have occurred at El Vado Dam. Corrective action studies have determined that construction and repair work need to be conducted at the dam. The planned El Vado Safety of Dams Project will occur in two phases: 1) embankment seepage reduction, which will involve installation of a synthetic liner system across the entire face plate of the existing dam, and 2) spillway repair and refurbishment. Reclamation reported that a contract for the embankment seepage reduction phase of the project was awarded in August 2021, with contractor mobilization to occur in March 2022. The El Vado spillway repair and refurbishment 60-percent design phase was completed in August 2020, and a contract is expected to be awarded by May of 2023.

During both phases of construction, there will be restrictions on storage of water in El Vado Reservoir. NMISC and Reclamation have each submitted a request to the Corps to deviate

from the Water Control Plan at Abiquiu Reservoir to temporarily store native water at Abiquiu Reservoir during El Vado Dam and spillway construction activities under the same rules that would apply to native water storage at El Vado Reservoir. Additionally, MRGCD has applied for and received a temporary NMOSE storage permit at Abiquiu Reservoir that is contingent on the Corps' approval of the deviation. The Corps is analyzing the deviation and expects to provide a decision in April, that is contingent on favorable advice and consent from the Commission. An approval letter from each state is considered sufficient as advice and consent from the Commission.

Middle Rio Grande Project Channel Maintenance

Reclamation's report indicates it is pursuing work at 17 active priority sites along the Middle Rio Grande Project reach where bank erosion or reduced channel capacity could cause levee failure. Of the active priority sites, five require an annual review of channel capacity and possible maintenance due to sediment accumulation. Reclamation reported that Phase I of the maintenance work at the River Mile 202.2 project area near Sandia Pueblo (Sandia Priority Site), begun in early 2020, was completed in April 2021. This project includes major side-channel construction intended to provide increased channel capacity, resulting in less lateral migration, as well as habitat improvements for listed species. A second phase of that project is anticipated to begin in late 2022 or later.

Reclamation reported that the Bosque del Apache National Wildlife Refuge (BDANWR) Pilot Realignment Project was completed in March 2021. Reclamation reported that due to the low snowmelt runoff, the realigned channel has not seen high enough flows to further advance the river slope adjustment from the new downstream connection. The New Mexico Engineer Adviser notes that the current channel continues to be undefined through a significant portion of the project, resulting in extensive open water evaporation that is likely contributing to Compact delivery issues.

Reclamation reported that it is working on a new programmatic approach to Clean Water Act (CWA) compliance for river maintenance activities, using a Letter of Permission. This approach will take time to implement but should reduce the time needed for future projects to achieve CWA compliance. Project specific mitigation requirements under CWA compliance,

specifically wetlands and vegetation replacement, continues to be an issue for river maintenance and habitat restoration projects in the Middle Rio Grande.

Vegetation Management at Elephant Butte and Caballo Reservoirs

Reclamation reported that it performed vegetation maintenance at Caballo Reservoir during 2021, but that it did not use State of New Mexico funds because of the state's concerns with mowing locations. Reclamation noted that maintenance at Caballo Reservoir included mowing and mulching of approximately 709 acres of phreatophytic vegetation.

The Engineer Advisers remain concerned about the lack of vegetation management activities by Reclamation at Elephant Butte Reservoir. The State of New Mexico is reluctant to continue the Vegetation Management Agreement if Elephant Butte Reservoir is not included in the effort.

Southwestern Willow Flycatcher and Yellow-billed Cuckoo

Reclamation and the Service conduct surveys and nest monitoring for the southwestern willow flycatcher (flycatcher) and the western yellow-billed cuckoo (cuckoo) during the summer along the Rio Grande from Belen, New Mexico, to El Paso, Texas. Survey efforts were impacted by travel and hiring restrictions due to the COVID-19 pandemic that resulted in inconsistent survey efforts in 2020 and 2021. Decreases in reported territories may not represent the actual species condition within the Middle Rio Grande. The Service has requested Reclamation conduct a full survey in 2022.

For 2021, 378 flycatcher territories were documented in the Middle Rio Grande. As usual, most of the flycatcher territories are in the San Marcial and Elephant Butte Reservoir areas; however, increased activity also occurred within the Isleta Reach. While the current number of flycatcher territories in the Middle Rio Grande is well above the recovery goal of 100 territories, habitats in other regions have not hit their recovery targets yet, and down listing or delisting has not been considered for this species.

Reclamation has historically conducted surveys for the cuckoo from Belen to El Paso. In 2021, 90 cuckoo territories were observed in the surveyed area.

A final revised proposal of critical habitat for the cuckoo was completed in April 2021 and 298,845 acres of land in seven states were declared critical habitat. New Mexico contains seven units of this area covering 57,459 acres. In late 2021, the Service began a Species Status Assessment (SSA) to inform the future recovery plan.

The tamarisk leaf beetle continues to be found in most of the Rio Grande area, and defoliation of salt cedar in occupied territories may result in impacts to nesting success. Although numbers of tamarisk beetles in the Middle Rio Grande have been declining in the past few years, this may be cyclical, and it is uncertain if there is a long-term trend.

The Service agreed to report to the Engineer Advisers on any flycatcher and cuckoo monitoring that is occurring in Colorado and the upper Rio Grande area in future years.

Additional Listing Information Provided by the Service

In 2016, the Service found that listing the Rio Grande chub and the Rio Grande sucker may be warranted. A Conservation Agreement was signed in September 2018 between the Service and the states of New Mexico, Colorado and Texas, the Jicarilla Apache Nation, the Pueblo of Santa Ana, several counties in Colorado, the U.S. Forest Service, Bureau of Land Management, and the National Park Service to reduce the threats to these fishes. The Service will complete a SSA in 2023 and conduct a 12-month review in 2024.

The Service conducts photographic monitoring of the New Mexico meadow jumping mouse (jumping mouse) at BDANWR. In 2021, there were 23 unique photo detections compared to seven photo detections in 2020.

International Boundary and Water Commission Activities

The IBWC provided a report of its activities along the Rio Grande in New Mexico and Texas during 2021 and their projected activities for 2022. The items discussed included their levee rehabilitation work and Federal Emergency Management Agency (FEMA) status, the status of their new hydraulic modeling, the River Management Plan and habitat restoration, flood control issues and activities, sediment removal activities, water accounting operations, IBWC gaging station information and status, as well as information on the border fence projects and the El Paso Water wastewater emergency.

The Sunland Park West Levee construction was awarded in September 2019, and the construction was completed in June 2021. The designs for East Levee sections are complete and construction will be awarded in 2022. The IBWC also provided updates on the FEMA status for their levee projects which have been either submitted to FEMA, are pending design, in design, or pending construction. Floodplain maps will be developed for the levee areas which show the reduced flood zones due to the levees. However, levee projects are required to include interior drainage designs to be certified by FEMA in order to gain the benefits of removing properties from the floodplain.

Brief updates were also provided for the IBWC's ongoing channel maintenance projects. The American Canal Upper Reach was completed in 2020. This project included concrete lining replacement, soil remediation, treatment of contaminated groundwater, a new Parshall flume, a gaging bridge, access ramp and new safety features. The American Canal Lower Reach redesign is expected to be completed in 2022. This project redesign will include access ramps, section redesigns and relining, and a transition into College Arroyo.

IBWC presented updates to the status of the Canalization River Management Plan (RMP). The RMP covers floodplain management, endangered species management, and channel maintenance. It incorporates the 2009 Record of Decision (ROD) commitments, the 2017 Biological Opinion, and statutory compliance. The last version of the RMP was November 2018, and the update is pending the analysis in the ongoing hydraulic modeling study. The target date for the revised update is late 2022.

In 2019, the IBWC began development of a new hydraulic model for three separate reaches between Percha Dam and American Dam. The modeling system will include both 1-dimensional, steady-state and 2-dimensional, unsteady-state HEC-RAS hydraulic models. The project will be 90 percent completed in June 2022, with a final completion date of August 31, 2022.

The IBWC committed to implement 30 habitat restoration projects under the River Habitat Restoration Program. Currently, the IBWC has implemented 22 habitat restoration sites, totaling over 500 acres. Under the River Habitat Restoration Program, the IBWC is treating 246 acres of salt cedar, planting about 160,000 trees and shrubs, and installing groundwater-

monitoring wells. The IBWC completed an Environmental Assessment for aquatic habitat restoration in November 2021.

Status updates were also provided for the Environmental Water Transaction Program, included under the 2009 ROD for the Canalization Project. In 2021, the IBWC awarded a contract to conduct an appraisal of EBID surface water rights to acquire additional water rights to meet their commitments for the 2009 ROD. They are currently working with several federal agencies to develop an interagency agreement allowing them to conduct review appraisals pursuant to federal regulations.

Under the 2017 Biological Opinion, the IBWC is required to move vegetation from islands being removed that have known endangered species nesting or have suitable habitat. In 2020, about 15,000 additional willows were transplanted at the Vado West mitigation site.

The IBWC estimated that 400,000 cubic yards of silt is deposited into the Rio Grande Canalization Project reach annually. This results in sediment plugs, island formations, raised riverbeds, increased flooding risks, and inhibited irrigation return flows. The Canalization reach is defined as 105 river miles from Percha Dam in New Mexico to El Paso. Prior to 1990, the IBWC removed 250,000 to 300,000 cubic yards of sediment per year. During 2019, the IBWC removed over 422,000 cubic yards. In 2020, they were able to hire outside contractors to remove about 1,188,000 cubic yards, and for 2021, contractors removed an additional 400,000 cubic yards of sediment. For 2022, due to limited funding, the IBWC will be relying on in-house capabilities to remove about 200,000 cubic yards of sediment deposited in the Rincon, Canutillo and El Paso County regions of the Rio Grande.

The IBWC reported deliveries for the Convention of 1906 to Mexico in 2021, which were 20 percent of a full allocation. The initial allocation for 2022 to Mexico was reported to be 5,283 acre-feet (an 8.8 percent allocation) based on Usable Water in storage.

The IBWC provided an update on the border wall fence projects in the Compact reach. These consist of replacing the survey monuments which were moved or damaged during the previous border wall construction activities, which were halted in 2021.

Finally, the IBWC provided an update on the status of the El Paso Water Frontera wastewater emergency. On August 12, 2021, the Frontera force main lines ruptured which caused approximately 8 to 10 million gallons per day of sewage to be diverted into the Rio

Grande for four months. Repairs to the line were completed in January 2022, which included replacement of about 1.2 miles of pipe. Currently, remediation to remove contaminated soil is ongoing for the reach of the Rio Grande above the Courchesne Bridge to the American Dam, including the lower section of the American Canal. Contractors are working to complete the remediation of this reach and the reach between the American and International dams prior to the start of irrigation season.

ENGINEER ADVISER RECOMMENDATIONS

On January 1, 2020, Reclamation implemented new area-capacity tables for Elephant Butte Reservoir based on their 2017 sediment survey. These tables account for the sediment buildup within the reservoir and the related loss of storage. They also are used to determine the current total storage volume of the reservoir. The Rio Grande Compact Rules and Regulations describe the now-outdated total storage volume in the reservoir. The Engineer Advisers again recommend that the Commissioners direct the Legal Committee, in conjunction with the Engineer Advisers, to incorporate the new tables developed by Reclamation for Elephant Butte Reservoir into the Compact Rules and Regulations for potential approval at the 2023 Commission annual meeting.

The Engineer Advisers recommend that the Commissioners direct the Legal Committee in conjunction with the Engineer Advisers to investigate the need to create an official Rio Grande Compact document repository and report the results of their investigation at the 2023 Commission annual meeting.

The Engineer Advisers recommend that the Commissioners direct the Engineer Advisers to investigate and to better understand URGWOM calculations and the output data that are used by the states and federal agencies, how those are used in Compact accounting procedures, and whether they are appropriate for Compact accounting purposes.

BUDGET

The Engineer Advisers reviewed the cost of operation for the fiscal year ending June 30, 2021 and the budget for the fiscal year ending June 30, 2023.

The Engineer Advisers found that the expenses for gaging stations and administration of the Compact for the year ending June 30, 2021 were incorrectly listed as part of the 2019 Report of the Rio Grande Compact Commission. Specifically, the total cost for the USGS Technical Services and the portion of this cost borne by the United States was incorrect. An errata sheet has been prepared for the 2019 report. The budget for FY 2021 as listed in this report are correct.

The Engineer Advisers found that the expenses for gaging stations and administration of the Compact for the year ending June 30, 2021 were \$228,229. The U.S. federal government bore \$74,203 of this total, with the balance of \$154,026 to be borne equally by the three states.

The Engineer Advisers found that the proposed budget for the fiscal year ending June 30, 2023 indicates that a total of \$235,187 will be spent for gaging and administration, with a proposed contribution by the U.S. federal government of \$73,468.



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