

# RECLAMATION

*Managing Water in the West*

## Calendar Year 2018 Report to the Pecos River Commission

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U.S. Department of the Interior  
Bureau of Reclamation  
Albuquerque Area Office  
Albuquerque, New Mexico

March 2019

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Cover photo: Tecolotito Dam near Anton Chico, NM (Jen Bachus, Reclamation)

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## Introduction

The Albuquerque Area Office (AAO) of the Bureau of Reclamation (Reclamation) has oversight responsibilities for three projects on the Pecos River (Pecos). These projects are the *Carlsbad Project*, which includes Sumner, Brantley, and Avalon Dams; the *Pecos River Basin Water Salvage Project*; and the *Fort Sumner Project*, which includes the Fort Sumner Diversion Dam. Figure 1 depicts the general location of the Projects on the Pecos.

Reclamation's Annual Report to the Pecos River Compact Commissioners conveys all required reporting information on the three projects mentioned above. It also informs the Commission of proposed changes in programs, management activities, and strategies that may affect operations, operating conditions, and/or the Compact, including Endangered Species Act (ESA) issues.

An agreement between Reclamation and Carlsbad Irrigation District (CID), finalized on October 2, 1989, provides for CID to operate and maintain Sumner, Brantley, and Avalon Dams, and the Pecos River Water Salvage Project. Reclamation continues to be responsible for assuring that this work is accomplished in compliance with all applicable agreements, contracts, regulations, compacts, and related laws.

The Pecos River Water Salvage Project has not been funded since fiscal year (FY) 2012. Funding is not anticipated in the near future. It will not be discussed further in this report.

The gage data used within this report were downloaded from the United States Geological Survey's (USGS) web page, <https://waterdata.usgs.gov/nm/nwis/current/?type=flow>. All 2018 data presented or used in this report has been approved. Reclamation receives provisional reservoir elevation and weather data from CID on a monthly basis.

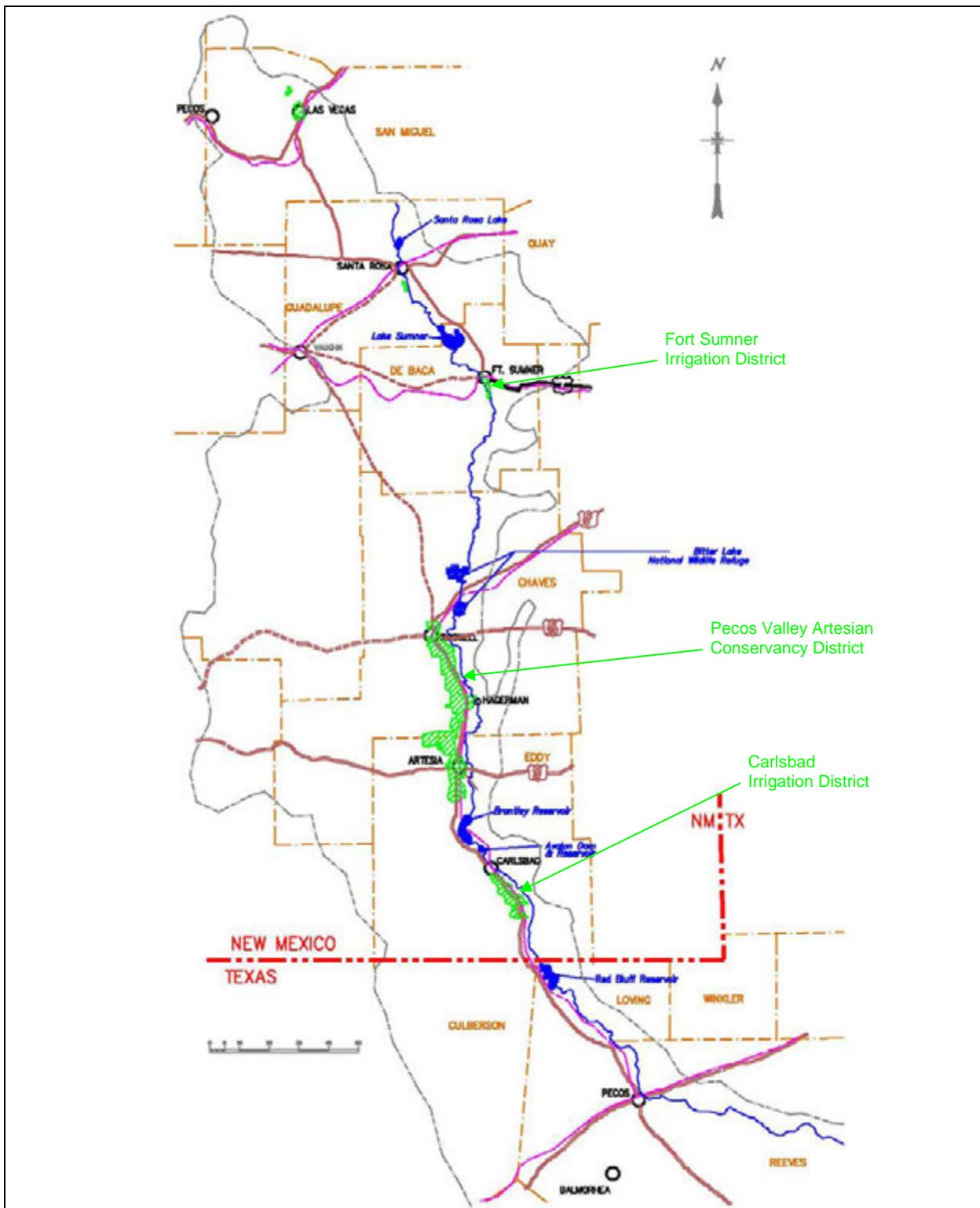


Figure 1: Map of Reclamation Projects on the Pecos

## Carlsbad Project Operations

### Reservoir Storage Entitlements

All Carlsbad Project reservoirs are operated in accordance with the requirements of the Pecos River Compact and U.S. Army Corps of Engineers' (Corps) flood control criteria. Figure 1 depicts the location of the Carlsbad Project storage dams on the Pecos. Operation of the dams on the Pecos is a joint effort between Reclamation, Carlsbad Irrigation District (CID), and the Corps, in coordination with the Fort Sumner Irrigation District (FSID) and the State of New Mexico.

Reclamation calculated annual total conservation storage entitlements for the four Pecos reservoirs within New Mexico (Santa Rosa, Sumner, Brantley, and Avalon). Table 1 presents the calendar year 2018 storage entitlements for these Reservoirs. Note that the Avalon elevation references a project datum.

Carlsbad Project conservation storage in the Pecos reservoirs began the year on January 1, 2018, at 95 percent of entitlement. Santa Rosa, Sumner, Brantley, and Avalon Reservoirs were at approximately 95, 70<sup>1</sup>, 95<sup>2</sup>, and 0 percent, respectively. On December 31, 2018, the total storage in the reservoirs was 64 percent of entitlement. Santa Rosa, Sumner, Brantley, and Avalon Reservoirs were at approximately 59, 51<sup>1</sup>, 70, and 0 percent, respectively.

Table 1: Pecos Reservoir Storage Entitlements for 2018

Reservoir	Entitlement Storage (af)	Minimum Pool (af)	Total Estimated Sediment Accumulation (af)	Total Conservation Storage (af)	Conservation Elevation (feet)
Santa Rosa	99,894	0	449	100,343	4,749.55 (NAVD88)
Sumner	32,740	2,500	677	35,917	4,260.88 (NAVD88)
Brantley	40,000	2,000	449	42,449	3,256.27 (NAVD88)
Avalon	3,866	600	0	4,466	3,117.40 (USBR)
TOTAL	<b>176,500</b>		<b>1,575</b>	<b>183,175</b>	

The 2015 storage entitlement changed slightly when values were recalculated with approved data. Those corrected values were not reflected in Reclamation's 2018 Storage Entitlements, but are shown above.

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<sup>1</sup> During the winter months, Sumner is permitted to store an additional 20,000 af above the entitlement storage as long as the total entitlement storage is not exceeded in all four reservoirs.

<sup>2</sup> Due to operational constraints, the release of excess water from Brantley was delayed and began on January 6, 2016. Consequently, storage briefly rose above entitlement.

The Natural Resource Conservation Service's (NRCS) May 1, 2018, most probable streamflow forecast for March through July predicted 2,000 acre-feet (af) of inflow into Santa Rosa Reservoir, or 4 percent of the 30-year median kept by the NRCS. Observed March through July inflow to Santa Rosa Reservoir was just above 8,760 af at the Above Santa Rosa gage, or 16 percent of the 30-year average of 56,000 af. None of that inflow, however, was classified snowmelt runoff.

Surveys at Avalon Reservoir have shown there has been little to no loss of volume since 1979. Brantley Dam is immediately upstream, and has an estimated trap efficiency of 90%. Therefore, unless a future survey shows volume lost in Avalon due to sediment, Avalon's conservation storage will remain the same, and it is not discussed further in this section.

### **Santa Rosa Reservoir Sediment Accumulation**

The Corps completed a sediment resurvey in 2016, and applied the results on January 1, 2017. Because of the new sediment survey, there was no sediment accumulation in Santa Rosa Reservoir in 2016. Estimated sediment accumulation in 2017 was 449 af.

Table 2: Estimated Sediment Accumulation for 2018 Santa Rosa Storage Entitlement

Calendar Year	Sediment Accumulation (af)
2016	0
2017	449
<b>Total</b>	<b>449</b>

### **Lake Sumner Sediment Accumulation**

The basis of the estimated sediment accumulation calculations for Lake Sumner is the ratio of total sediment deposition to total inflow during the period between the May 2001 and April 2013 sediment surveys. Inflow to Sumner was measured at the USGS gage, Pecos River near Puerto de Luna, NM (PDL). The total sediment deposition during this period was the difference in the content between the 2001 and 2013 surveys at the top of conservation pool, elevation 4,262.88 feet (NAVD 88 vertical datum, 4261.00 feet referencing project vertical datum). In 2012 and at the request of CID, Reclamation reduced the maximum conservation pool elevation in Sumner by 2.11 feet to 4260.88 feet (NAVD 88).

The total sediment deposition, divided by the total inflow, obtained an average ratio of sediment deposition to inflow during this period. To estimate sediment deposition in a given period, calendar year inflow is multiplied by this ratio. Table 3 shows an annual tabulation of the inflow and estimated sediment accumulation since April 2013. The estimated cumulative sediment deposition since the 2013 sediment survey was 677 af.

Table 3: Estimated Sediment Accumulation for 2018 Sumner Storage Entitlement

Calendar Year	Inflow (af)	Sediment Accumulation (af)
4/2013 - 12/2013	74,640	96
2014	121,581	156
2015	108,299	139
2016	128,384	155
2017	102,480	131
<b>Total</b>		<b>677</b>

### **Brantley Reservoir Sediment Accumulation**

The basis of the estimated sediment accumulation calculations for Brantley is the ratio of total sediment deposition to total inflow during the period between the May 2001 and March 2013 sediment surveys. Inflow to Brantley is measured at the USGS gage, Pecos River near Lakewood, NM (Kaiser Channel). The total sediment deposition during this period was the difference in the content between the 2001 and 2013 surveys at the top of the designated conservation pool, elevation 3,272.6 feet (NAVD 88 vertical datum, 3271.00 feet referencing NGVD 29). Total sediment deposition divided by the total inflow yields an average ratio of sediment deposition to inflow during this period.

Annual sediment deposition since the 2013 survey is estimated by multiplying this ratio by the calendar year inflow. Table 4 shows estimated inflow and sediment accumulation since April 1, 2013. The estimated sediment deposition since the last sediment survey was 449 af based on provisional data.

Table 4: Estimated Sediment Accumulation for 2018 Brantley Storage Entitlement

<b>Calendar Year</b>	<b>Inflow (af)</b>	<b>Sediment Accumulation (af)</b>
4/2013 - 12/2013	74,801	57
2014	183,316	139
2015	132,404	100
2016	102,309	78
2017	98,605	75
<b>Total</b>		<b>449</b>

### **Reservoir Data**

Previously, Reclamation used reservoir data – elevation, storage, weather, and evaporation – received from the Carlsbad Irrigation District (CID). Reclamation has transitioned away from using most of the data that CID collects and records manually to using data collected and transmitted electronically. Use of data collected and transmitted electronically is standard operating procedure at the majority of Federal reservoirs. All storage and flow data used in this report for the three Reclamation-owned reservoirs are from electronic instrumentation maintained by the USGS.

First of the year elevation and storage are the midnight values on December 31 of the previous year. Unless otherwise specified, other elevations are the daily elevation, recorded at midnight of the date listed, and daily storage values correspond to that end-of-day elevation. Reclamation continues to use weather and pan evaporation data collected and recorded by the CID's dam tenders, typically at about 8 am daily.

## Sumner Dam and Lake

### Sumner Dam Operations

Note: All elevations reference the North American Vertical Datum of 1988 (NAVD 88).

Operations at Sumner Dam (Sumner) store available natural inflow as long as bypass is not required. Bypass may be required either to meet the 35 cubic feet per second (cfs) target at the USGS' Pecos River below Taiban Creek near Fort Sumner gage or to maintain continuous flow in the river. A flow of 5 cfs or greater at the Pecos River near Acme gage is considered an indication of continuous river flow. The targeted flows are required by the *Final Biological Opinion for the Carlsbad Project Water Operations and Water Supply Conservation, 2016-2026* (2017 BO; Consultation Number 02WNNM00-2016-F-0506), implemented in December 2017 for the Pecos Bluntnose Shiner (shiner) and the Interior Least Tern (tern).

Natural inflow may be bypassed at any time outside of irrigation season. During irrigation season, the New Mexico Office of the State Engineer (NMOSE) calculates Fort Sumner Irrigation District's (FSID) two-week allotment from the estimated natural inflow to Sumner Reservoir over the previous two weeks. Bypass is only available during irrigation season when the estimated natural inflow, as calculated by the NMOSE, exceeds FSID's maximum direct diversion water right of 100 cfs.

All other inflow into Sumner is considered Carlsbad Project water. Stored Project water is released as a block at CID's discretion. The duration of block releases from Sumner is restricted to a maximum of 15 contiguous days. The cumulative annual duration of all block releases is restricted to a maximum of 65 days, not including flood operations, and scheduled block releases should have a minimum of 14 days between releases. These restrictions are in accordance with the 2017 BO.

When possible, CID schedules block releases in cooperation with Reclamation to alleviate river intermittency. Reclamation directs the CID dam tender on releases from Sumner to maintain compliance with the 2017 BO. CID is responsible for all maintenance activities at the dam. This operating procedure does not alter the normal operations of Avalon and Brantley Dams for delivering water to CID.

From November 1 to April 30, under a water right permit granted by the NMOSE, the Carlsbad Project is permitted to store up to 20,000 af above its storage entitlement in Sumner provided that the entitlement storage of all four reservoirs on the Pecos in New Mexico does not exceed 176,500 af. The CID is required to evacuate the winter storage above its storage entitlement by May 1.

Sumner began 2018 with 39,123 af (4,262.15 feet) in total storage. Total storage reached a maximum on March 6, 2018, at 42,930 af (4,263.56 feet). Sumner's minimum storage occurred on September 8 at 17,761 af (4,251.49 feet). Figure 2 depicts Sumner's total storage and releases.

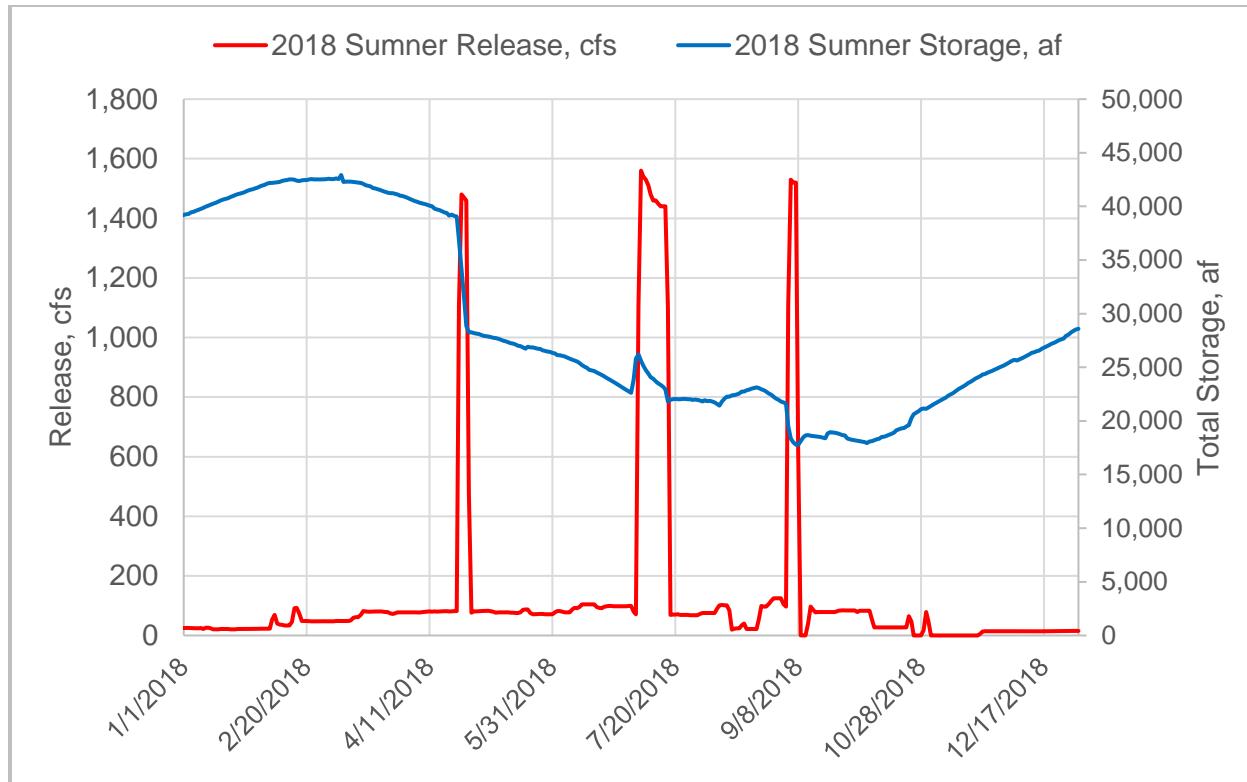


Figure 2: Storage and Release for Sumner Dam

FSID has a forbearance contract with Reclamation under which they may forbear up to 2,500 af per year. Forbearance storage for 2018 began on February 13. FSID called for their full two-week allotment on February 15, but on February 18 curtailed their use to about half and forbore the remainder. By March 14, a volume of 2,018 af of forbearance water had been stored. An additional 482 af was stored sporadically between March 26 and August 14, reaching the full forbearance volume of 2,500 af.

There were three block releases made this irrigation season (Figure 2). The first block release from Sumner, to evacuate winter storage, began on April 23 and ended on April 27, at an average release rate of 1,199 cfs, for a total CID release of 11,126 af from Sumner to Brantley Reservoir. An additional 765 af was released for FSID during this period. The second block release began on July 2 from Santa Rosa Dam and July 5 from Sumner, at an average release rate from Sumner of 1,425 cfs for a total CID release of 34,800 af. An additional 2,138 af were diverted by FSID, of which 203 af was returned to the river through the Sand Gate Diversion. The third block release began on September 4 from both Santa Rosa and Sumner, with an average release rate from Sumner of 1,261 cfs. The release from both reservoirs was stopped on September 8, earlier than planned, due to abundant precipitation in the Pecos Basin. The CID release was 12,174 af, with an additional 369 af diverted by FSID and 41 af returned through the Sand Gate Diversion.

As stated above, Reclamation acquired 2,500 af of forbearance water in 2018 through a contract between the United States and FSID (Contract No. 08-WC-40-292; FSID Forbearance Agreement Pool). The forbearance is stored in Sumner to provide releases for target flows at the Taiban gage and to avoid river intermittency. This water was stored and released under the

Carlsbad Project Water Supply Management Agreement between the United States and CID. Reclamation also pumped 750 af of water into Brantley Reservoir from April 3 through June 25 to acquire the 1,000 af Fish Conservation Pool (FCP) in Sumner.

Releases of forbearance water began on May 19. It was released on 68 days, with the last release on December 9, 2018. Forbearance releases were needed in every month except for October and November. During calendar year 2018, all 2,500 af were released.

During the non-irrigation season, 1,751 af was bypassed to meet target flows and to avoid river intermittency. Flow was bypassed between January 1 and February 12, at an average rate of 21 cfs. As FSID's allotment never reached the maximum of 100 cfs, no flow was bypassed during irrigation season. Because Reclamation had remaining forbearance and FCP water in storage in Sumner, these sources were used to provide flow below Sumner from the end of irrigation season on October 31 to the end of 2018, and no water was bypassed during that time.

Reclamation released 637 af of FCP between December 10 and December 31. The remaining 363 af of FCP reverted to Project storage on December 31, 2018, which was the total supplemental water returned to Project storage in 2018.

### **Sumner Dam Facility Review and Safety of Dams Programs**

A Comprehensive Review (CR) was completed of Sumner Dam on February 6, 2018. One new Safety of Dams (SOD) recommendation, two new Category 1 Operations and maintenance (O&M) recommendations, and 20 new Category 2 O&M recommendations resulted from this review. Prior to the CR, there were 11 incomplete Category 2 O&M recommendations.

Reclamation's Technical Service Center completed the SOD recommendation and one of the two Category 1 O&M recommendations in 2018. The Carlsbad Irrigation District (CID) also completed 12 of 31 total Category 2 O&M recommendations in 2018. That leaves 19 incomplete Category 2 O&M recommendations, of which four are scheduled to be completed by CID in 2019. Seven are related to the radial gate rehabilitation, and the remaining eight are related to updating the Standing Operating Procedures (SOP) and will be completed by Reclamation.

All three radial gates at Sumner Dam are in need of repair and rehabilitation. CID is responsible for performing the repairs and contributing 68.36% of the total repair cost. Reclamation has provided 31.64%, or \$1.2 million, of the estimated repair cost. Reclamation helped CID prepare for this project by providing information regarding planning, designs, schedules, cost estimates, and environmental issues. Between 2008 and 2013, CID completed approximately 15% of the radial gate O&M recommendations. From 2013 to 2017, no major repairs were performed on the radial gates because the gates had water against them. Reclamation plans on contracting the remaining repairs to expedite completion of the project. A plan for completion of the radial gate rehabilitation, to include costs and repayment, will be submitted to the CID board by the end of 2019, with construction tentatively planned for the summer of 2020. On October 19, 2018, a Reclamation Climb Team completed a comprehensive examination of all three radial gates for the investigation and analysis to determine the risk associated with the gates in their current condition. A report is expected for review by early 2019.

The last Periodic Facility Review (PFR) for Sumner Dam was completed in 2014. An Annual Site Inspection (ASI) was completed on February 4, 2017 (not required in 2018 due to the CR),

with no significant O&M issues reported. The next PFR for Sumner Dam is scheduled for FY 2022, and the next ASI is scheduled for FY 2019.

The last security reviews for Sumner Dam were an Annual Security Review (ASR) completed on August 14, 2018, an Annual Security Equipment Inventory (ASEI) checklist completed on August 14, 2018, and a Security Tailored Assessment Report (STAR), completed on September 9, 2018, all with no significant security issues reported. The next security reviews will be an ASR, an ASEI, and a STAR scheduled for FY 2019.

The Sumner dam tender received classroom training from Reclamation on March 13, 2017, and onsite training on February 8, 2018, during the CR.

## **Brantley Dam and Reservoir**

### **Brantley Dam Operations**

**Note:** All elevations reference the North American Vertical Datum of 1988 (NAVD 88).

During periods without irrigation releases, approximately 20 cfs is bypassed from Brantley Dam to mitigate reservoir impacts to Major Johnson Springs. In 2017, however, an exception was allowed for maintenance and inspections at the downstream Avalon Reservoir, and it was drained at the end of the 2017 irrigation season. The Brantley bypass would have refilled Avalon, preventing or delaying the work. The bypass was therefore shut off beginning in November 2017, except for small releases to keep the area immediately downstream from the dam wet.

During the irrigation season, releases were made from Brantley to Avalon Reservoir at a rate necessary to support diversion into CID's Main Canal, generally between 150 and 300 cfs as required by irrigation demand. The highest release of 2018 was 492 cfs in February and March to refill Avalon. During the irrigation season, the highest release was 360 cfs in July during a period of high irrigation demand. Figure 3 depicts Brantley's total storage and releases.

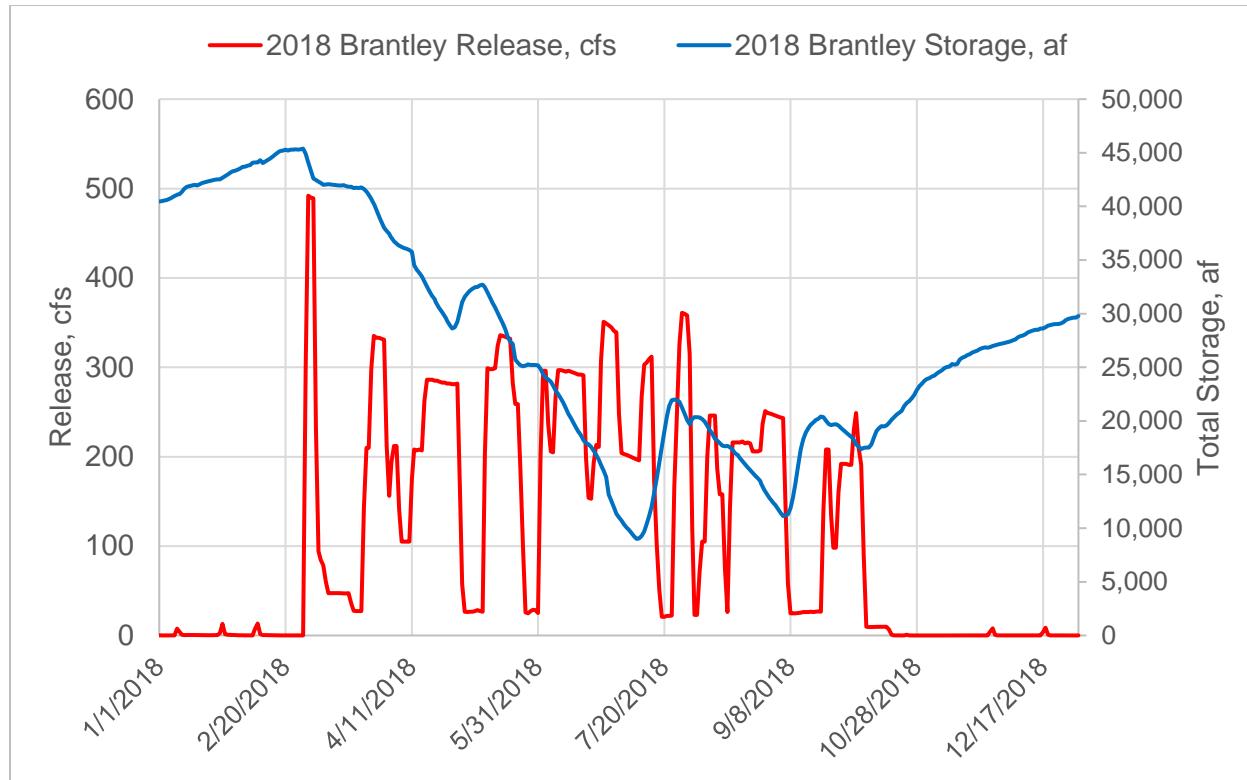


Figure 3: Storage and Release for Brantley Dam

Brantley began the year with a total storage of 40,447 af (3,255.59 feet). On February 27, Brantley reached its maximum storage for 2018, 45,391 af (3,257.12 feet). The lowest total storage in 2018 was 9,008 af (3,239.36 feet) on July 9.

After refilling Avalon from February 28 to March 4, irrigation releases from Brantley began on March 23. Subsequently, water releases varied to meet demand and conserve water. The final irrigation release from Brantley occurred on October 7. The total released from Brantley in 2018 was 83,226 af, with 80,864 af released for irrigation, and 2,362 af for mitigation flows and to maintain storage below the maximum Project entitlement of 176,500 af.

As was done at the end of 2017, Avalon was drained for required maintenance work at the end of 2018 irrigation season. Releases from Brantley on January 22 and 23, 2019, refilled Avalon in preparation for the irrigation season.

### **Brantley Dam Facility Review and Safety of Dams Programs**

A Comprehensive Review (CR) was completed on Brantley Dam on February 7, 2018. There were five new Category 2 O&M recommendations noted as a result of this review. Prior to the CR, there were eight incomplete Category 2 O&M recommendations. The Carlsbad Irrigation District (CID) completed six of 13 incomplete Category 2 O&M recommendations in 2018. There are currently seven incomplete Category 2 O&M recommendations for Brantley Dam. Three are scheduled to be completed by the CID in 2019. The remaining four are related to updating the SOP and will be completed by Reclamation.

There are sinkholes upstream and downstream on the left (southeast) side of Brantley Dam. The sinkholes are monitored visually on a regular basis, and are documented via photographic surveys every eight years. The last survey was conducted in August 2015. The sinkholes appear to be filling in naturally and are more difficult to locate during every survey.

The last Periodic Facility Review (PFR) for Brantley Dam was completed in 2014. An Annual Site Inspection (ASI) was completed on February 4, 2017, with no significant O&M issues reported. The next PFR for Brantley Dam is scheduled for FY 2022, and the next ASI is scheduled for FY 2019.

The last security reviews for Brantley Dam were an Annual Security Review (ASR) completed on February 7, 2018, an Annual Security Equipment Inventory (ASEI) checklist completed on August 14, 2018, and a Security Tailored Assessment Report (STAR) completed on September 9, 2018, all with no significant security issues reported. The next security reviews will be an ASR, an ASEI, and a STAR all scheduled for 2019.

The Brantley dam tender received classroom training from Reclamation on March 13, 2017, and onsite training on February 8, 2018, which occurred during the CR.

## Avalon Dam and Reservoir

### Avalon Dam Operations

**Note: All elevations reference Project Datum. Subtract 16.49 feet to obtain NGVD29 elevation.**

Due to the small reservoir capacity and the location of Brantley Dam 10 miles upstream, Avalon Dam is used primarily as a diversion dam to meet irrigation demand for CID. Water released from Brantley Dam is re-regulated at Avalon, which releases into the CID Main Canal. Avalon Reservoir began the year drained for required maintenance and inspections with zero af (3,161.52 feet) and ended the year with 0.0 af (3,161.52 feet), again drained for required maintenance. It reached a maximum storage of 3,683 af (3,176.48 feet) on March 17 in preparation for 2018 irrigation. Diversions into the CID Main Canal began on March 18 and ended on November 14. The total release for irrigation was 72,146 af. Figure 4 depicts Avalon's total storage and releases. There were no spill releases into the Pecos River in 2018.

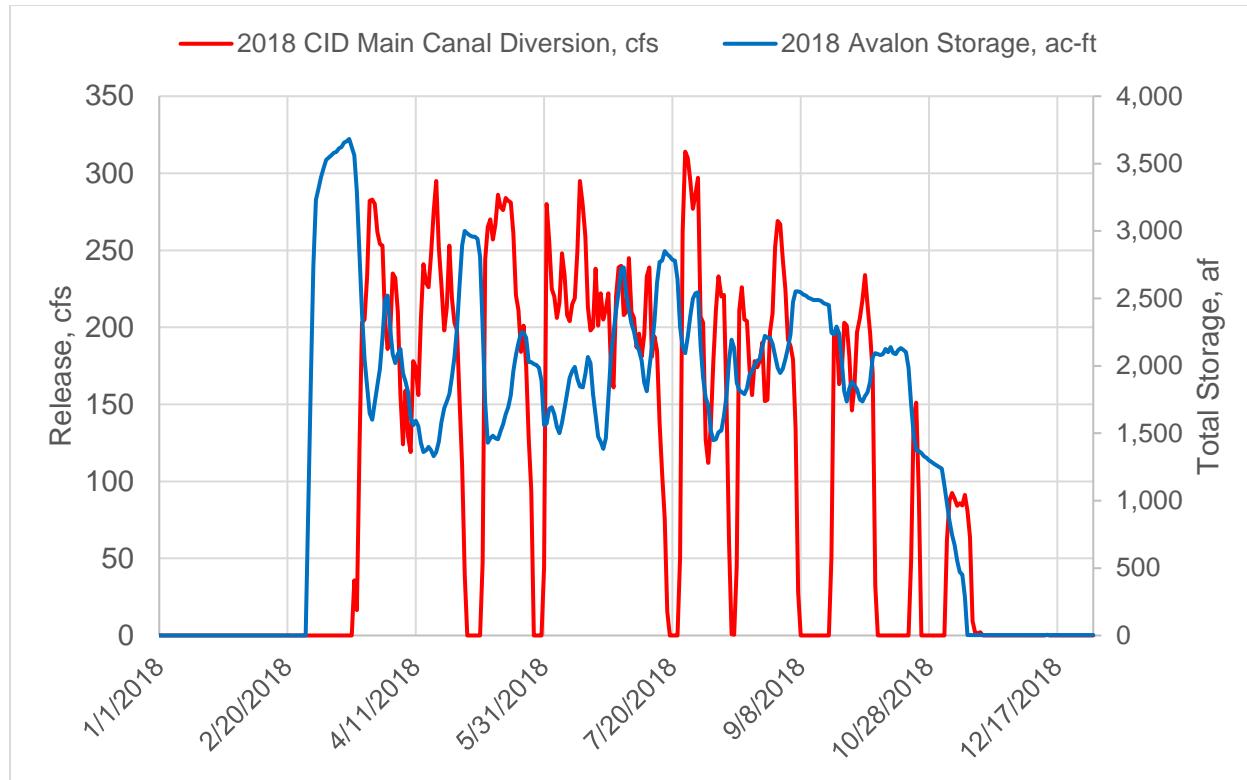


Figure 4: Storage and Release for Avalon Dam

As stated in the Brantley section above, the reservoir was completely drained at the end of the 2018 irrigation season for maintenance and inspections. By November 14, the reservoir was empty and remained so through the end of 2018. Avalon was refilled between January 22 and 24, 2019.

### Avalon Dam Facility Review and Safety of Dams Programs

Avalon Dam's outlet works cylinder gates, hoist platform, and walkway are currently in poor structural condition and are in need of repair or replacement. The Carlsbad Irrigation District (CID) is interested in decommissioning both cylinder gates and determining alternative methods to release to the Pecos River, such as converting the cylinder gates to glory holes. Avalon Reservoir and stilling basin were completely drained from October 2017 to February 2018 in order to better complete O&M recommendations, examine the structure, and bore concrete core samples for further evaluation.

A Comprehensive Review (CR) was completed on Avalon Dam on February 8, 2018. As a result of the CR, there were 10 new Category 2 O&M recommendations. Prior to the CR, there were 15 incomplete Category 2 O&M recommendations. Of the 25 total Category 2 O&M recommendations, CID completed 10 in 2018. These actions left a total of 15 incomplete Category 2 O&M recommendations at the end of 2018. Of these 15 Category 2 recommendations, two are currently scheduled to be completed by Reclamation in 2019, nine are related to the outlet works cylinder gate rehabilitation and date back as far as 2005. The remaining four recommendations are related to updating the SOP and will be completed by Reclamation.

Reclamation is working with CID to complete the cylinder gate rehabilitation, and can provide assistance with data collection, testing concrete and paint; conducting a value planning study to further develop alternatives; conducting feasibility studies, providing structural design, risk analysis, and cost estimates of alternatives; providing final design, and developing all reports/drawings; transmitting official documents, and conducting meetings related to this project. CID will be responsible for all construction costs. The first site visit for the cylinder gate investigation occurred on February 3, 2018, with a more comprehensive examination completed on February 9, 2018. These examinations occurred while Avalon Reservoir and stilling basin were drained.

The last Periodic Facility Review (PFR) for Avalon Dam was completed in 2014. An Annual Site Inspection (ASI) was completed on February 4, 2017 (not required in 2018 due to the CR), with no significant O&M issues reported. The next PFR for Avalon Dam is scheduled for FY 2022, and the next ASI is scheduled for FY 2019.

The last security reviews for Avalon Dam were an Annual Security Review (ASR) completed on February 8, 2018, an Annual Security Equipment Inventory (ASEI) checklist completed on August 14, 2018, and a Security Tailored Assessment Report (STAR), completed on September 9, 2018, all with no significant security issues reported. The next security reviews will be an ASR, an ASEI, and a STAR scheduled for FY 2019.

The Avalon dam tender last received classroom training from Reclamation on March 13, 2017, and onsite training on February 8, 2018, which occurred during the CR.

## Carlsbad Project Environmental Compliance

### Current ESA and NEPA Compliance

Reclamation submitted a new Biological Assessment (2016 BA) to the U.S. Fish and Wildlife Service (USFWS) on March 22, 2016, requesting consultation with the USFWS under the Endangered Species Act (ESA). On May 24, 2016, Reclamation received a memo from USFWS requesting additional information to start the formal consultation process. Reclamation submitted the additional information to the USFWS on July 7, 2016. On December 5, 2017, USFWS provided Reclamation the *Final Biological Opinion for the Carlsbad Project Water Operations and Water Supply Conservation, 2016-2026* (2017 BO; Consultation Number 02WNNM00-2016-F-0506), which provides compliance under ESA for Reclamation's Carlsbad Project actions and effects to ESA-listed species, including the Pecos Bluntnose Shiner and the Interior Least Tern.

Reclamation is preparing a parallel Environmental Assessment (EA) for compliance with the National Environmental Policy Act (NEPA), and which is tiered from the Final Environmental Impact Statement (EIS) for Carlsbad Project Water Operations and Water Supply (June 2006). This EA will analyze the changes from the actions under the 2006 BO to the actions covered by the 2017 BO. It should be completed in March 2019.

### Reclamation's Direct Flow Operations

Reclamation has a lease agreement with the New Mexico Interstate Stream Commission (NMISC) for groundwater (Vaughan and VP Bar) to be pumped into the Pecos River annually. The Vaughan Pipeline (Pipeline) supplements flows on the Pecos to minimize the chance of intermittency between Sumner and Brantley Reservoirs. The outfall structure of the Pipeline is located upstream of the USGS' Taiban gage. Maximum output during 2018 was 8.9 cfs. The Pipeline provided 1,644 af of the 1,649 af available for 2018, with 5 af remaining for exercising the pumps periodically.

In addition to the lease agreement described above, Reclamation has established a 1,000 af fish conservation pool (FCP) in Sumner through an exchange of 750 af of water rights it owns at Seven Rivers Wildlife Management Area (Seven Rivers). Water under this water right is pumped into Brantley from wells at Seven Rivers and is exchanged for the water stored in Sumner Lake.

Under a forbearance agreement with FSID, 2,500 af were stored for Reclamation under the Carlsbad Project's storage right at Sumner Lake. The forbearance and FCP waters were released as needed to maintain flow in the Pecos below Sumner at the Taiban and Acme gages. Reclamation utilized 637 af of the 1,000 af FCP and all of the forbearance water. The remaining 363 af of FCP returned to Project Storage, described further in the Sumner Operations section.

## Pecos Basin Water Accounting

Reclamation, the NMISC, and CID developed a 20-year Depletions Agreement for ESA water use (2014-2033). The accounting related to this agreement determines the reduction in Carlsbad Project water supply due to modification of Reclamation's Sumner operations to meet BO obligations, and the amount by which any reductions in Project water supply are offset by Reclamation's water acquisitions.

Historically, a Microsoft Excel® spreadsheet, the Annual Accounting Method (AAM), was used to determine the amount of water depleted from the Pecos River. An accounting model that utilizes RiverWare® software, called the Pecos River Operations Model (PROM) was developed and, beginning in 2015, its results were compared to those from the AAM. Both the AAM and PROM were jointly developed by Reclamation and NMISC with review by CID. For several years, the two methodologies were compared. PROM\_2016 was the first version of the RiverWare model, and accounting in 2018 was performed using the PROM\_2018 version.

Comparisons in past years have shown that the two models have differences, but Reclamation believes that the RiverWare® model is a better representation of physical conditions on the river. This is because RiverWare® more accurately models physical hydrologic processes using current data, whereas the spreadsheet typically uses historical averages to represent processes such as channel losses.

The three parties have agreed that the PROM will replace the spreadsheet previously used to account for depletions. From 2017 forward, the current version of PROM will be used exclusively to determine depletions.

## Reclamation's Water Offset Program

Reclamation leases water rights from willing owners within the Pecos Basin to offset the additional depletions caused by ESA-related operations. Reclamation is entirely dependent on the availability of willing water rights holders and budget constraints to meet the instream flow requirements of the 2017 BO.

During the 2018 water accounting year, which extends from November 1, 2017, through October 31, 2018, Reclamation had water lease agreements with five Pecos river-pumpers to lease 1,126.2 af of surface water rights and 507 af of Hagerman Canal water rights. Both volumes are the consumptive use portion of the right. The land associated with the leased water was fallowed. The Hagerman Canal water was pumped directly into the Pecos River.

In water accounting year 2018, Reclamation bypassed 1,869 af and released 3,058 af of forbearance water. Note that both include water released in 2017 and 2018. This caused 415 af of depletions in the 2018 accounting year.

Carlsbad Project Water Acquisition (CPWA or Offset) amounts of 5,600 af, adjusted for consumptive use, transmission loss, and Brantley evaporation, were provided at Brantley for the

accounting year to eliminate these additional depletions. This resulted in a Reclamation credit of 3,130 af for the 2018 accounting year.

The accounting calculations were made using the PROM\_2018 Two Stream Model. Output from the model indicates that, for the 2018 accounting year, Reclamation's CPWA Program put 3,130 af more into the Pecos River than were depleted as a result of modified operations at Sumner. During the set up and running of the PROM\_2018 Two Stream Model numerous data loading problems were discovered. These problems have been corrected, and the corrections will be used in future model runs.

Another problem was discovered with the Data Management Interface (DMI) output. After this was corrected, the Two Stream Model was re-run for accounting year 2017 and the depletions were recalculated. The corrected values for 2017 are a total normalized net depletion of 268 af and a credit to Reclamation of 4,988 af.

## **Endangered Species Program**

### **Pecos Bluntnose Shiner**

The threatened Pecos Bluntnose Shiner (*Notropis simus pecosensis*, shiner) is monitored annually to assess population status and determine incidental take for Reclamation's Carlsbad Project. During normal flow conditions, the 2017 BO established take for shiner using the mean 3<sup>rd</sup> trimester density of 12 fish/100m<sup>2</sup> as a surrogate for determining if take has been exceeded during a given water year. The BO states that under normal flow conditions, Pecos Bluntnose Shiner density would be either increasing from the previous year's 3<sup>rd</sup> trimester density or staying above the prescribed mean 3<sup>rd</sup> trimester density of 12 fish/100m<sup>2</sup>. Decreasing densities below 12 fish/100m<sup>2</sup> as a result of the Proposed Action require further consultation with the USFWS.

The 2017 BO also defines a *Critically Dry* condition, which has various measures. Some are the percent of the basin classified as Extreme or Exceptional Drought per the U.S. Drought Monitor, the proportion of the 30-year average of the National Resources Conservation Service's forecast for inflow to Santa Rosa Reservoir, and the percent of time in which bypass is available. Reclamation assesses these factors monthly from January to June. A designation of *Critically Dry* is an indication that Reclamation may not be able to cover the deficit in the hydrologic system with its available resources. In that case, the Taiban gage target of 35 cfs is removed, and Reclamation focuses on maintaining 5 cfs at the Acme gage, which should insure that the reach is continuous. In addition, under *Critically Dry* conditions, no take from the proposed action occurs providing all water resources at Reclamation's disposal are utilized to minimize drying (USFWS, 2017).

Reclamation funds, and receives trip reports from, the USFWS for fish sampling from April to October. These data are compiled into an annual report on the status of the shiner. The following

shiner data summarizes information provided to Reclamation under the USFWS interagency agreement<sup>3</sup>.

In 2018, 12 sites were monitored on five separate sampling occasions. A total of 15,556 fish were collected from 22 different species. More fish were collected in 2018 compared to 2017. The most abundant fish species was Red Shiner (*Cyprinella lutrensis*). Pecos bluntnose shiner was second most abundant fish species, with a total of 3,218 collected during 2018 site visits. Small bodied minnows dominated fish collections: Red Shiner, Plains Minnow (*Hybognathus placitus*), Speckled Chub (*Macrhybopsis aestivalis*), Rio Grande Shiner (*Notropis jemezanus*), and Pecos Bluntnose Shiner accounted for nearly 95% of all fish collected.

During the 3<sup>rd</sup> trimester of 2018 (September through December), 2,690 Pecos Bluntnose Shiner were collected from the Pecos River, comprising a mean percent of total that was  $22.8 \pm 2.1\%$  of all species collected. The 2018 mean Pecos Bluntnose Shiner 3<sup>rd</sup> trimester density was  $34.3 \pm 4.6$  fish per  $100m^2$ , while in 2017 the 3<sup>rd</sup> trimester density was  $7.1 \pm 1.0$  fish per  $100m^2$  (Table 5). The 2018 3<sup>rd</sup> trimester density was well above the prescribed mean 3<sup>rd</sup> trimester density of 12 fish per  $100m^2$ , therefore take was not exceeded in 2018. Overall, the species 2018 abundance was one of the highest observed between years 2000 through 2018 (Table 5).

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<sup>3</sup> Davenport, S.R. 2018. Pecos River Basin Fisheries Update Summary Report. DRAFT report submitted to US Bureau of Reclamation, Albuquerque Area Office.

Table 5: Presence and abundance of Pecos Bluntnose Shiner (*Notropis simus pecosensis*) in trimester three only, Pecos River, New Mexico for calendar years 2000–2017. Take metric catch rate is in bold for 2018.

Calendar Year	Presence			Abundance				
	Total Site Visits	Occupied Sites	Percent Occupied	Total Shiner	Total Fish	%	Total Area (m <sup>2</sup> )	Shiner/100 m <sup>2</sup>
2000	23	23	100	1,510	8,907	15.50	9,879	16.78
2001	14	12	85.7	1,141	8,521	13.55	3,339	33.57
2002	13	13	100	585	8,923	7.45	3,780	17.64
2003	9	9	100	151	8,425	2.13	1,483	13.95
2004	23	19	82.6	118	10,676	1.56	5,628	2.50
2005	21	19	90.4	174	6,138	3.52	4,271	4.35
2006	25	21	84.0	358	4,757	7.76	5,661	6.56
2007	25	25	100	803	6,581	12.45	6,241	13.72
2008	30	29	96.6	781	11,511	7.78	7,389	16.96
2009	38	38	100	1,345	16,316	10.91	7,925	19.68
2010	41	41	100	2,217	20,387	15.04	10,058	23.26
2011	32	29	90.6	1,778	20,298	8.24	8,125	23.23
2012	24	14	58.3	509	24,484	1.93	5,598	7.35
2013	18	13	72.2	164	11,901	1.32	5,533	3.10
2014	33	26	73.3	385	7,106	5.27	12,496	3.04
2015	24	23	95.8	567	4,484	13.27	8,026	7.66
2016	22	22	100	593	6,337	8.90	7,304	8.8
2017	31	31	100	749	6,250	14.1	10,788.5	7.1
<b>2018</b>	<b>33</b>	<b>33</b>	<b>100</b>	<b>2,690</b>	<b>11,785</b>	<b>22.8</b>	<b>8,142.5</b>	<b>34.3</b>
Total/Avg.			91.0	16,626	203,787	9.1	131,667	13.9

### Literature Cited

Davenport, S.R. 2018. Pecos River Basin Fisheries Update Summary Report. DRAFT report submitted to US Bureau of Reclamation, Albuquerque Area Office.

U.S. Fish and Wildlife Service (USFWS). 2016 Biological Opinion for the Bureau of Reclamation's Proposed Carlsbad Project Water Operations and Water Supply Conservation, 2016–2026. New Mexico Ecological Services Field Office, Albuquerque, New Mexico.

### **Interior Least Tern**

When the elevation of Brantley Reservoir is at or above the full pool elevation of 3,256 feet (all elevations are North American Vertical Datum 1988), the surface area is 3,034 acres or greater and no suitable nesting shoreline habitat is available to Interior Least Terns (*Sterna antillarum athalassos*, tern). Even when the reservoir elevation is at the normal elevation defined by New

Mexico State Parks, 3,250 feet, and the surface area of Brantley Reservoir is approximately 2,219 acres, very little nesting shoreline is typically available to terns.

During the 2018 breeding season, reservoir elevations reached a seasonal low of approximately 3,239 feet on July 9 (Figure 5), which provided an abundance of exposed, unvegetated shoreline suitable for nesting. From a seasonal high of nearly 3,253 feet on May 9, to the seasonal low on July 9, more than 1,500 acres of shoreline became exposed.

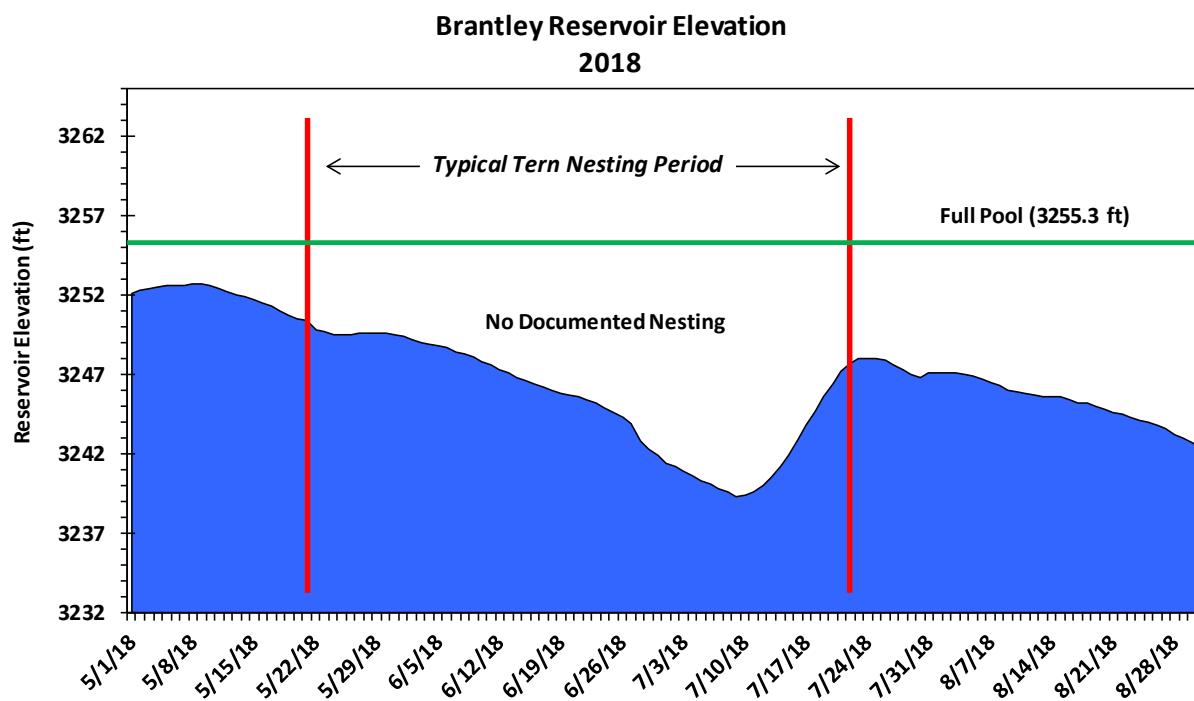


Figure 5: Brantley Reservoir Elevations during the 2018 Interior Least Tern Breeding Season

Survey dates and observation results for Least Terns at Brantley Reservoir during the spring and summer of 2018 are presented in Table 5. A single adult tern was observed on July 9, 2018. With concurrence from the USFWS, tern surveys were discontinued after the August 6 visit, as it was past the end of the typical tern nesting season. The July 9 tern sighting was the only sighting in 2018.

Table 6: Summary of 2018 Interior Least Tern Observations at Brantley, New Mexico<sup>4</sup>

Date	Adult	Sub-Adult	Immature	Nests
May 24/25	0	0	0	0
June 1/2	0	0	0	0
June 5/6	0	0	0	0
June 12/13	0	0	0	0
June 18/19	0	0	0	0
June 25/26	0	0	0	0
July 1/2	0	0	0	0
July 8/9	1	0	0	0
July 15/16	0	0	0	0
July 22/23	0	0	0	0
July 29/30	0	0	0	0
August 5/6	0	0	0	0
<b>2018 Totals</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>

The single adult tern seen on the morning of July 9 was observed on multiple occasions during the day's survey and was always alone. No evidence of pairing was observed. Similar to previous years, Brantley Reservoir levels fluctuated drastically over the course of the breeding season as a result of block releases from upstream reservoirs and releases for irrigation from Brantley. However, the 2018 block release arrived later than usual allowing exposed, unvegetated shoreline suitable for nesting to persist for a longer period. Unfortunately, there were no breeding pairs of Least Terns to take advantage of the prolonged habitat availability.

### Pecos River Restoration

Under the 2006 BO, Reclamation agreed to "assist in the completion of ongoing habitat improvement projects on the Pecos and to restore 1 to 1.5 miles of quality habitat within the Farmlands reach by 2009, and another 1 to 1.5 miles by 2014." In 2009, Reclamation funded and completed a channel restoration project that reconnected Oxbow 4 at Bitter Lakes National Wildlife Refuge (BLNWR) to the mainstem of the Pecos. Reclamation has completed the required monitoring for this restoration.

The second habitat improvement project, located at the Bureau of Land Management (BLM) Overflow Wetlands Area of Critical Environmental Concern (ACEC), south of the BLNWR restoration project, was completed in 2014. Lands in the project area are managed by BLM, the NM State Land Office, and private landowners. Monitoring of this habitat restoration project will continue through 2019 to conclude commitments made under the Clean Water Section 404 permit requirements.

According to the 2006 BO, activities that restore and optimize the interaction of river channel and floodplain habitats with available flows will be most successful in mitigating the observed displacement of the shiner eggs and in providing a variety of channel conditions favorable to the different life stages of the shiner. This project included removal of non-native vegetation, lowering and contouring riverbanks, and excavating smaller bank sites. Prior to construction, the

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<sup>4</sup> D. Ahlers and D. Moore. 2018. Interior Least Tern Monitoring Results 2018. Brantley Reservoir, New Mexico. Bureau of Reclamation, Albuquerque Area Office, NM.

Pecos River in this reach was a deep channel with very little diversity. The cross sectional data collected since 2014 shows areas of varying depth and flows that have improved the habitat for the shiner in this reach. Although all commitments under the 2006 BO have been fulfilled, Reclamation does from time to time monitor the restoration sites.

## Fort Sumner Project

### Operations

The irrigation season for FSID typically begins March 1 and ends October 31. FSID is also permitted to divert for two, eight-day periods during the winter. This winter allotment has generally been taken just prior to March 1.

FSID began diverting water for irrigation on February 15, 2018, and ended irrigation for the year on October 31. During the irrigation season, 0 to 99 cfs was bypassed through Sumner for FSID diversion based on the available water right and in accordance with their call, less the forbearance water stored and described in the Sumner Dam Operations section. FSID diverted 35,252 af into the FSID main canal as recorded by the USGS Fort Sumner Main Canal near Fort Sumner, NM, gage, and shown in Figure 6. The total allotment for FSID in 2018 was 38,472 af.

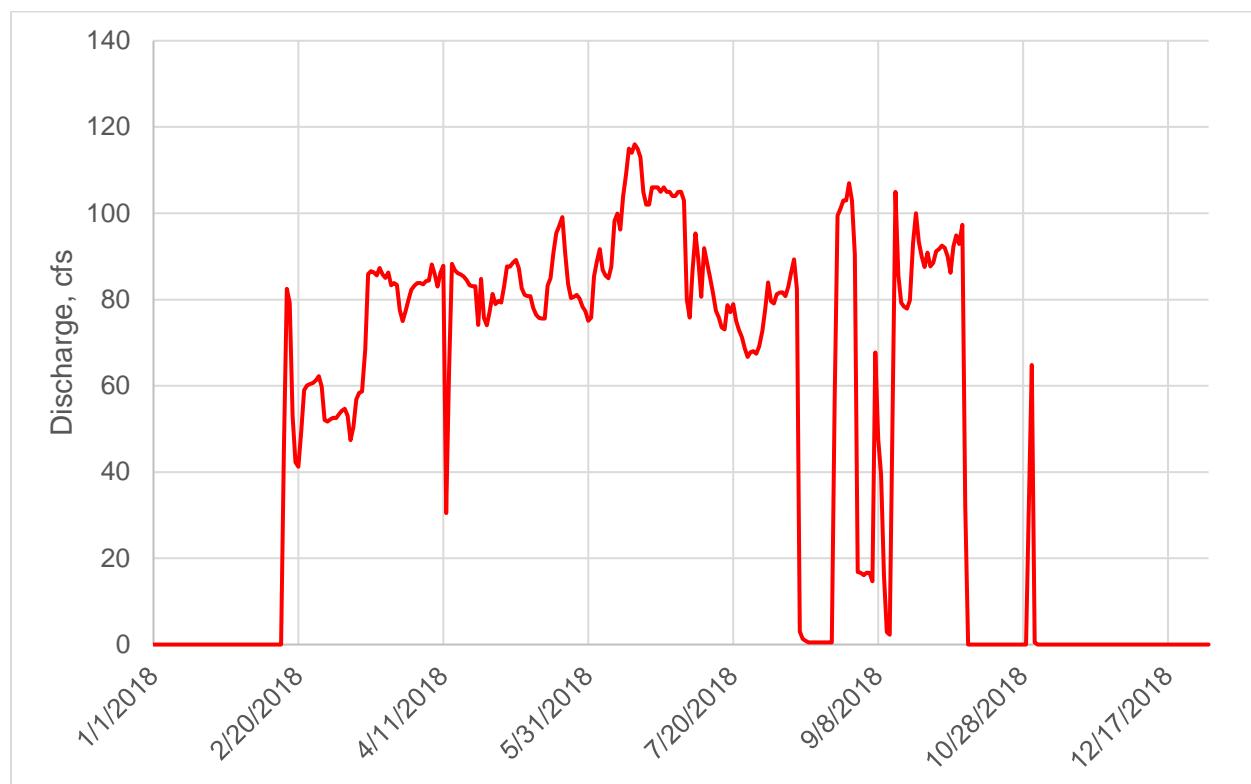


Figure 6: FSID Main Canal Diversion

This year, FSID often diverted all flow arriving at their dam, and then released Reclamation's supplemental water call back to the river at the Sand Gate Diversion ([08385503](#)). In recent years, FSID has for the most part only diverted the flow that NMOSE calculates as their two-week allotment. In 2018, FSID was often diverting more than that, up to their water right of 100 cfs of the natural flow of the Pecos River at their diversion.

In 2017, the USGS installed new equipment in the FSID Main Canal that measures flow using an area-velocity relationship. The previous system used a stage-discharge relationship. Unfortunately, some equipment was lost after high flows in October 2017. When the gage was replaced in 2018, sediment consistently built up on the new velocity meter causing it to malfunction. The velocity meter was replaced on September 6 and the old stage-discharge system measuring system was restored.

The FSID Main Canal Gage ([08385000](#)) often was either not reporting or reporting incorrectly, so it was at times difficult to determine the FSID's diversion. In addition, intervening flow between Sumner Dam and the FSID diversion is not measured. Both of these factors made Reclamation's 2018 operations in support of the 2017 BO more challenging.

## **Fort Sumner Irrigation District Review of Operation and Maintenance**

A Review of Operations and Maintenance (RO&M) examination of the Fort Sumner Irrigation District (FSID) Canal System and Diversion Dam was completed on April 21, 2015, with some significant O&M recommendations identified, including vegetation control and gate repairs.

There were six new Category 2 RO&M recommendations as a result of this review. There were already eight incomplete Category 2 RO&M recommendations and three incomplete Category 3 recommendations, dating as far back as 2010. FSID completed 11 of 14 incomplete Category 2 RO&M recommendations and two of the three incomplete Category 3 RO&M recommendations between 2010 and 2018. This leaves three incomplete Category 2 RO&M recommendations and one incomplete Category 3 RO&M recommendation yet to complete.

Reclamation personnel conducted an unscheduled site visit of the FSID Diversion Dam radial gates on September 23, 2018, to assist FSID in determining current condition of the gates. FSID finished maintenance work on the radial gates in March 2019. The completion of this work satisfies two of the remaining three incomplete Category 2 RO&M recommendations.

There are no other RO&M issues of concern for the FSID system other than vegetation control along the canals and ongoing RO&M maintenance. The next RO&M examination is scheduled for FY 2021.

## Other Pecos River Activities and Operations

### Carlsbad Irrigation District Water Lease Program

Reclamation and the NMISC completed an EIS in August 2006, clearing the way for a long term “Miscellaneous Purposes Contract,” which is required to allow Carlsbad Project Water to be released for delivery to the state line. Reclamation and CID entered into a 40-year contract on November 21, 2006, allowing Carlsbad Project water to be used for purposes other than irrigation. This contract allows NMISC and CID to enter into third-party lease agreements for the purposes of leasing water from other CID water users. It also allows NMISC to use water appurtenant to lands it owns within the District for purposes other than irrigation. Such leases must be approved by Reclamation. No third-party agreements have been executed and approved to date.

### Pecos River Settlement Implementation

The State of New Mexico, the Pecos Valley Artesian Conservancy District (PVACD), CID, and the United States Government signed the water rights Settlement Agreement (Settlement) on March 25, 2003. The Settlement and its implementation were vital to ensure delivery to Texas under the Pecos River Compact, to provide additional water supplies to CID, and to protect PVACD from a priority call on its junior groundwater rights. The Settlement provides additional water from two sources acquired by the NMISC: surface water from CID farmers, and groundwater from PVACD farmers that is pumped from augmentation well fields operated by the NMISC.

NMISC has not pumped water for CID under the Settlement since September 13, 2013. Climatic conditions since 2013 have kept the Carlsbad Project Supply above the Settlement’s maximum Target Supply.

### Pecos River Basin General Stream Adjudication

The Pecos River General Stream Adjudication<sup>5</sup> is ongoing in the fifth Judicial District Court in Chaves County, New Mexico. Reclamation and the U. S. Department of Justice are involved in this case by virtue of U. S. interest in the water rights for the Carlsbad Project. Adjudication of individual CID members’ rights is ongoing.

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<sup>5</sup> State of New Mexico, ex rel. the Office of the State Engineer and Pecos Valley Artesian Conservancy District v. L. T. Lewis, et al. and the United States of America, Case Nos. 20294 and 22600 (Consolidated).

## WaterSMART Program

Water is our most precious natural resource. Adequate water supplies are essential to human survival, ecosystem health, energy production, and economic sustainability. However, water supplies are increasingly stressed by the demands society places on them, as well as by the impacts of steadily increasing temperatures, and changing weather patterns. Significant climate-change-related impacts on water supplies are well documented in the scientific literature and scientists are forecasting significant further changes in hydrologic cycles.

Congress recognized these issues with the passage of the SECURE Water Act. The law authorizes federal water and science agencies to work together with state and local water managers to plan for threats to water supplies, and take action to secure water resources for the communities, economies, and the ecosystems they support.

To implement the SECURE Water Act, and ensure that the Department of the Interior is positioned to meet these challenges, Secretary Salazar established the WaterSMART Program in February 2010. WaterSMART allows all bureaus of the Department to work with States, Tribes, local governments, and non-governmental organizations to pursue a sustainable water supply for the Nation by establishing a framework to provide federal leadership and assistance on the efficient use of water, integrating water and energy policies to support the sustainable use of all natural resources, and coordinating the water conservation activities of the various Interior offices.

As the Department's main water management agency, Reclamation plays a key role in the WaterSMART Program. Reclamation's portion of the WaterSMART Program is focused on improving water conservation, and helping water and resource managers make wise decisions about water use. Goals are achieved through administration of grants, scientific studies, technical assistance, and scientific expertise.

These programs, funded and managed by Reclamation's Office of Policy and Administration in Denver, CO, include:

- WaterSMART Grants
  - Water and Energy Efficiency Grants
  - Small-Scale Water Efficiency Projects
  - Water Marketing Strategy Grants
- Water Conservation Field Services Program
- Cooperative Watershed Management Program (Phases I and II)
- Drought Response Program
  - Drought Contingency Planning
  - Drought Resiliency Projects
  - Emergency Response Actions
- Title XVI Water Reclamation and Re-use Program
  - Funding for planning, design, and construction of water recycling and re-use projects
  - Funding for development of new Title XVI feasibility studies
  - Funding for Title XVI water reuse research

- Funding for planning, design, and construction of brackish groundwater and ocean desalination projects.
- Basin Study Program
  - Baseline Water Assessments
    - Data, tools, and guidance
    - SECURE Reports to Congress
    - Reservoir Operations Pilots
  - Basin Studies (previously funded studies – no new Basin Studies were funded in 2018)
  - Applied Science Tools

More information about all of these programs, completed project reports, and funding opportunity announcements can be found at: <https://www.usbr.gov/watersmart/>.

A WaterSMART Data Visualization Tool and can be found at:

<https://usbr.maps.arcgis.com/apps/MapJournal/index.html?appid=043fe91887ac4ddc92a4c0f427e38ab0>.

General information about Reclamation's WaterSMART Program is provided below. Ongoing or newly funded projects within the jurisdiction of the Albuquerque Area Office (AAO) in the Pecos River Basin are summarized below.

## WaterSMART Grants

### Water and Energy Efficiency Grants

WaterSMART Water and Energy Efficiency Grants (WEEG) provide funding for projects that result in quantifiable water savings and support broader water reliability benefits. These projects conserve and use water more efficiently; increase the production of hydropower; mitigate conflict risk in areas at a high risk of future water conflict; and accomplish other benefits that contribute to water supply reliability, and have environmental benefits, in the western United States.

### Small-Scale Water Efficiency Projects

Small-scale water efficiency projects (SWEP) provide funding for small-scale water-management projects that have been identified through previous planning efforts. Benefits are similar to those described for Water and Energy Efficiency Grants, but on a smaller scale.

Brief descriptions of two SWEPs underway in the Pecos Basin are found below:

- Guadalupe Soil and Water Conservation District was awarded \$75,000 for their “Aequia Restoration & Conservation Project,” which is a cost-shared effort to begin actively assisting landowners with irrigation efficiency infrastructure projects. The funding will assist to further implement an ongoing small-scale conservation cost share program which restores compromised acequias, improves irrigation efficiency, and halts their degradation.

- Carlsbad Irrigation District was awarded \$75,000 for their “Main Canal Lining for Water Savings & Efficiency” cost-shared project to line a portion of the canal with polyuria material.

### **Water Marketing Strategy Grants**

Through the WaterSMART Water Marketing Strategy Grants, Reclamation provides assistance to states, tribes, and local governments to conduct planning activities to develop water marketing strategies that establish or expand water markets or water marketing activities between willing participants, in compliance with state and Federal laws. These grants support entities in exploring actions that can be taken to develop or facilitate water marketing that could provide a mechanism for willing participants to buy, sell, lease, or exchange water.

### **Water Conservation Field Services Program**

Through the Water Conservation Field Services Program (WCFSP), Reclamation provides funding and technical assistance to several water management entities in New Mexico and west Texas. The WCFSP seeks to promote water use efficiency through support of outreach efforts, research projects, and technical assistance to water users.

### **Cooperative Watershed Management Program**

The Cooperative Watershed Management Program (CWMP) contributes to the WaterSMART Program strategy by providing funding to watershed groups to encourage diverse stakeholders to form local solutions to address their water management needs. The purpose of the CWMP is to improve water quality and ecological resilience, conserve water, and reduce conflicts over water through collaborative conservation efforts in the management of local watersheds. Phase I of this program supports the initial establishment of watershed groups, and restoration planning by those groups. Phase II supports the completion of watershed management projects that were recommended in the restoration planning process under Phase I.

### **Drought Response Program**

The Bureau of Reclamation's Drought Response Program supports a proactive approach to drought by funding projects that build long-term resilience to drought and reduce the need for emergency response actions. The Drought Response Program provides assistance for three sub-programs: Drought Contingency Planning, which provides assistance to water users for drought contingency planning, including consideration of ways that climate change is affecting water supply reliability; Drought Resiliency Projects, which supports actions that will build long-term resiliency to drought; and Emergency Response Actions, which seek to minimize losses and damages resulting from drought, relying on the authorities in Title I of the Drought Act.

## **Drought Contingency Planning**

Reclamation provides financial assistance on a competitive basis for applicants to develop a drought contingency plan or to update an existing plan to meet the required elements described in the Drought Response Framework. Most drought contingency planning processes are structured to address the three following questions:

- How will we recognize the next drought in the early stages?
- How will drought affect us?
- How can we protect ourselves from the next drought?

The planning process is structured to help planners answer these three questions and to encourage an open and inclusive planning effort that employs a proactive approach to build long-term resiliency to drought.

## **Drought Resiliency Projects**

"Drought Resiliency" is defined as the capacity of a community to cope with and respond to drought. Under this element of the program, Reclamation will fund drought resiliency projects that will help communities prepare for and respond to drought. Typically, these types of projects are referred to as "mitigation actions" in a drought contingency plan. Projects must meet one of the following goals:

- Increase the reliability of water supply and sustainability,
- Improve water management and increase operational flexibility,
- Implement systems to facilitate voluntary sale, transfer or exchange of water,
- Provide benefits for fish and wildlife and the environment,
- Mitigate poor water quality caused by drought.

## **Emergency Response Actions**

Reclamation will continue to undertake emergency response actions under the Drought Response Program to minimize losses and damages resulting from drought, relying on the authorities in Title I of the Drought Act. Emergency response actions are crisis-driven actions in response to unanticipated circumstances. Eligible emergency response actions are limited to temporary construction activities and other actions authorized under Title I that do not involve construction of permanent facilities, including water purchases and use of Reclamation facilities to convey and store water.

## **Title XVI Water Reclamation and Re-use Projects**

Title XVI of P.L. 102-575, as amended (Title XVI), provides authority for Reclamation's water recycling and reuse program. Through the Title XVI Program, Reclamation identifies and investigates opportunities to reclaim and reuse wastewaters and naturally impaired ground and surface water in the 17 Western States and Hawaii. Title XVI includes funding for the planning, design, and construction of water recycling and reuse projects in partnership with local government entities.

## **Basin Study Program**

Reclamation's Basin Study Program represents a comprehensive approach to identifying and incorporating the best available science into climate-change adaptation planning. Within the Basin Study Program, Reclamation and its partners seek to identify strategies for addressing imbalances in water supply and demand, as authorized in the SECURE Water Act. The Program includes the West-Wide Climate Risk Assessment (WWCRA) Program, now referred to as Baseline Water Assessments, as well as the Basin Studies themselves. Further information about each of these sub-programs is provided below.

### **Baseline Water Assessments**

Baseline Water Assessment activities focus on development of projections of future water supply and demand for Western river basins, and evaluation of impacts of the projected changes to water/reservoir operations, water quality, hydropower generation, endangered species, fish and wildlife, flow- and water-dependent ecological resiliency, and recreation. Program activities include development of guidance for analysis of potential impacts of changes to water supply and demand on Reclamation projects. The Baseline Water Assessment Program includes the Reservoir Operations Pilot Projects, which seek to identify ways to increase operational flexibility for Federal reservoirs.

### **Basin Studies**

Reclamation has entered partnerships with local water management agencies to perform Basin Studies. The projects seek to develop adaptation and mitigation strategies for watersheds affected by climate change. Basin studies require a 50% cost share from Reclamation's local water-management partners, and involve considerable cooperation with other members of the water community in a basin.

#### **Pecos Basin Study**

In 2012, Reclamation entered into a partnership with the NMISC for a Basin Study focusing on the Pecos watershed in eastern New Mexico. This project is evaluating projected changes in water supply and demand in the New Mexico portion of the Pecos Basin, with emphasis on agricultural impacts and adaptation in the three major irrigation districts in the Pecos Basin – FSID, PVACD, and CID.

Reclamation has developed projections of the hydrologic impacts of climate change for this basin, with assistance from the US Army Corps of Engineers. These projections provide the basis for simulations of the river system using the PROM RiverWare™ model that simulates groundwater/surface water interaction in the Fort Sumner Area, as well as the Roswell Artesian Basin groundwater model, which simulates groundwater/surface water interaction between the Pecos and the Roswell basin aquifers. Changes in Department of Interior requirements for Basin Studies have resulted in the need for additional modeling analyses to support this study. The project is expected to be completed in December 2019.

### **Science & Technology Program**

Reclamation's Science and Technology (S&T) Program is a Reclamation-wide, competitive, merit-based applied research and development program. The program focuses on innovative solutions for water and power challenges in the Western United States for Reclamation water and facility managers and the stakeholders they serve. The program has contributed many of the tools and

capabilities Reclamation and western water managers use today.

The AAO actively participates in Reclamation's Science and Technology Program, in which it initiates and participates in research to improve the services that Reclamation provides to its stakeholders. S&T Program projects that were underway in 2018 include:

- FY 2017 Award: Detecting, Interpreting, and Modeling Hydrologic Extremes to Support Flexible Water Management and Planning (AAO partnership with National Center for Atmospheric Research [NCAR]),
- FY 2018 Award: Improving the Robustness of Southwestern US Water Supply Forecasting in the Face of Climate Trends and Variability (AAO partnership with NCAR).

## Zebra and Quagga Mussels

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

In 2018, none of the seven Reclamation reservoirs sampled in New Mexico tested positive for zebra or quagga mussels via either microscopy or Polymerase Chain Reaction (PCR). Factors that may contribute to a lack of mussel occupation in New Mexico reservoirs include a fast spring runoff coupled with high levels of suspended solids, rapid drawdown of reservoir waters and canals, and ongoing drought (D. Hosler, Personal Communication). Continued vigilance is important, as conditions more suitable to AIS establishment may occur in the future (Table 6).

Table 7: 2018 AIS Sampling Results for Reclamation Reservoirs in New Mexico

Water body	Number of samples	Microscopy results	PCR results
Navajo Reservoir	23	Negative for all	Negative for all
Heron Reservoir	11	Negative for all	Negative for all
El Vado Reservoir	6	Negative for all	Negative for all
Elephant Butte Reservoir	9	Negative for all	Not tested
Caballo Reservoir	8	Negative for all	Not tested
Sumner Reservoir	14	Negative for all	Negative for all
Brantley Reservoir	14	Negative for all	Not tested

Literature Cited

Hosler, D. Bureau of Reclamation. Personal communication. January 4, 2017.

Pucherelli, S. Bureau of Reclamation. Personal communication. January 8, 2018.