1997 Calendar Year Report to the

Pecos River Commission

NEW MEXICO	*TEXAS*
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Hector Villa

UNITED STATES DEPARTMENT of the INTERIOR
BUREAU of RECLAMATION

Upper Colorado Region
Albuquerque Area Office
March 18, 1998

United States Department of the Interior

BUREAU OF RECLAMATION
Albuquerque Area Office
505 Marquette NW, Suite 1313
Albuquerque, New Mexico 87102-2162

MAR 1 9 1998

IN REPLY REFER TO:
ALB-430
WTR-4.10

Subject: Bureau of Reclamation's *1997 Report to the Pecos River Commission*

Dear Interested Individuals and Organizations:

Enclosed is your copy of Reclamation's 1997 Report to the Pecos River Commission. This report will be presented at the Pecos River Commission meeting in Carlsbad, New Mexico on April 9, 1998. If you have any questions, please contact Karl Martin of my staff at (505) 248-5321.

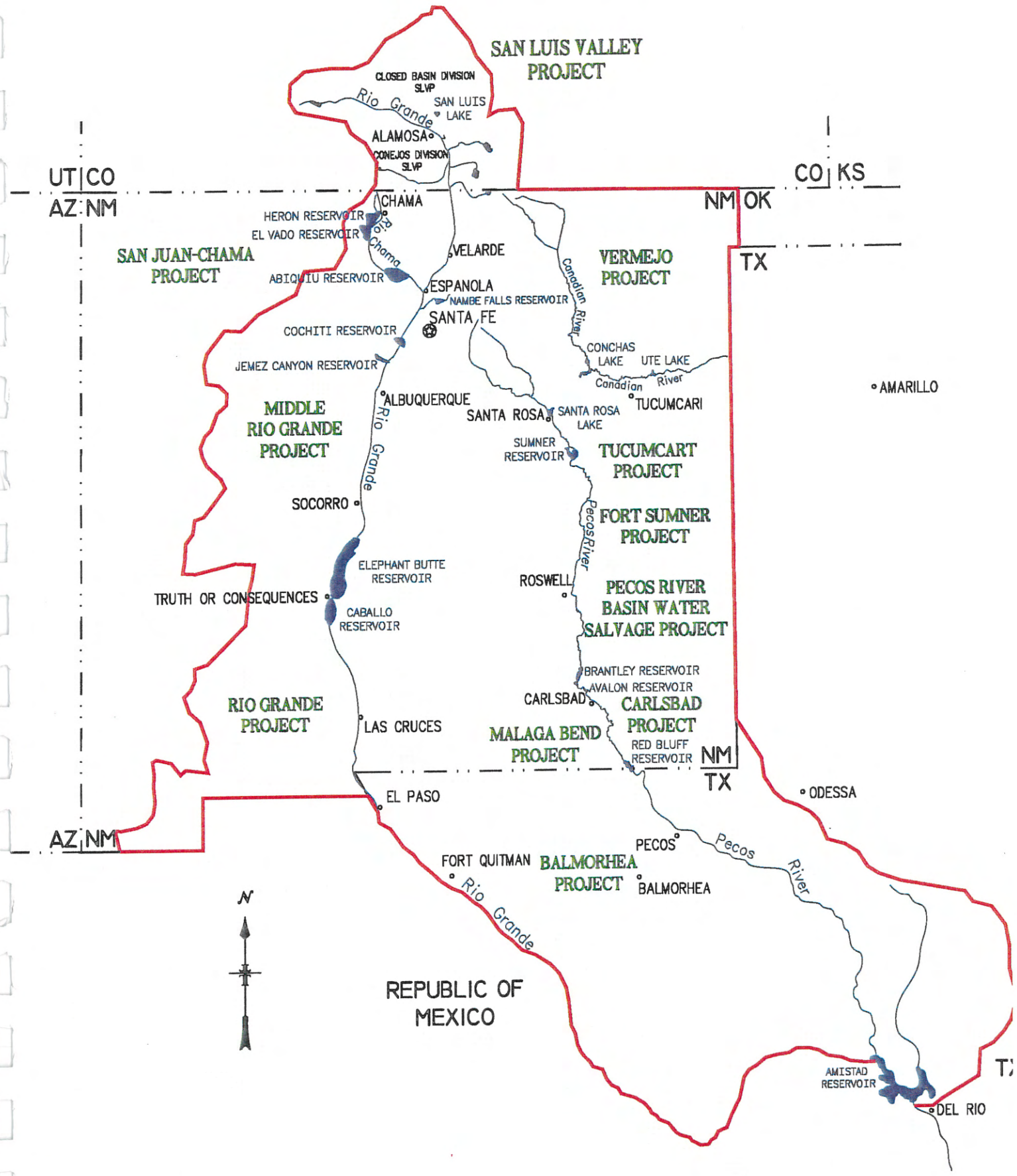
Sincerely,

William Rohmer

For Garry M. Rowe
Area Manager

Enclosure

ALBUQUERQUE AREA OFFICE
BUREAU OF RECLAMATION



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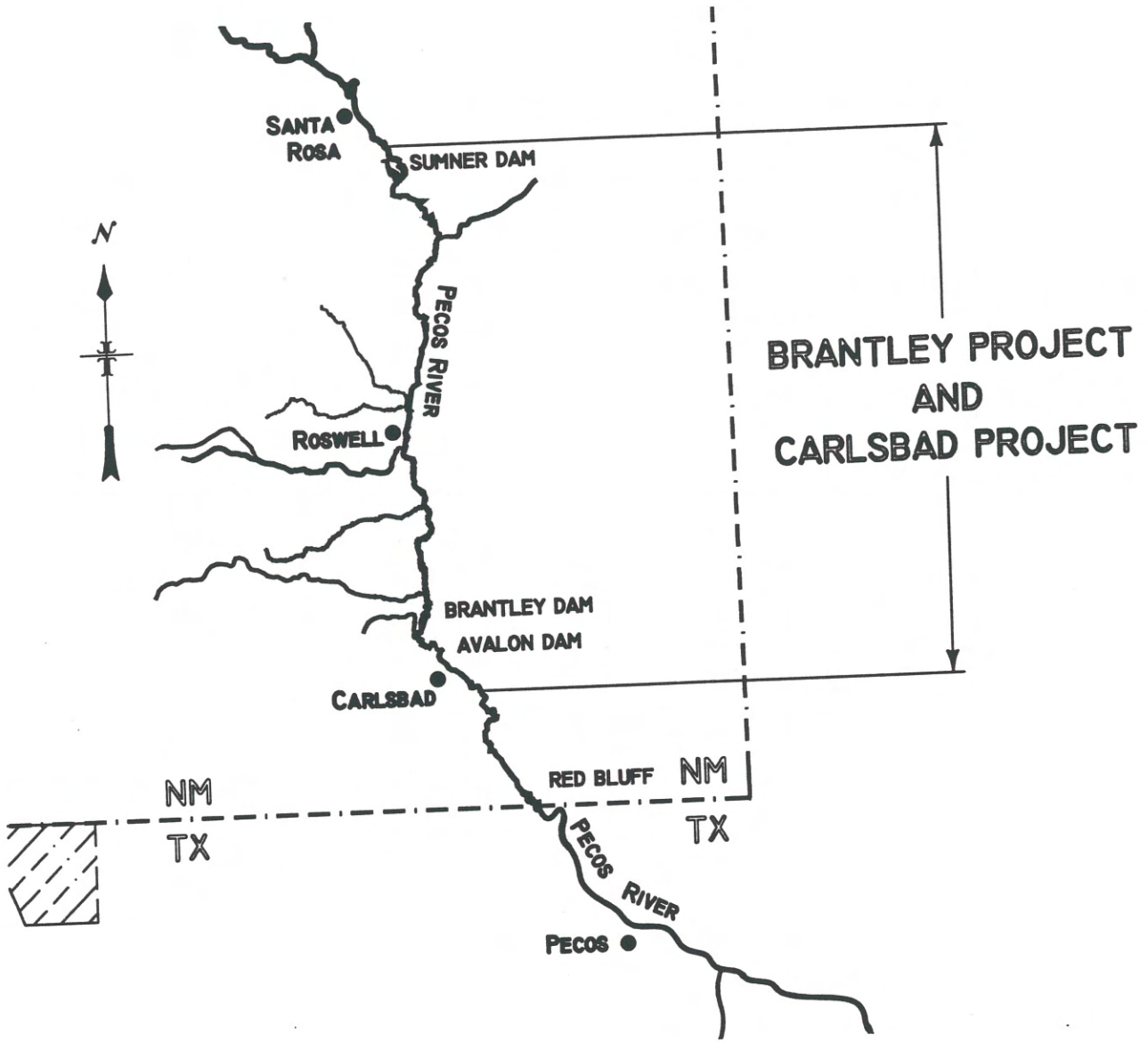
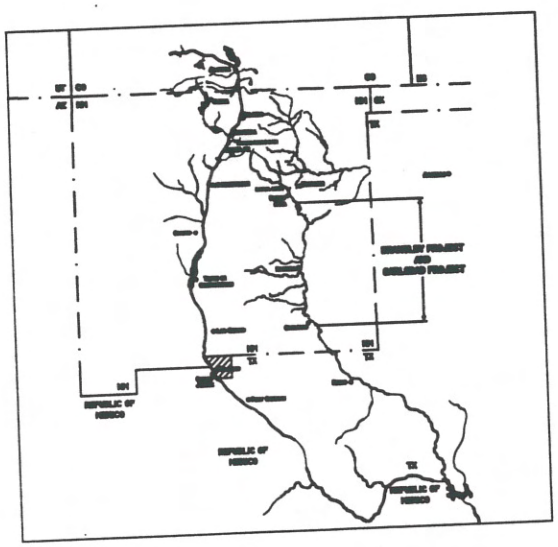
U. S. Bureau of Reclamation
Upper Colorado Region - Albuquerque Area Office
1997 Calendar Year Report to the Pecos River Commission

INTRODUCTION

The Albuquerque Area Office of the Bureau of Reclamation (Reclamation) is responsible for operation, maintenance, and/or oversight of four projects on the Pecos River. These projects are: the *Carlsbad Project*, which includes Sumner, Brantley, and Avalon Dams; the *Pecos River Basin Water Salvage Project*; the *Fort Sumner Project*; and the *Malaga Bend Salinity Alleviation Project*.

The Carlsbad Office continues to report to the Albuquerque Area Office's Resource Management Division. An agreement between Reclamation and Carlsbad Irrigation District (CID), finalized on October 2, 1989, provided for CID to operate and maintain Brantley and Sumner Dams, and the Pecos River Water Salvage Project. This contract was implemented during 1990 and has continued during 1997. Reclamation continues to be responsible for assuring that this work is accomplished in compliance with all applicable agreements, contracts, regulations, compacts, and other related laws.





UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

ALBUQUERQUE AREA OFFICE

BRANTLEY AND CARLSBAD PROJECTS

50 0 50 100

SCALE IN MILES

CARLSBAD PROJECT

Crop Production

A total of 81,890 acre-feet (ac-ft) was diverted during 1997 from the Pecos River by the Carlsbad Irrigation District (CID), as measured at the Carlsbad Main Canal Heading[1].

As reported by CID, the major crops grown were alfalfa hay, cotton, and sorghum. Out of a total irrigable area of 25,055 acres, 20,662 acres were irrigated in 1997. Total gross crop value was $10,860,479.with an average crop value of $525.63 per irrigated acre. Of the total water diverted, 56,996 ac-ft was delivered to farms for a total of 2.76 ac-ft delivered per irrigated acre.

Reservoir Storage Entitlements

All Carlsbad Project reservoirs were operated in accordance with the requirements of the Pecos River Compact and Flood Control Criteria of the Corps of Engineers.

New area and capacity tables were issued by the Corps of Engineers for Santa Rosa Reservoir, and by Reclamation for Avalon Reservoir. Based on the new tables and estimates of sediment deposition for each of the reservoirs, the following represents 1998 storage entitlements for the four Pecos River Reservoirs:

Reservoir	Total Storage (ac-ft)	Min. Pool + Sed. Pool (ac-ft)	Entitlement Storage (ac-ft)	Entitlement Elevation (ft)
Santa Rosa	97,198	760	96,438	4,745.03
Sumner	43,768	7,572	36,196	4,261.00
Brantley	51,724	11,724	40,000	3,256.71
Avalon	4,466	600	3,866	3,177.40
TOTALS:	197,156	20,656	176,500	

[1] Volume as measured at the Carlsbad Main Canal USGS Gaging Station. Data is provisional and subject to change.

Sumner Dam

Sumner Reservoir began the year with a total storage of 28,350 ac-ft (4,254.79 feet (ft)). It reached a maximum storage of 42,790 ac-ft (4,260.65 ft) on June 17, and a minimum storage of 14,820 ac-ft (4,246.92 ft) on November 12. It ended the year with a storage of 23,860 ac-ft (4,252.54 ft). Sumner did not exceed its maximum conservation storage in 1997 (see Figure 1 for actual operations).

The year's first irrigation block release for CID, (excluding water for Fort Sumner Irrigation District (FSID)), from Sumner to Brantley took place between March 17 and 26, totaling 21,307 ac-ft. A second block release occurred between June 9 and 25, totaling 35,942 ac-ft. High irrigation demands and CIDs lease agreement program with the State of New Mexico required a third release from August 1 and 18, totaling 39,435 ac-ft. To complete the lease program demands, a fourth release was made between November 3 to 12, totaling 20,308 ac-ft. The total water moved for CID from Sumner to Brantley was 116,992 ac-ft. A maximum release of 1,310 cfs occurred on March 19 and 20.

Under a water right permit granted by the State of New Mexico, CID is allowed to store up to an additional 20,000 ac-ft in Sumner Reservoir from November 1 to April 30 each year, provided that the accumulated conservation storage of all four reservoirs on the Pecos River in New Mexico does not exceed 176,500 ac-ft. No additional storage under this water right permit occurred in 1997.

Carlsbad Irrigation District's Reassumption of Sumner Dam Operations

Reclamation operated Sumner Dam for the entirety of 1997. This was necessitated by the New Mexico 5th Judicial Court's August 1996 issuance of a *writ of mandamus* directing the Carlsbad Irrigation District to release water from Sumner and Santa Rosa Reservoirs. In January 1998, following a New Mexico Court of Appeals ruling overturning the *writ*, CID requested Reclamation return operations of Sumner Dam back to them. Reclamation agreed, and CID has re-assumed operations.

Brantley Dam

Brantley Reservoir began the year with a total storage of 20,510 ac-ft (3,244.57 ft). It reached a maximum storage of 43,620 ac-ft (3,254.30 ft) on August 26, and a minimum storage of 15,290 ac-ft (3,241.39 ft) on November 7. Brantley did not exceed its conservation storage in 1997. It ended the year at a storage of 20,840 ac-ft (3,244.75 ft) (see Figure 2 for actual operations).

A maximum release of 739 cfs occurred on July 21 during the first compact delivery to Texas. Throughout the year, releases varied depending upon irrigation demand and compact delivery requirements, but did not fall below the required mitigation release of 20 cfs for fishery flows between Brantley and Avalon.

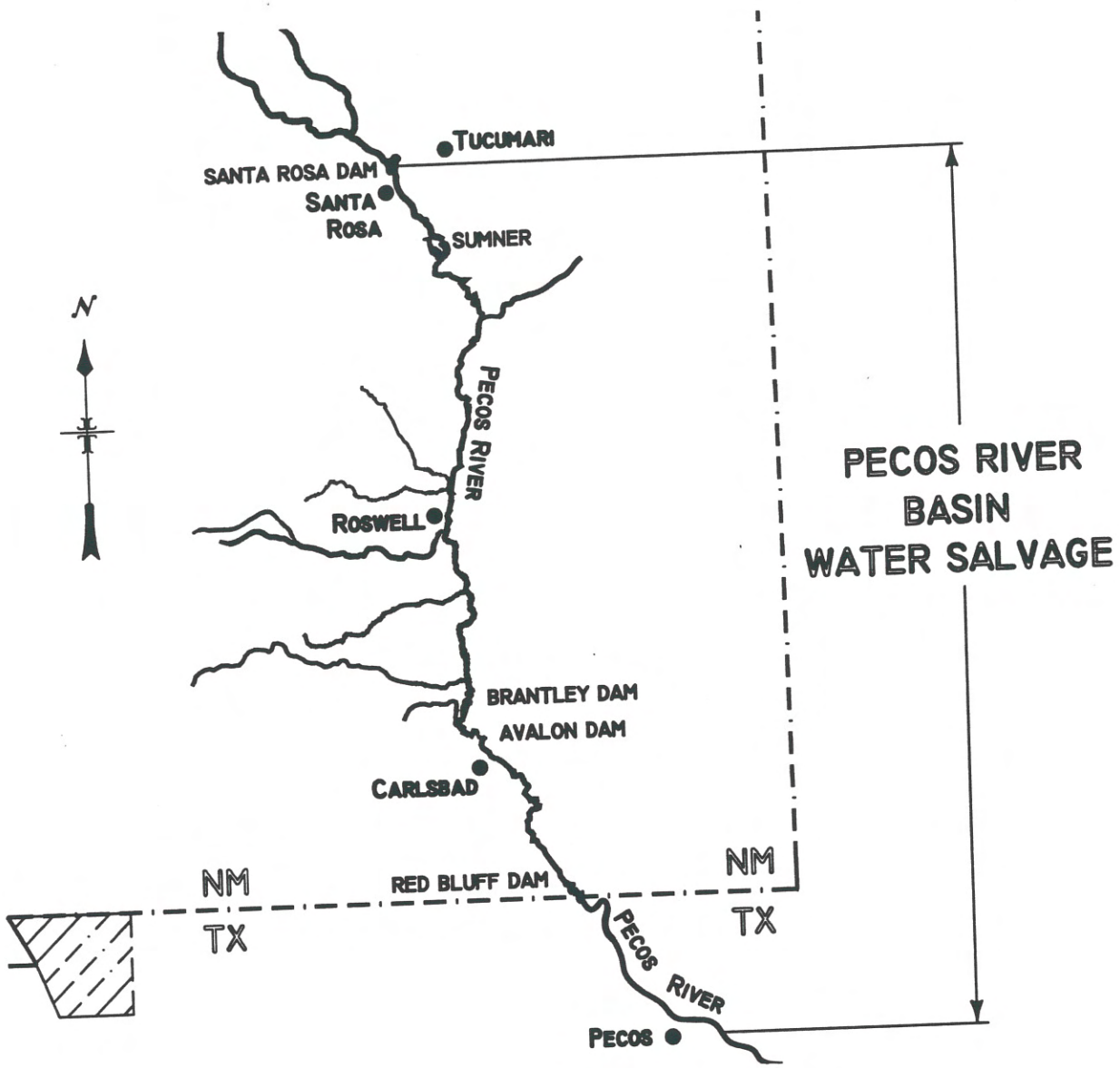
Avalon Dam

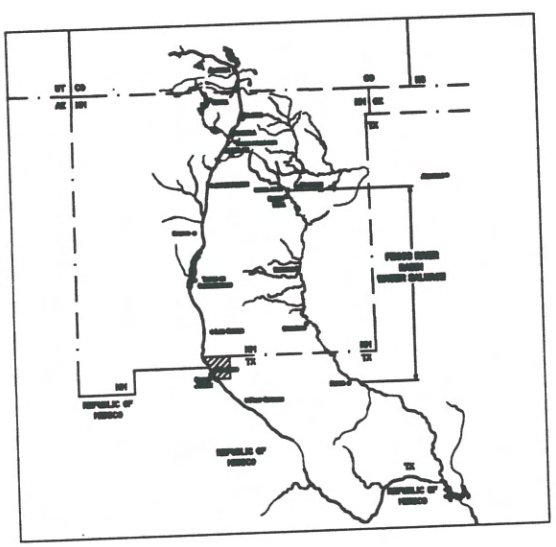
Avalon Dam is used to provide hydraulic head for diversion into the Carlsbad Main Canal. The reservoir began the year with a total storage of 1,990 ac-ft (3,174.30 ft). Diversions into the Carlsbad Main Canal began on March 24 and continued through October 31. A maximum diversion into the canal of 376 cfs occurred on June 26. The CID diverted a total of 81,890 ac-ft into the Carlsbad Main Canal during 1997.

From July 14 to 22, 5,800 ac-ft was released to the Pecos River for delivery to the State of Texas for Pecos River Compact purposes as part of the State of New Mexico's lease agreement program with CID. A second release of 36,780 ac-ft took place between October 16 and November 22. A third release of 2,000 ac-ft also for the same purpose took place between December 8 and 15. The total release to Texas for 1997 was 44,580 ac-ft. The peak release to the river was 641 cfs and occurred on November 1.

Carlsbad Irrigation District Proposed Title Transfer

In 1997, members of the New Mexico Congressional delegation introduced companion bills in the U.S. Senate and House of Representatives. The bills provided for the transfer of title to lands acquired by the United States for the benefit of the Carlsbad Project in 1905; and, the irrigation distribution system, from the United States to the Carlsbad Irrigation District. Reclamation was not able to support the bills as they were written. The CID, Reclamation, Department of Interior, and the New Mexico Congressional delegation continued to negotiate terms of the proposed transfer throughout the remainder of the year. No consensus was reached, therefore Congress adjourned without taking any action on the bills. It is expected that revised bills will be introduced in 1998.





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PECOS RIVER BASIN WATER SALVAGE

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SCALE IN MILES

PECOS RIVER BASIN WATER SALVAGE PROJECT

Activities

In 1997, under the authority of Public Law 88-594, Reclamation continued controlling salt cedar growth from the Sumner Dam area to the New Mexico-Texas state line. Reclamation continued to contract with CID for the mechanical removal and mowing program. All areas for which easements have been obtained from the land owners were treated at least once during the year.

The New Mexico Interstate Stream Commission continued to support the Pecos River Basin Water Salvage Project by funding Reclamation's program to obtain easements from private land owners. This support is accomplished through a cooperative agreement between the agencies that is renewed annually. In 1997, in De Baca County, the remaining easements for significant land areas were obtained, with exceptions of a few landowners who could not be located and one who refused to sign. In 1998, a few of the temporary easements in Eddy and Chavez Counties will expire and will need to be resigned. There has been renewed interest by some landowners to sign who refused to initially.

Biological Control of Salt Cedar

In 1997, Reclamation did not contribute funding the U.S. Department of Agriculture's (USDA) research program aimed at controlling salt cedar by means of biological agents. Although the research aspect of the program produced encouraging results with the Israeli mealy bug and the China leaf beetle, the USDA continues to encounter difficulties in its efforts to initiate test releases. The USDA issued a Biological Assessment for Endangered Species Act compliance which has been submitted to the U. S. Fish & Wildlife Service. Reclamation is monitoring the activities, but is unsure whether or not the USDA will be able to release the insects in 1998.

FORT SUMNER PROJECT

Crop Production

A total of 38,230 ac-ft was diverted during 1996 from the Pecos River by FSID, as measured at the Fort Sumner Main Canal Heading[2].

As reported by FSID, the four major crops grown in 1997 were alfalfa hay, hay, irrigated pasture, and sorghum. Out of a total irrigable area of 6,500 acres, 5,934 acres were irrigated in 1997. Total gross crop value was $1,045,600, which includes Federal ASCS payments of $44,379. The average crop value per irrigated acre is $176.20. Of the total water diverted, 28,566 ac-ft was delivered to farms for a total of 4.81 ac-ft delivered per irrigated acre.

Operations

The irrigation season for FSID typically begins March 1 and ends October 31. They are also allowed to divert for a two week period during the winter, which is usually just prior to the March 1 irrigation season. During irrigation season, 80 to 100 cfs is usually released from Sumner Reservoir depending on demand or their available water right.

In 1997, FSID began diverting on March 10. Summer rains and a lack of demand resulted in no diversions during four different periods totaling 30 days. Diversions ceased on October 31.

ENVIRONMENTAL COMPLIANCE ACTIVITIES

Endangered Species Program

As a result of a 1991 jeopardy biological opinion regarding the effects of Reclamation's Pecos operations on the Pecos bluntnose shiner (bluntnose shiner), an MOU was formed and studies conducted to determine the biological requirements of the bluntnose shiner and flow-related effects on native fishes. In February 1997, Reclamation, CID, the U.S. Fish and Wildlife Service (FWS), the New Mexico

[2] Volume as measured at the Fort Sumner Main Canal USGS Gaging Station. Data is provisional and subject to change.

Department of Game and Fish (NMDGF), and New Mexico Office of the State Engineer (SEO) entered into a new MOU to provide an additional 3 years to extend the relationship among signatories in order to complete the hydrology model, analyze data, write reports, develop management recommendations, and to provide water operations that are not detrimental to the Pecos bluntnose shiner. It also added SEO as a signatory.

Each year, release scenarios from Sumner Dam are coordinated by MOU signatories. In 1996 and 1997, releases were "block" not "ramped" and discharges higher than the traditional 1,100 cfs peak were reached. There were four block releases in 1997 ranging in duration from 10 to 18 days. During late January 1998, river flows dropped below 20 cfs at the Acme river gage. On January 28, 1998, water was released from Sumner to maintain approximately 20 cfs for habitat maintenance. This rate was maintained for a period of 33 days, totaling 1,256 ac-ft from Sumner Reservoir. Releases during the 1998 irrigation season will be block, less than 25 days duration, and will target discharges higher than 1,100 cfs.

The data collection phase of the research program has been completed, although monitoring of fish populations and water quality is likely to continue. New information has been obtained about Pecos bluntnose shiner abundance, life history and spawning characteristics, population size class structure, habitat requirements, channel morphology, water quality, and hydrology. A flow model to evaluate various operational schedules and assist with water management decisions is currently in its final phase of development. Preliminary findings to date indicate that there are certain management strategies that may be important for conservation of bluntnose shiner. Since wetted habitat in the reach from 10 miles south of the Chaves County line south to Roswell has been shown to recently support healthy populations that were nonexistent during dry periods in the 1980s, the maintenance of some level of aquatic habitat appears to be valuable. The duration of releases is also critical since the bluntnose shiner is a broadcast spawner, spawns in response to flow increases, and its eggs and larvae become a part of the downstream drift. As irrigation releases become increasingly long in duration they result in poor population structure in downstream reaches (lack of adult fish). As releases are shortened, the likelihood of transporting eggs/larvae downstream and creating unsustainable populations is less. There is also the possibility that habitat enhancement to provide additional low velocities and augment overall habitat heterogeneity would promote a more even dispersal of eggs/larvae and increase survival to adulthood. Reclamation is currently funding research and development of a plan for restoration in the Bitter Lake National Wildlife Refuge reach that could complement efforts by FWS to control exotic vegetation.

Currently, the Research team continues to analyze data, provide preliminary results, and assist the NEPA team with development of water operations alternatives. The Pecos River hydrologic model will be available for use in 1998. Final study results and management recommendations will proceed concurrently with the on-going NEPA process. Both are anticipated to be completed in 1999.

Other endangered species issues of recent importance on the Pecos River include the proposed listing of the Pecos pupfish. Current operations could indirectly affect the pupfish through groundwater recharge. Also, Reclamation will soon be joining an MOU led by the Bureau of Land Management (BLM) and comprised of other water and land resource management agencies. Reclamation will be sharing expertise and data regarding the bluntnose shiner as BLM pursues a program to study the effects of proposed oil and gas lease development on BLM lands adjacent to the Bitter Lake National Wildlife Refuge near Roswell, New Mexico.

National Environmental Policy Act (NEPA) Activities

The Federal action considered in the environmental assessment is changing operation of Sumner Dam, and the area of study includes the Pecos River system from Santa Rosa Reservoir to the New Mexico-Texas state line. The purpose of the proposed action is to meet delivery requirements and comply with the Endangered Species Act. The proposed action will also seek to maximize efficiency of water management, improve the quality (TDS) of water available to Carlsbad Irrigation District, and provide additional environmental benefits to biological and recreational resources.

NEPA compliance for Pecos River water operations began in late 1996 with internal scoping and has continued throughout 1997 with interagency scoping, public scoping, and work by an interdisciplinary team on technical issues including identification of significant issues and preliminary alternative development.

During the NEPA process, Reclamation is working cooperatively with the CID, FWS, SEO, NMDGF, and U.S. Army Corps of Engineers. Additionally, informal meetings were held with other stakeholders (FSID, Interstate Stream Commission, Pecos River Compact Commissioners), and public scoping meetings were held in Santa Rosa, Roswell, and Carlsbad.

Concerns expressed by the general public were mostly related to the potential effect that changing water operations may have on farming and ranching activities. Other important issues identified include: water delivery (to CID and state line), endangered

species, native flora and fauna, reservoir fishery, aquatic and riparian habitat, water quality, and recreational use at reservoirs.

Currently, the NEPA team with assistance from the Research team is developing the No Action alternative (future without the proposed action) and an array of preliminary action alternatives. The alternatives will include different ways of operating Sumner Dam to accommodate a range of contemporary demands. Proposed operational changes may include modifications of release duration, magnitude, timing, and/or frequency. The flow model currently under development will serve as a tool to analyze proposed scenarios for feasibility and efficiency and will likewise assist the team in developing and improving alternatives.

It is Reclamation's intention that alternative operations not cause a negative impact on supplies for CID, and Reclamation will seek to acquire supplemental supplies to offset any such negative impact. While our federal operations are not subject to state line requirements, Reclamation anticipates that maintaining CID's supply will not impact state line deliveries. Currently, we are investigating mechanisms of acquiring water and storage space should it be needed.

Alternative development and effects analysis is anticipated to continue throughout 1998. After that, Reclamation will reinitiate consultation with the FWS regarding the preferred alternative. A draft environmental assessment is targeted for May 1999 and completion of the process by the end of 1999.

PECOS RIVER ACTIVITIES AND OPERATIONS

Pecos River Model Development

Development of a river and reservoir operations simulation computer model for the Pecos River continued in 1997. Reclamation is using the RiverWare model developed in a joint effort between Reclamation, the Tennessee Valley Authority (TVA), and the Center for Advanced Decision Support for Water and Environmental Systems (CADSWES). CADSWES is based at the University of Colorado in Boulder. During 1997, efforts continued with the development of a mean daily flow model using the variable lag-loss routing method within RiverWare. However, the model was inaccurate at low flow ranges (less than 100 cfs) which is critical to evaluating impacts for different endangered species related flow scenarios. Thus, Reclamation contracted FLO Engineering, from Breckenridge, Colorado, to assist Reclamation and CADSWES in the modeling effort. FLO Engineering performed extensive analysis of available data

to estimate losses in the Pecos River at low flows. Moreover, FLO Engineering worked with different routing methods to test their effectiveness for modeling low flows in the Pecos River. The Muskingum and Muskingum-Cunge routing methods were tested extensively. FLO Engineering also began to investigate the utility of variance propagation within the model. Since there is extreme variability of conditions which can effect low flows, a variance element would be very valuable when analyzing the model results for low flows. Initial focus was on the reach from Sumner Dam to Acme. The analysis will continue in 1998 for the Pecos River from Santa Rosa Reservoir to Avalon Reservoir.

The RiverWare model of the Pecos River will enable users to evaluate different flow scenarios in support of NEPA activities. Optimum operations will be sought which balance between the needs of CID and endangered species. The model will simulate river flow, including losses within each reach of the river, and reservoir storage. The model will also include simulation of reservoir losses from bank storage and evaporation. The current version of RiverWare does not estimate snowmelt or rainfall runoff into the Pecos River basin nor does it model groundwater. However, such data can be supplied to RiverWare and routed downstream. Current plans are to complete the RiverWare model from Santa Rosa to Avalon in 1998. The model should be ready to use by the end of 1998 after it has been calibrated and the data validated.

Seven Rivers Farm

To meet mitigation requirements associated with the Brantley Project, a waterfowl management area has been established at the Seven Rivers Farm, located approximately 15 miles northwest of Carlsbad, New Mexico. The property is being managed by the NMDGF.

The waterfowl management area consists of a planned ultimate development of 640 acres that will be farmed to feed migratory waterfowl. Nearby backwater pools from Brantley Reservoir provide water and resting areas for the seasonal wintering birds. In 1997, additional farming equipment and supplies were purchased and about 240 acres were farmed.

Roswell Drainage District Technical Investigations

A Memorandum of Understanding was signed in May 1997 to establish commitments by the SEO for data analysis, Pecos Valley Artesian Conservancy District for monitoring the wells, and Reclamation for well installation and data analysis.

Reclamation's Technical Service Center drillers spent 10 days in May 1997 installing 33 observation wells. The drillers also identified some dairy wells that will be monitored as part of the network. These wells are being monitored in lieu of drilling new wells near existing dairy well locations. In September 1997, Reclamation provided a survey crew to determine the relative elevations of the wells used in the monitoring network. Data collection is being performed by the Conservancy District and transmitted to the SEO and Reclamation for analysis. Data collection and analysis is expected to continue through 2002.

Emergency Management Program

Reclamation's Emergency Management Policies and Directives were finalized in 1996. They provide for safety of the public and protects environmental resources from incidents at Reclamation's storage dams by (1) taking reasonable and prudent actions necessary to ensure timely notification to potentially affected jurisdictions of such incidents: and (2) defining program needs and requirements essential to maintain self regulation by line managers, be responsive to public safety and satisfy legal requirements during operations or emergency incidents at Reclamation facilities. The directives require that the Emergency Action Plans (EAP) be rewritten for each dam to include initiating conditions, response levels and expected actions. When each EAP is drafted and rewritten, a working draft EAP will be included in the Standing Operating Procedures (SOP) for each dam. A tabletop exercise of the EAP will be conducted and evaluated, in coordination with the dam operators and local jurisdictions and appropriate corrections and changes made to the EAP. The directives require that the EAP be completed through the tabletop exercise by the end of fiscal year 1999.

Work is proceeding on the rewriting of the EAPs for Brantley, Avalon, and Sumner Dams. Due to a transfer of workload from the Reclamation's Albuquerque Area Office to the Carlsbad Field Office and personnel changes in Carlsbad Field Office, work on the EAPs has been delayed somewhat beyond projected estimates but is still scheduled for completion by the end of fiscal year 1999.

Review of Operations and Maintenance (RO&M) Program

Reclamation Manual directives were finalized in 1997 for the "Review of Operation and Maintenance (RO&M) Program Examination of Associated Facilities (Facilities Other Than High- and Significant-Hazard Dams).

Field examinations of the radial gates at Sumner Dam were performed in 1997 as a follow-up on exams performed in 1996. Four coating samples were taken from various locations on the gates and tests were performed for the presence of lead. Each sample showed that lead was present, which will effect the requirements (see Photograph on page 14).

An RO&M exam was performed on the FSIDs system in 1997. No Category 1 recommendations were noted during the examination.

Facility Review Program

Reclamation Manual directives for the review and examination program for significant and high hazard dams were initially released and implemented starting in 1996. These directives were developed to ensure that reviews and examinations properly assess and evaluate the condition of Reclamation dams. These directives also ensure a more consistent Reclamation-wide approach to examinations and reviews. Facility Reviews have combined aspects of the RO&M and the Safety Evaluation of Existing Dams programs into one review and examination process.

Periodic Facility Reviews were conducted on Sumner, Brantley, and Avalon Dams in 1997. Reports were distributed to CID.

Safety of Dams (SOD) Program

The Reclamation Manual directive for the "Annual Reporting for Dam Safety, Security and Related Operations" was finalized and implemented in 1997.

Additional sinkholes have been exposed downstream of the left end of Brantley Dam. There were two small sinkholes identified downstream of the dam before construction of the dam and in 1997 additional holes have developed in the same general area. The situation is being monitored and additional controls will be established in 1998 (see Photograph on page 15).

The Corrective Action Study (CAS) decision document was finalized for Avalon Dam. Areas of concern identified are the upstream masonry wall with the open cracks and joints, and the area at the toe of the dam on the right side of Spillway No. 1 The voids previously noted behind the upstream masonry wall at Avalon Dam were investigated more closely before and during the Periodic Facility Review. The system of voids was more extensive than originally thought. This area is of concern only if the reservoir water level reaches the base of the wall, which would take a very large flood event.

The area at the toe of the dam on the right side of Spillway No. 1 is of concern because of the possible erosion of the toe of the dam during high floods. These two areas of concern are being evaluated as a part of the final design for the CAS (see Photograph on page 14).

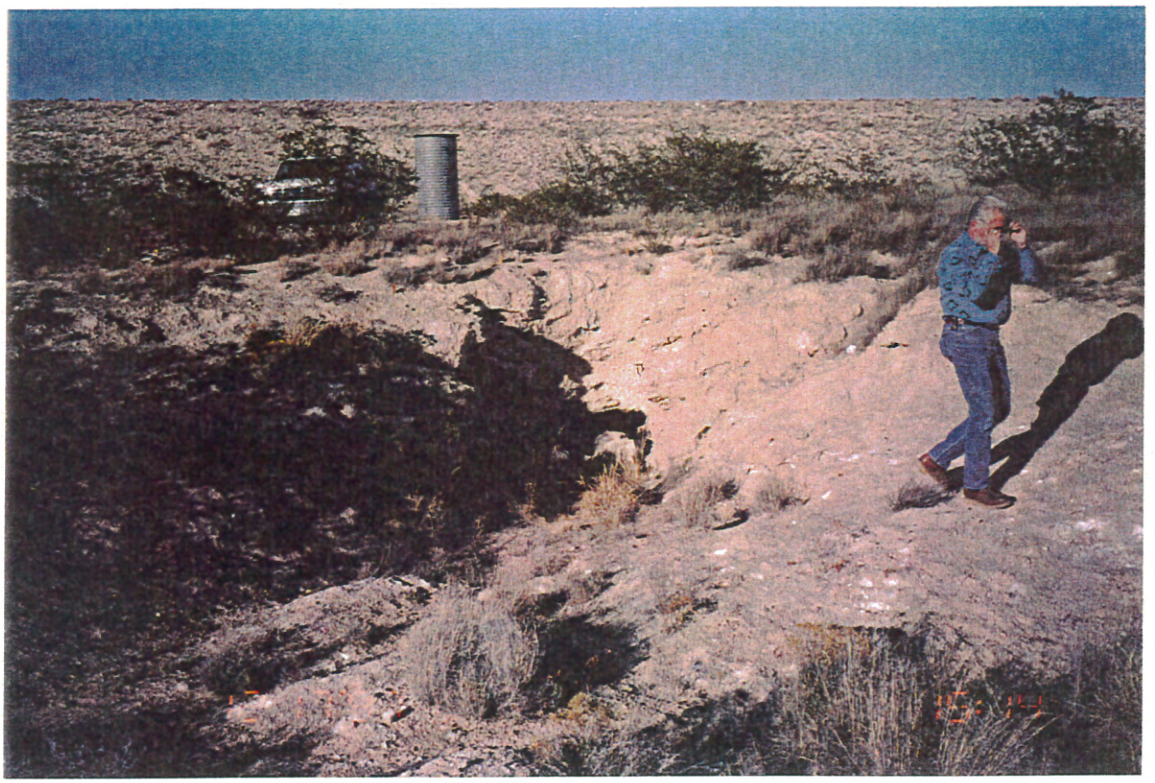
Pecos River Stream Adjudication

The Pecos River General Stream Adjudication (State Engineer v L.T. Lewis) is on-going in the 5th Judicial District Court in Chavez County. Reclamation is involved in this case as record title holder of the water rights for the Carlsbad Project. Judge Harl Byrd issued an opinion on November 3, 1997 regarding the Project water rights (Threshold Legal Issue No. 3) but the opinion seemed unclear about the status of United States and CID with regard to ownership of, or interest in, those rights. The United States has filed a motion to reconsider or clarify the decision on Threshold Legal Issue No. 3, but no decision has been made by the Court at this time. It is expected that this adjudication will continue into the foreseeable future.

PHOTOGRAPHS

AND

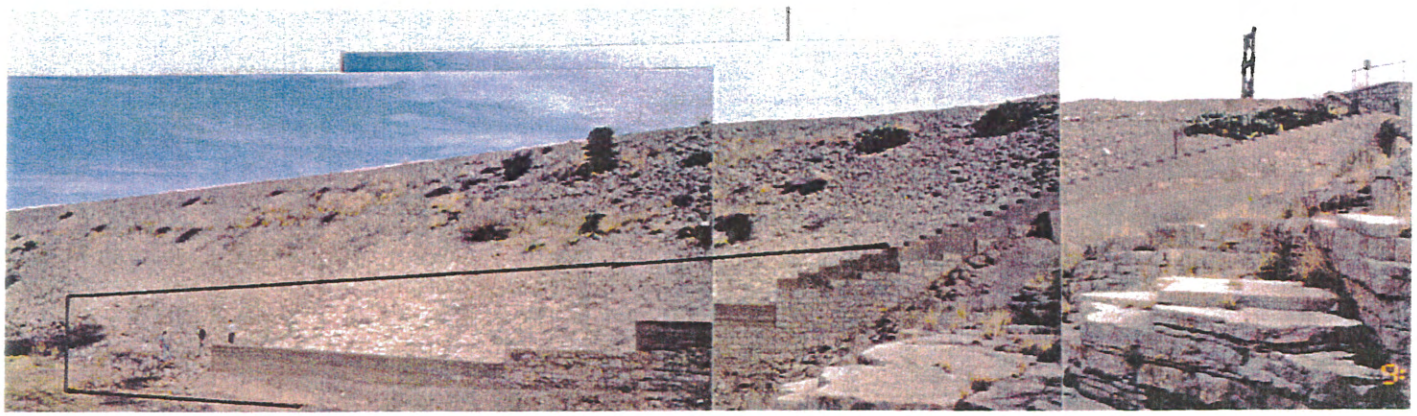
FIGURES



View of Sinkhole #2, approximately 200' downstream of Brantley Dam. This is one of the two original sinkholes noted at the dam before construction. Note the dam and observation well #508 in the background. The sinkhole is about 15-20' in diameter and 7' deep. The sinkhole opens into a small wash. 12/17/97

View of the recently formed Sinkhole # 4 downstream of Brantley Dam. The sinkhole is about 2' in diameter, 8' deep, and located about 60' east of observation well #508. 12/17/97

A typical view of the downstream side of the radial gates at Sumner Dam. Note the extensive corrosion and rust on the stiffeners and bracing. The existing coatings have been tested positive for lead. The coatings on all the gates need to be removed and recoated. 8/27/97



Panoramic view of the left downstream toe of Avalon Dam. The approximate area outlined in black is located on the right side of Spillway #1 and has been identified during the Corrective Action Study as an area that could have serious erosion and possibly cause failure of the dam during high flooding events. The preferred fix would be to armor this area with rip rap and add 5' and 10' wide concrete slabs behind the existing training wall. 3/11/97.

Figure 1

1997 SUMNER STORAGE AND RELEASES

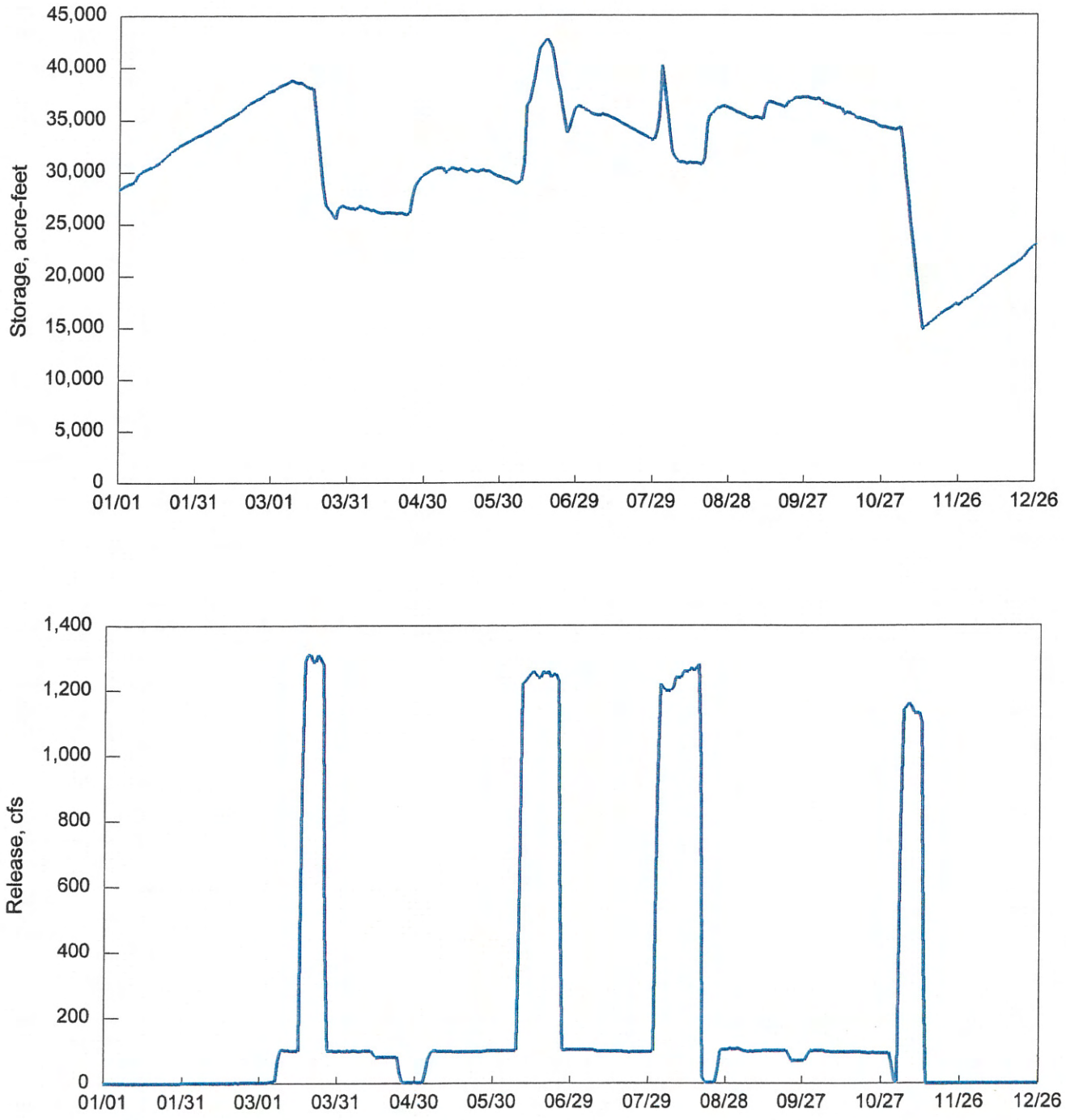
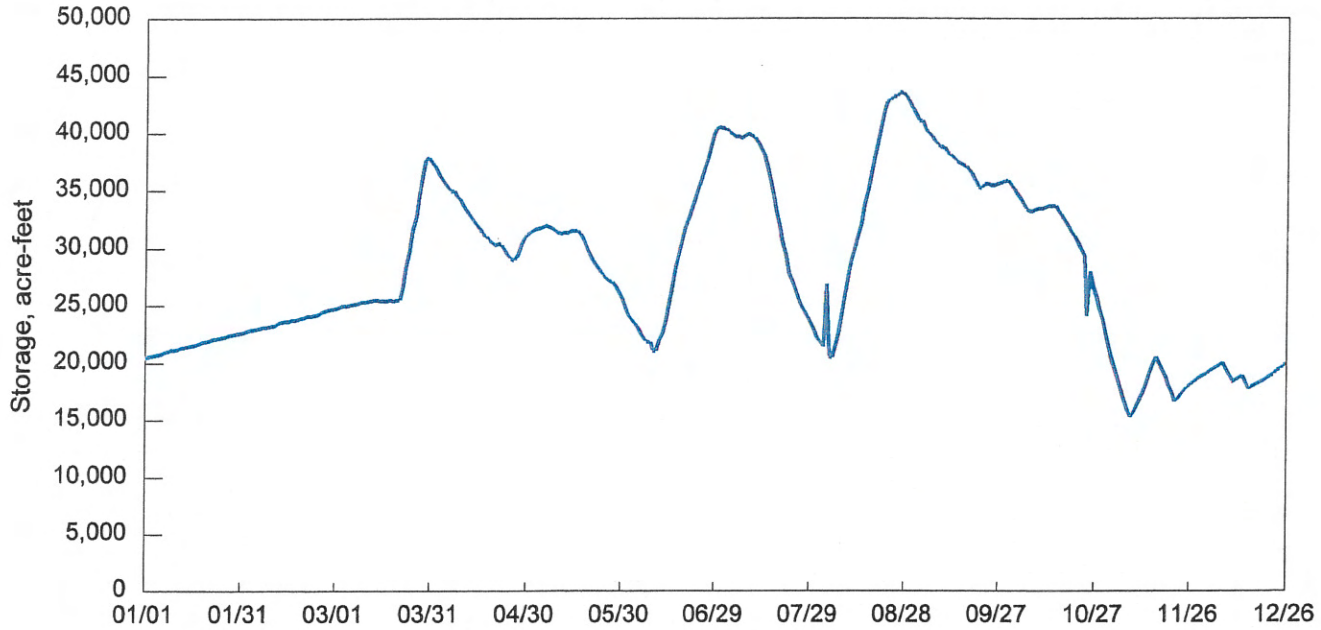


Figure 2

1997 BRANTLEY STORAGE AND RELEASES



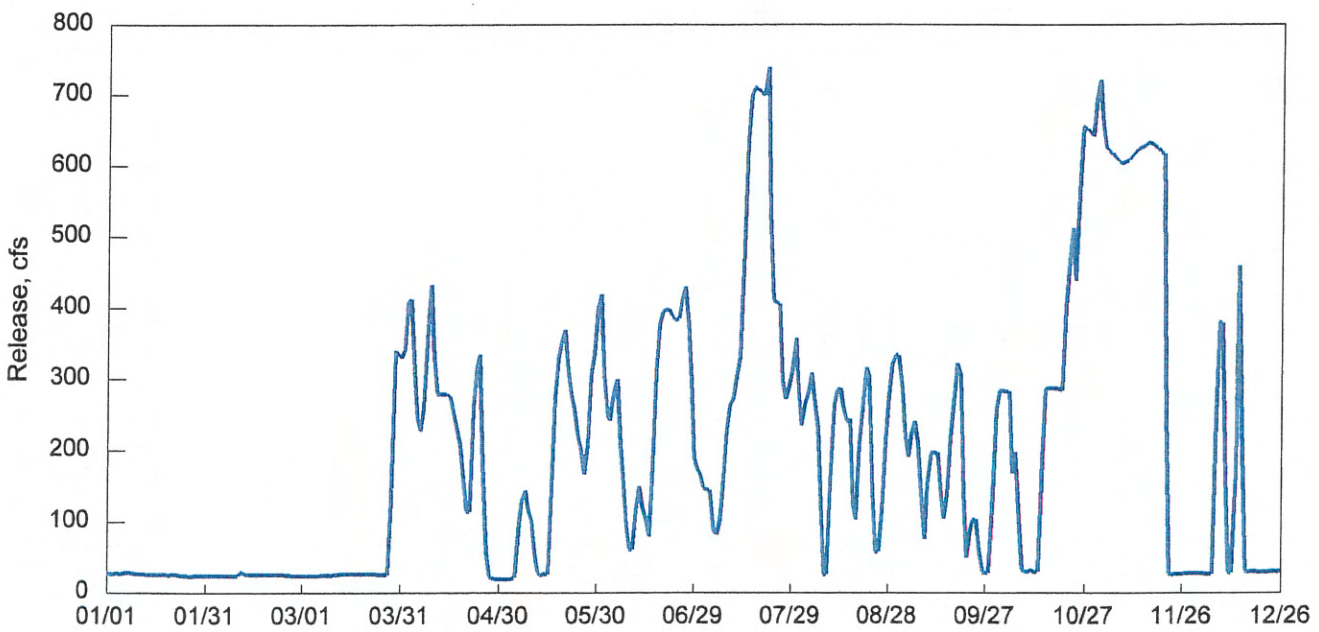
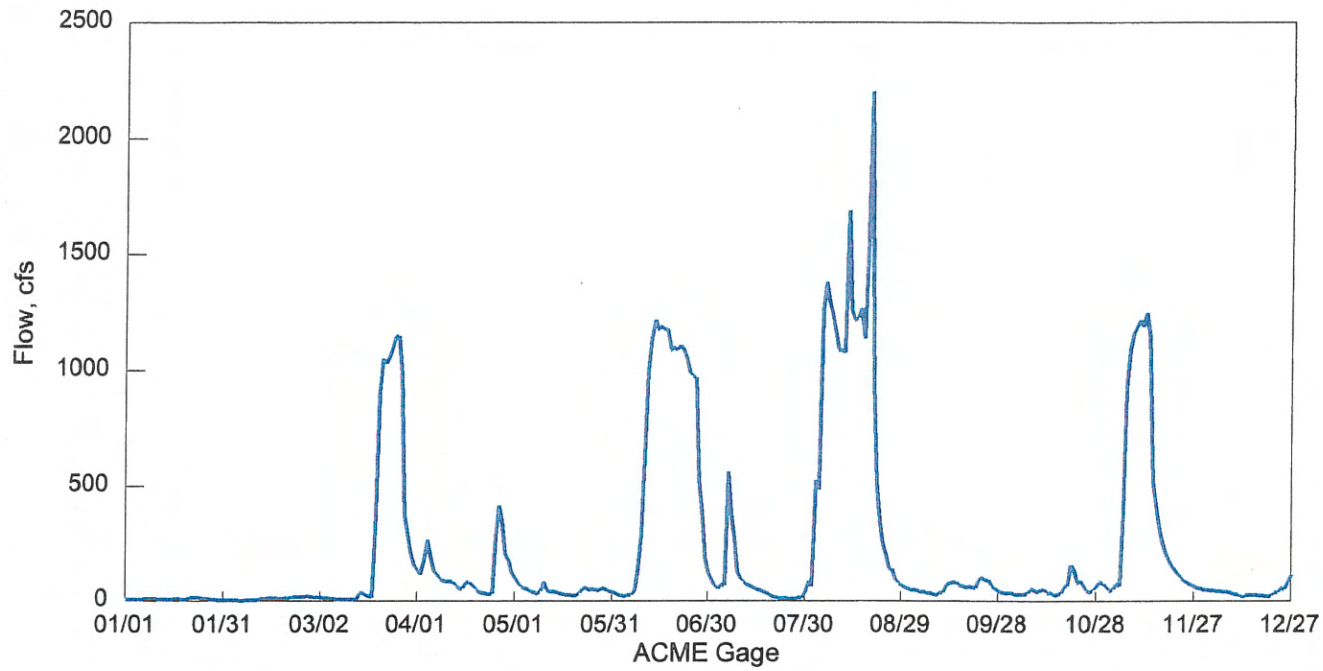
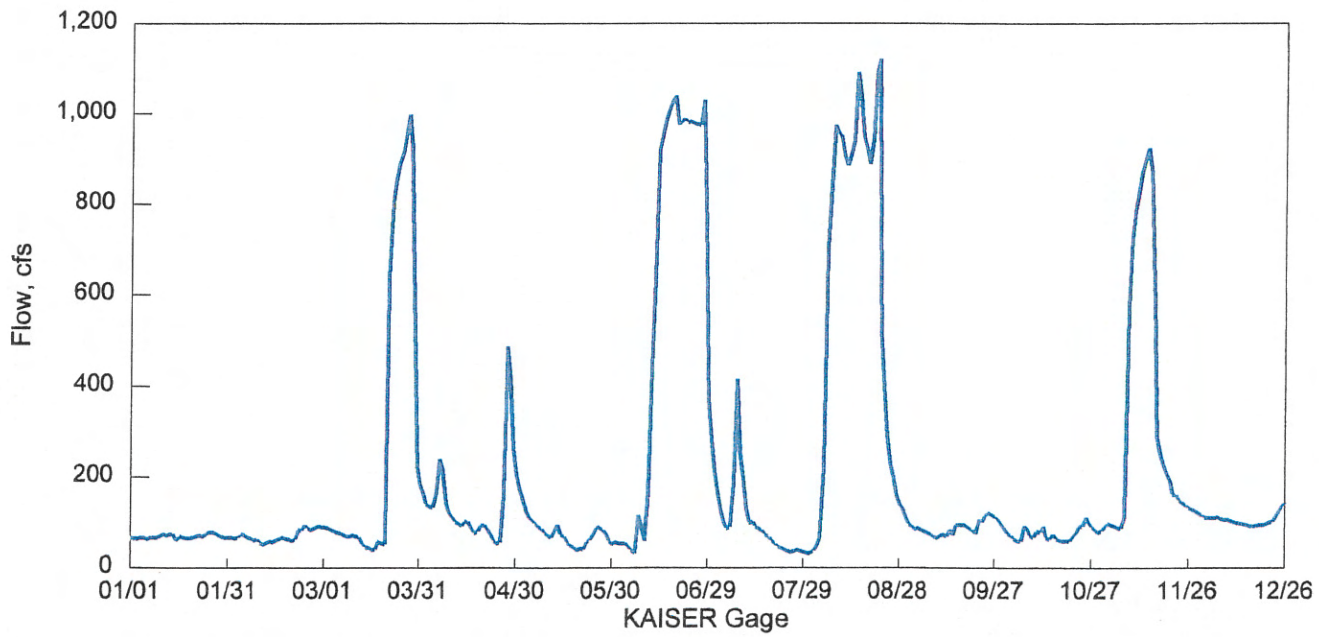


Figure 3

1997 ACME AND KAISER GAGES