RECLAMATION

Managing Water in the West

Seven Rivers Pipeline Environmental Assessment

Pecos River, New Mexico

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

April 2007

Mission Statements

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

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

Seven Rivers Pipeline Environmental Assessment

Pecos River, New Mexico

Cover photograph: Upstream of Acme Gage on the Pecos River

Prepared by

ERO Resources Corp. for New Mexico Interstate Stream Commission and Bureau of Reclamation

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Chapter 1. Purpose and Need

Introduction

This Draft Environmental Assessment (EA) documents the analysis of the potential environmental consequences of Reclamation providing a license for right-of-use for a proposed pipeline in accordance with the requirements of the National Environmental Policy Act of 1969 (NEPA). The New Mexico Interstate Stream Commission (NMISC) proposes to construct and operate a water delivery pipeline from the Seven Rivers Augmentation Wellfield to Brantley Reservoir (Figure 1). The Seven Rivers Wellfield development is discussed in and is tiered from the Long-term Miscellaneous Purposes Contract Final Environmental Impact Statement (July 2006) and the ROD issued August 2006. Tiering is provided for in NEPA (U.S. Council on Environmental Quality [CEQ]) Regulations Section 1502.20.

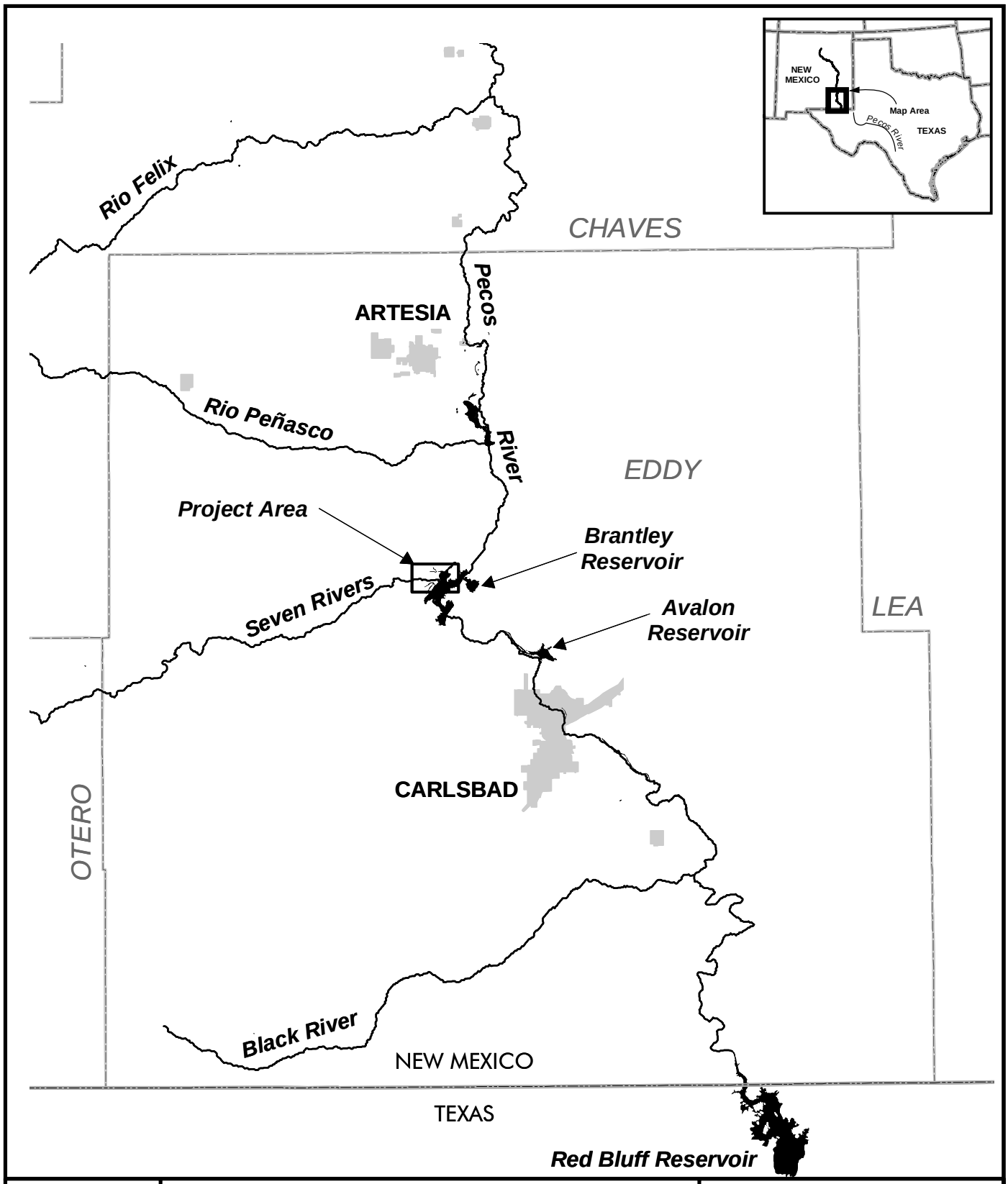
This chapter describes the purpose and need for the Proposed Action, and provides pertinent background information pertaining to the Proposed Action. Consultations or approvals that would be necessary to implement the Proposed Action are also discussed in this chapter.

Reclamation and NMISC are jointly preparing this EA and are responsible for all decisions involving preparation of the EA and issues arising during the NEPA process. Reclamation is the lead federal agency and is responsible for the Finding of No Significant Impact. The analysis in this EA complies with the provisions of NEPA and Reclamation's draft NEPA Handbook (2000).

This document is organized into six chapters:

- *Chapter 1 – Purpose and Need:* Presents information on the history of the proposed project, the purpose of and need for the project, and the lead agency's proposal for achieving that purpose and need. This section also details how the lead agency informed the public of the proposed project and how the public responded.
- *Chapter 2 – Comparison of Alternatives, including the Proposed Action*: Provides a detailed description of the lead agency's proposed action, alternative methods for satisfying the stated purpose and need, and key environmental issues regarding the proposed action and alternatives. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- *Chapter 3 – Affected Environment and Environmental Consequences:* Describes the environmental effects of implementing the proposed action and other action alternatives. The analysis is organized by affected resource topic. Within each section, the affected environment is described first, followed by the effects of no action, the proposed action, and other action alternatives. The final section in Chapter 3 describes Cumulative Effects.
- *Chapter 4 – Agencies and Persons Consulted:* Lists preparers and agencies consulted during the development of the EA.
- *Chapter 5 – Environmental Laws and Directives:* Lists relevant federal environmental laws and directives.
- *Chapter 6 – Literature Cited:* Lists documents used in the preparation of this EA.
- *Appendices:* The appendices provide more detailed information to support the analyses presented in the EA.

Reclamation proposes to grant a license for right-of-use to the NMISC for pipeline construction and operation on federal property, specifically those Reclamation-administered lands that surround Brantley Reservoir.



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County Boundary

1 Inch = 11 Miles

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Figure 1
Project Location

File: 2300-SR_ProjectLocation.mxd (JP)
Date: December 7, 2006

Purpose and Need for Action

This section describes the purpose of and need for the Proposed Action. The purpose of the Proposed Action is to deliver water from the Seven Rivers Augmentation Wellfield to Brantley Reservoir for use as Carlsbad Project water. The proposed augmentation well field pipeline would address two primary needs along the Pecos River. The NMISC needs to augment the Carlsbad Irrigation District (CID) water supply as partial fulfillment of the Settlement Agreement (see below); and as a member of CID and under the Pecos River Settlement Agreement, the NMISC needs to use Carlsbad Project water to maintain long-term compliance with the Pecos River Compact (Compact) and the United States Supreme Court Amended Decree in Texas v. New Mexico. Delivery of water from the augmentation well field has independent utility for the NMISC apart from the Settlement Agreement.

Background

The Seven Rivers Augmentation Wellfield and proposed pipeline to Brantley Reservoir are located in southeastern New Mexico (Figure 1) on the Pecos River. Brantley Reservoir is part of the Carlsbad Project, a Reclamation irrigation project that provides water for the CID near Carlsbad, New Mexico. Reclamation owns Brantley Reservoir, and diverts to storage and delivers Carlsbad Project water to CID. CID operates Brantley Dam and Reservoir, and other Carlsbad Project facilities, under an operation and maintenance contract and repayment contract with Reclamation.

NMISC oversees interstate stream compacts and interstate stream litigation, and cooperates in the planning of federal water projects. NMISC is responsible for ensuring that the State of New Mexico meets its water delivery requirements to the State of Texas as measured at the state line, and for complying with the 1948 Pecos River Compact and the 1988 Texas v. New Mexico U.S. Supreme Court Amended Decree (485 U.S. 388). In 1992, NMISC began leasing Project water as part of its Water Resource Conservation Project to ensure continued compliance with the Pecos River Compact and Amended Decree.

In 2003, the New Mexico Office of State Engineer (NMOSE), NMISC, Reclamation, CID, and the Pecos Valley Artesian Conservancy District (PVACD) entered into a Settlement Agreement that resolves water issues (Lewis Case-Carlsbad Project Phase), implements a plan to ensure delivery of water to the CID and state line, and settles many water management issues on the Pecos River. Section 9 of the Settlement Agreement describes the augmentation pumping, which requires the NMISC to pump water to the Pecos River in order to augment the Pecos River flow.

NMISC currently is constructing wellfields west of Brantley Reservoir in part to meet the requirements of the Settlement Agreement. When completed, the wellfields will consist of up to 16 wells, some of which have been constructed. Currently, ten wells are planned in the western area (Price Farm and Home Farm Systems; see Figure 2) and three in the northern area (Lewis Farm System). Up to three additional existing wells may be added to the system in the future, if the additional capacity is needed.

Reclamation completed a Categorical Exclusion for funding to complete environmental studies and compliance on February 14, 2006. The control number for that Categorical Exclusion is ALB-CE-06-0021. In addition, the Seven Rivers Wellfield development is discussed in the Carlsbad Project Water Operations and Water Supply Conservation Final Environmental Impact Statement (Reclamation 2006a).

Authorizing Actions, Licenses, and Permits

Implementation of the proposed action could require authorizations and permits from state and federal agencies:

- Reclamation authorization needed to construct and operate facilities on Reclamation lands

- Permit from the U.S. Army Corps of Engineers (Corps) in compliance with Section 404 of the Clean Water Act, as amended (permit has been acquired; see Appendix A)
- New Mexico Department of Transportation permit to install utility facilities in a public right-of-way

Decision to be Made

Reclamation is the lead federal agency responsible for determining whether the proposed action will have a significant effect on the human environment. If the EA demonstrates that the environmental consequences are not significant, Reclamation will issue a Finding of No Significant Impact (FONSI). The FONSI will allow the project to proceed without preparation of an Environmental Impact Statement (see Chapter 5 for additional environmental compliance requirements).

Chapter 2. Proposed Action and Alternatives

This EA analyzes one design alternative for addressing the purpose and need for the project. Several alternative pipeline alignments were considered but eliminated due to impacts on cultural resources. The No Action Alternative is included as a baseline for comparing potential effects of the action alternative.

No Action Alternative

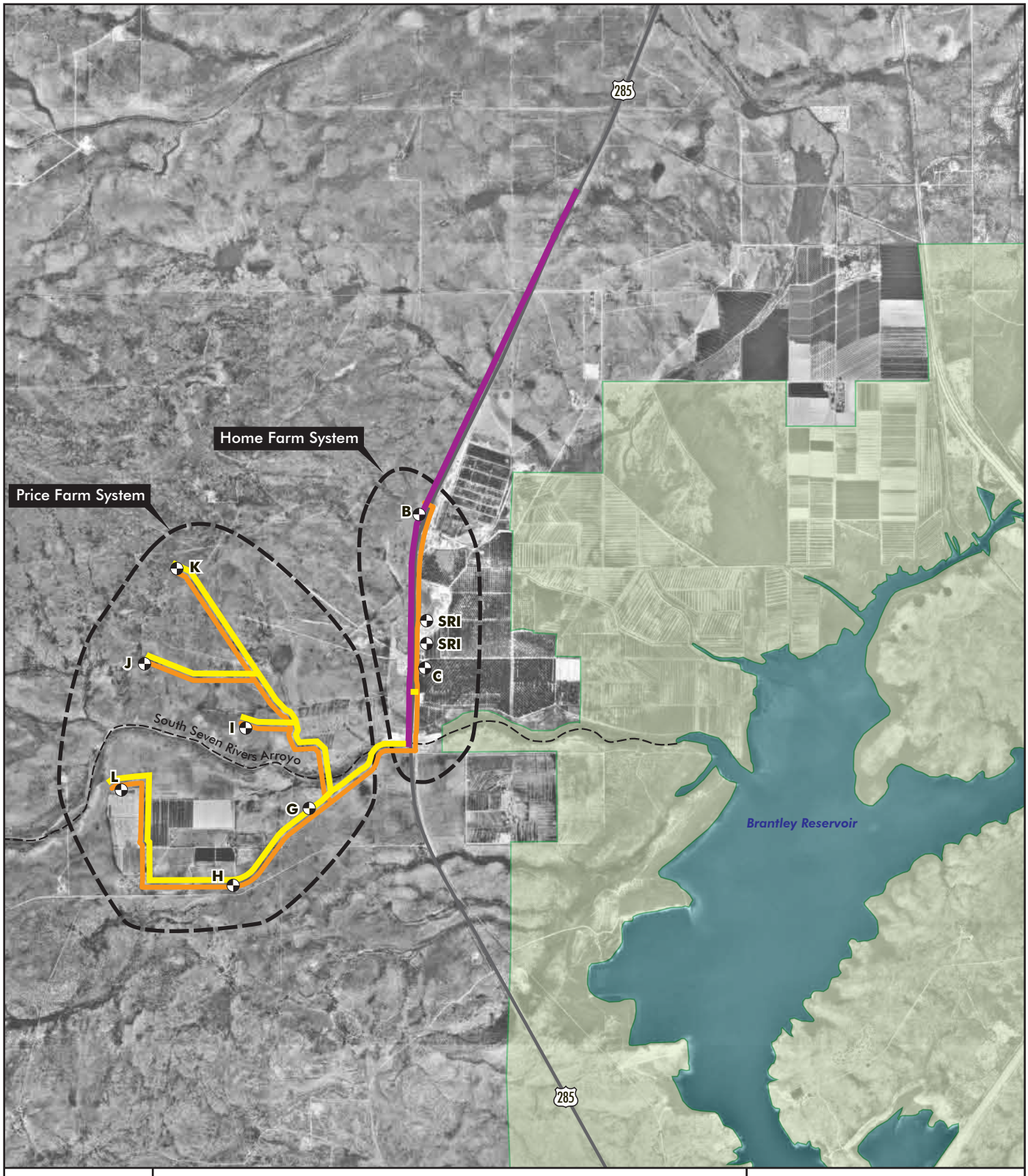
Under the No Action Alternative, Reclamation would not provide a license for right-of-use to the NMISC. The NMISC would not construct a pipeline and associated facilities through Reclamation-administered land to Brantley Reservoir. In the absence of a license from Reclamation, the NMISC would construct an alternative pipeline alignment that would release wellfield water into South Seven Rivers arroyo upstream of federal property. This alternative would not be practical because water delivered to the arroyo would be lost to a variety of reasons prior to reaching Brantley Reservoir, including:

1. High seepage to the shallow aquifer underlying the arroyo;
2. Heavy infestations of salt cedar;
3. Presence of multiple earthen dams (height 7 to 8 feet) perpendicular to the arroyo channel.

In the No Action Alternative, a buried pipeline network would carry water from 10 to 13 wells (Price Farm System and Home Farm System) to the South Seven Rivers arroyo (see Figure 2). Total pipeline length would be 7.3 miles, and maximum disturbance width would be 50 feet, resulting in a temporary disturbance area of 44.2 acres. Under the No Action Alternative, the Lewis Farm System would likely be abandoned due to the lack of a feasible way to get the water to the reservoir. To meet project water demands, it would be desirable to increase the volume pumped by the Price Farm System and the Home Farm System to compensate for the loss of the Lewis Farm System's capacity; however, this is not physically possible due to pumping constraints.

The maximum pipe diameter would be 42 inches, designed to carry a total of 22,400 gallons per minute (gpm) from the Price and Home Farm Systems. The Price Farm System would operate under gravity flow conditions, and the Home Farm system would require pressurization with pumps. An outfall/stilling basin structure would be constructed to prevent erosion damage during pumping and discharge. The final dimensions of the outfall/stilling basin structure would be 20 feet by 25 feet. Riprap scour protection would be placed at the base of the outfall/stilling basin structure.

Upgrades to existing power supply lines and new power supply lines would be required for well pumps and pipeline pressurization (see Figure 2). New power supply lines for the well pumps would be placed in the same disturbance area as the water pipeline. About 3.1 miles of the existing power supply system



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NMISC Seven Rivers Pipeline

- Pipeline Alignment
- Existing Powerline
- Existing Powerline Upgrade
- New Powerline
- Reclamation Property
- Well Location

0 ½ 1 Mile

N

Figure 2
No Action Alternative

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March 2007

would require upgrading. For the No Action Alternative, the upgraded transmission line corridor would be along the western side of U.S. 285, within and just west of the right-of-way fence. For this 3.7 miles, the existing utility poles would be removed and replaced. The disturbance width would be 50 feet or less, and the total disturbance would be 22.4 acres. All disturbances other than the pole footprint would be temporary. The upgraded power poles would have the same height and diameter of the existing power powers. The spacing of the power poles would be 300 feet instead of the existing 400-foot spacing. Once pole and power supply line installation is completed, the disturbed areas along power line alignments would be re-seeded.

An outfall structure would be located at the terminus of the combined Price Farm-Home Farm system (see Figure 3). The structure would have baffle-style energy dissipaters to control flow. The shoreline would be reinforced with a riprap anti-scour protection to prevent erosion.

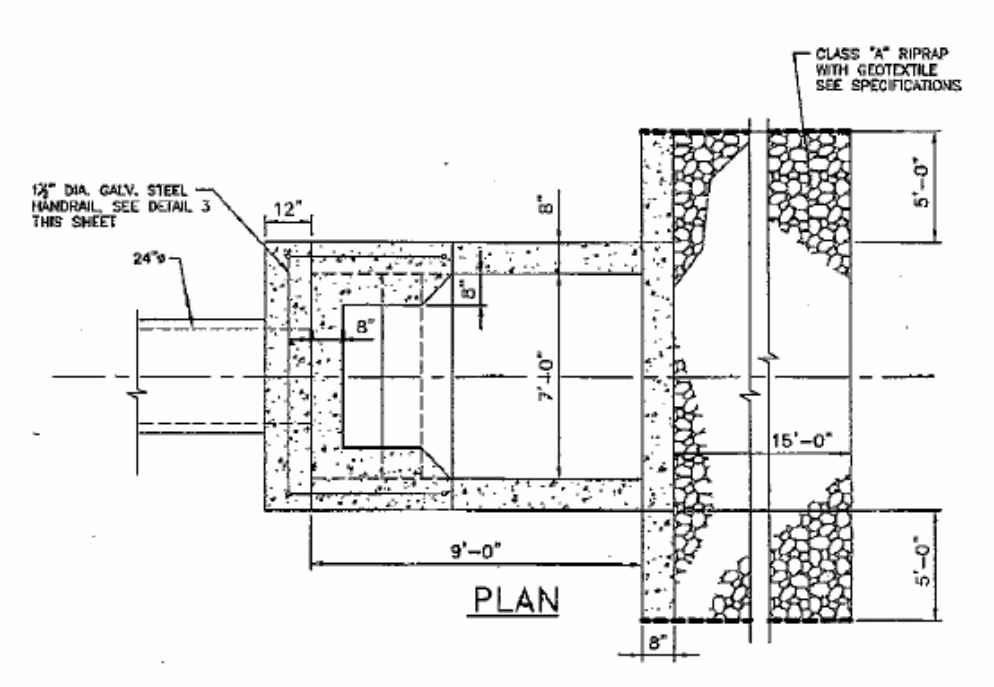
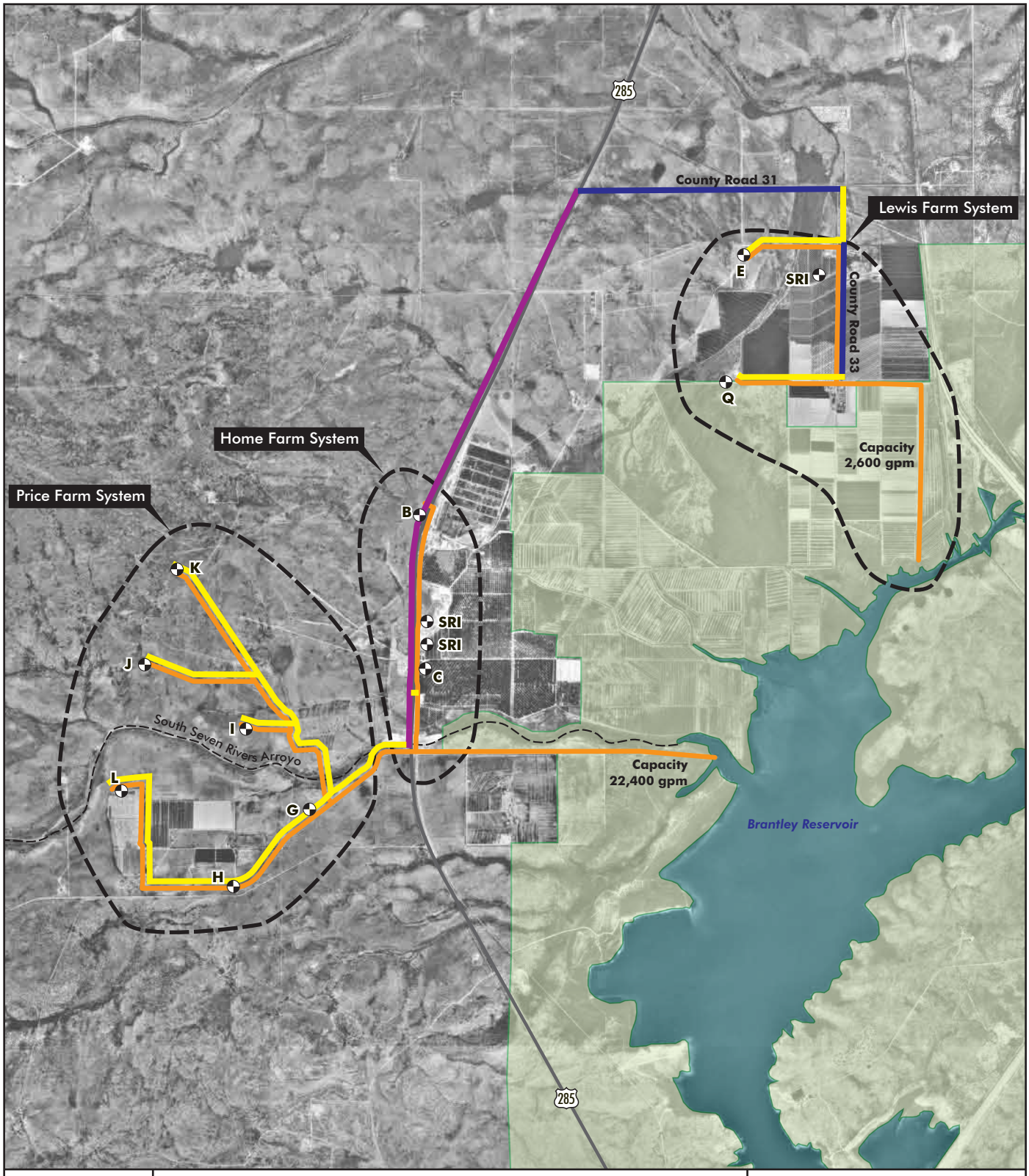


Figure 3. Diagram of proposed outfall/stilling basin construction.

Minimum burial depth for the pipeline would be 3 feet, and actual burial depth would range from 3 feet to 15 feet. Deeper burial would be required in some locations in order to maintain gravity flow. During construction, all open trenches would be constructed to reduce small mammal access and/or to allow small mammals to escape. No trenches would be left unprotected during the night. Pressure tanks would be buried at intervals along the pipeline as needed. Once pipeline installation is completed, the disturbed areas along pipeline alignments and in staging areas would be re-seeded. The construction disturbance width for the pipeline would be a maximum of 50 to 65 feet. With the exception of manhole, surge tanks, and outfall structure locations, all disturbances would be temporary.

Due to the high permeability of the soils in the South Seven Rivers arroyo and other factors mentioned previously, the No Action Alternative would be less efficient in water delivery, and could result in higher evaporation losses and increased aquifer recharge instead of the desired result of supplementing storage in Brantley Reservoir. The No Action Alternative would not meet the project purpose and need.



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NMISC Seven Rivers Pipeline

- Pipeline Alignment
- Existing Powerline
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- Well Location

0 ½ 1 Mile

N

Figure 4
Proposed Action

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Proposed Action

Under the Proposed Action, Reclamation would provide a license for right-of-use to the NMISC, which would allow for the construction and operation of an underground pipeline across Reclamation-administered land to Brantley Reservoir (see Figure 4). The average annual volume proposed for delivery to the reservoir is 12,000 acre-feet. This volume would vary annually.

Under the Proposed Action, the pipeline would consist of two distinct segments. Total pipeline length would be 10.5 miles, and a maximum disturbance width would be 50 feet, resulting in temporary disturbance area of 63.6 acres. There would be two discharge points—one from the northern area wells (Lewis Farm System) into an outfall/stilling basin structure at the northwestern edge of Brantley Reservoir, and one from the western area wells (Price Farm System and Home Farm System) into an outfall/stilling basin structure on the west shore of Brantley Reservoir south of the South Seven Rivers arroyo. The dimensions of the outfall/stilling basin structures for both the Lewis Farm System and Price and Home Farm Systems would be 20 feet by 25 feet (see Figure 3). Riprap scour protection would be placed at the base of the outfall/stilling basin structure. The maximum pipe diameter for the western system (Price Farm and Home Farm) would be 42 inches, designed to carry a total of 22,400 gpm from the western section. The maximum pipe diameter for the Lewis Farm system would be 22 inches, designed to carry 2,600 gpm from the northern section. The maximum rate of delivery would be 25,000 gallons per minute (gpm), or 55.7 cubic feet per second (cfs). Most of the system would operate under gravity flow conditions.

The Price Farm and Lewis Farm systems would operate by gravity flow, and the Home Farm system would require pressurization with pumps. Minimum burial depth for the pipeline would be 3 feet, and actual burial depth would range from 3 feet to 15 feet. Deeper burial would be required in some locations in order to maintain gravity flow. Pressure tanks would be buried at intervals along the pipeline as needed. During construction, all open trenches would be constructed to reduce small mammal access and/or to allow small mammals to escape. No trenches would be left unprotected during the night.

Upgrades to existing power supply lines and new power supply lines would be required for well pumps and pipeline pressurization (see Figure 4). New power supply lines for the well pumps would be placed in the same disturbance area as the water pipeline. About 3.4 miles of the existing power supply system would require upgrading. For the Proposed Action Alternative, the upgraded power supply corridor would be along the west side of U.S. 285, within and just west of the right-of-way fence. For this 3.7 miles, the existing utility poles would be removed and replaced. A disturbance width of approximately 50 feet would result from removal and replacement of the utility poles and installation of a new power supply line (22.4 acres). New power supply line installation also would be necessary. New power supply lines would be required for the Lewis Farm System. The first portion would be south from the intersection of County Road 31 and County Road 33 along County Road 33, and would be 0.3 mile long (2.0 acres). New power supply lines would also follow the pipeline corridors to Wells E and Q. New power supply lines on the Price Farm System would follow the pipeline alignments (see Figure 4). The Home Farm System would require only a short tie-in section of power supply line (see Figure 4). All disturbances other than the pole footprint would be temporary. The upgraded power poles would have the same height and diameter of the existing power poles. The spacing of the power poles would be 300 feet instead of the existing 400-foot spacing. Once pole and power supply line installation is completed, the disturbed areas along the alignments would be re-seeded.

The western section of the Seven Rivers pipeline would cross 1.3 miles of federal property and 6 miles of private property. The northern section of the pipeline would cross 1.4 miles of federal property and 1.5 miles of private property.

Two crossings of U.S. 285 would be required, one near Well B on the Home Farm System and one from the Price Farm System (see Figure 4). These crossings would be encased in steel and would be accomplished by boring under the roadway.

Outfall structures would be located at the termini of the combined Price Farm-Home Farm system, and the Lewis Farm System (see Figure 3). These structures would have baffle-style energy dissipaters to control flow. The shoreline would be reinforced with a riprap anti-scour protection to prevent erosion.

Once pipeline installation is completed, the disturbed areas along pipeline alignments and in staging areas would be re-seeded. The construction disturbance width for the pipeline would be a maximum of 50 to 65 feet. With the exception of manhole, surge tanks, and outfall structure locations, all disturbances would be temporary.

Construction and maintenance access would be along existing rights-of-way. For the Lewis Farm System, ownership of a portion of County Road 33 (also known as Sweetwater Road) would be transferred from the Eddy County to the adjacent landowner. Reclamation holds a perpetual easement for access over the road known as County Road 33. An encroachment agreement will be provided to NMISC for placement of its pipeline with Reclamations senior rights. The NMISC will be responsible to ensure Reclamation and NMDGF unrestricted access and will repair the road to a condition as found or better. Reclamation will not be subject to agreements between NMISC and third parties.

Actions Common to Both Alternatives

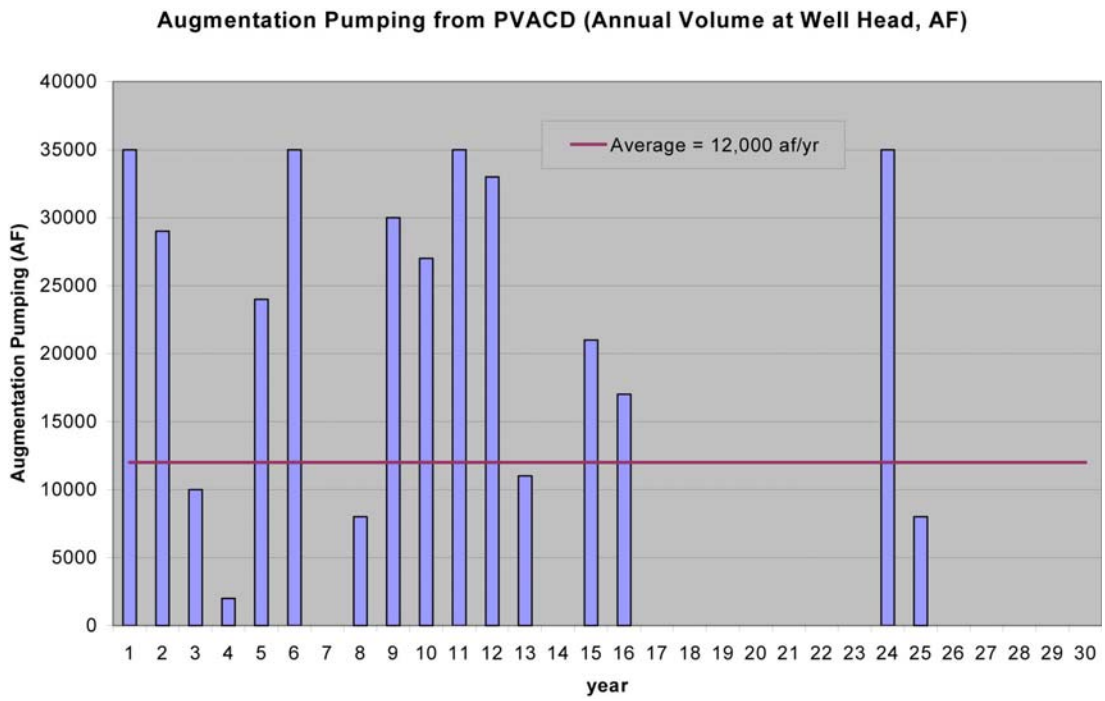
Augmentation pumping would be the similar for both the No Action Alternative and the Proposed Action. Augmentation pumping would occur based on Carlsbad Project water supply levels (acre-feet) listed in the Settlement Agreement. The Settlement Agreement lists "target dates" and "target supplies" for Carlsbad Project water (see Table 1). If the Project water supply is anticipated to fall short of the targets, water would be delivered from the augmentation wellfield to Brantley Reservoir until target levels are met. The Settlement Agreement states,

> "The State Engineer shall determine, in good faith consultation with CID, the United States and PVACD, the Project Water Supply on March 1, May 1, June 1, July 15, September 1 and November 1 of each year. The quantity of water delivered from the Augmentation Wells to the Pecos River pursuant to this Paragraph 9 shall be based upon the Project Water Supply on each of the "Target Dates", measured against a "Target Supply" for each of the Target Dates."

Table 1. Settlement Agreement target dates and Carlsbad Project supply for augmentation pumping.

Target Date	Target Supply
March 1	50,000 acre-feet
May 1	60,000 acre-feet
June 1	65,000 acre-feet
July 15	75,000 acre-feet
September 1	90,000 acre-feet

Augmentation well pumping modeling was completed based on the Settlement Agreement target dates, target volumes, and restrictions (Carron 2004; also see Appendix C). Historical water supplies were used in the modeling. In addition, augmentation water supply is limited in the Settlement Agreement to no more than 100,000 acre-feet during any 5-year accounting period and no more than 35,000 acre-feet during any one year. In Figure 5, the volume of augmentation water never exceeds the 35,000 acre-feet per year restriction, and also never exceeds 100,000 acre-feet during any 5-year period. This means that the target volumes in Table 1 would not be met. The average annual volume of water that NMISC anticipates would be delivered to the reservoir is 12,000 acre-feet. This volume would vary from year to year depending on hydrologic conditions. The maximum rate of delivery of the augmentation pumping would be 25,000 gpm, or 55.7 cubic feet per second (cfs). In addition, the NMISC may use the augmentation wells to deliver water to the New Mexico-Texas state line in the event of a shortfall in state line deliveries.



Source: Carron 2004.

Figure 5. Augmentation pumping model results.

Actions Eliminated from Further Consideration

A pipeline alignment that would traverse BLM property was considered, but eliminated due to cultural resource concerns. Additionally, several minor realignments of the pipelines were completed to avoid cultural resource impacts.

Preferred Action Alternative

As a result of the analysis presented in this EA, Reclamation considers the Proposed Action to be the preferred action alternative.

Chapter 3. Affected Environment and Environmental Consequences

Introduction

This section describes the current conditions of resources in the project area that may be affected by the Proposed Action and No Action Alternatives. This chapter describes the affected environment and the direct and indirect effects that would be expected to occur as a result of implementing the No Action Alternative and the Proposed Action Alternative as described in Chapter 2. Environmental attributes that are evaluated in this document fall within the general categories of water resources, land use, soils, air quality, biological resources, cultural resources, socioeconomics, environmental justice, and Indian Trust Assets. The affected environment for each resource area is initially discussed, followed by the direct and indirect effects. In some cases, these discussions follow a brief introduction to the regulatory setting. Potential effects are discussed by alternative, with the No Action Alternative discussed first. In the effects section, potential direct and indirect effects are described, and effects are compared to the effects of the No Action Alternative.

The affected environment is the area surrounding the Seven Rivers Augmentation Wellfield and pipeline route, including Brantley Reservoir for water resources. For Socioeconomic resources, Eddy County was considered to be the affected environment. For the purposes of the analysis of direct impacts, the project area is defined as areas within the disturbance footprint of the project's facilities, i.e. the pipeline disturbance right-of-way and the disturbance footprint for the outfall/stilling basin structures. The final section in this chapter addresses cumulative effects.

Water Resources

The water resources discussion is divided into three sections—surface water, groundwater, and water quality. The affected environment and potential environmental consequences are described in the following section.

Affected Environment

Surface Water

Surface water features in the project area include Brantley Reservoir, South Seven Rivers arroyo, and various constructed irrigation ditches for orchards and other agriculture. The South Seven Rivers arroyo is tributary to the Pecos River, but now flows into Brantley Reservoir. At its headwaters west of the project area, the Seven Rivers arroyo is perennial, but within the project area it is ephemeral (Marron 2006a). Most of the channel is flood-scoured and bare, with some areas having annual vegetation cover. The channel carries storm water flow generally from convective summer storms (Marron 2006a).

Brantley Reservoir is located on the Pecos River. It was completed in 1988 for the purposes of irrigation and flood control, has a 335,054 acre-feet capacity assigned to flood control functions and a minimum pool of 2,000 acre-feet. Brantley Reservoir is part of a system of four reservoirs operated by the Carlsbad Irrigation District for the Carlsbad Irrigation Project. Brantley Reservoir levels are dependent on releases from upstream reservoirs, tributary inflows, irrigation return flows, and spring inflows. Water levels fluctuate during the spring and summer because of (1) variations in releases to meet demands for irrigation by CID and (2) large variations in inflows that are primarily from block releases (movement of water from upstream reservoirs for irrigation purposes) and monsoon season storm inflows. Water levels can fluctuate during the autumn, but generally not with as much deviation. CID makes block releases during the irrigation season, as needed, but it attempts to end the irrigation season with Brantley Reservoir at relatively low water levels to provide storage for side inflows that may occur over the winter (Reclamation 2006a and 2006b).

Existing ditch and canals occur on agricultural property in and near the project area. These surface water features carry flow during spring and summer months in the irrigation season.

Groundwater

The project area is in the Roswell Artesian Basin, which contains two major water-bearing features: a shallow alluvial aquifer and a deep artesian carbonate aquifer. Throughout most of the Roswell Artesian Basin, the shallow and carbonate aquifers are separated by a semi-confining layer. Both aquifers, however, are connected in the northwestern part of the groundwater basin where the carbonate aquifer rises structurally to meet the shallow aquifer. The deep artesian aquifer is associated with the San Andres Formation and is confined on the east side and unconfined on the west. The shallow alluvial aquifer is unconfined throughout the basin, and in the southern part of the basin it contains the Major Johnson Springs aquifer. Both aquifers were developed for irrigation water supplies beginning in the late 19th century (Reclamation 2006b).

Groundwater studies were completed as part of the "Groundwater Quality in the Seven Rivers Area, Southern Roswell Basin, New Mexico, 2005 Annual Report" (McCord and Hall, 2006). Groundwater levels were measured in various months throughout 2004 and 2005. Ground surface elevation within the Seven Rivers project area varied between 3,497 feet and 3,286. Depth to water measurements varied from 28 to 212 feet, and therefore groundwater levels ranged from 3,239 to 3,363 feet. In addition, information from NMISC's pumping tests is available for wells that have been completed. The depth to water varied from 38 to 125 feet prior to testing of the wells. Total depth of the eight NMISC wells with information available ranged from 637 to 1,003 feet, with the screened interval ranging from 400-630 feet for Well G, to 740-1002 feet for Well E (see Figure 4 for location of these wells).

As required by the Settlement Agreement, NMISC will acquire up to 18,000 acre-feet of water rights in the Pecos Basin and will seek to transfer the necessary water rights for wellfield operations. Only the consumptive use portion of the water right will be transferred. Modeling for the Settlement Agreement (Carron 2004) made the following assumptions:

- Retirement of 11,000 acres and augmentation pumping are distributed uniformly across both the artesian and alluvial aquifers throughout the PVACD.
- Land retirement and augmentation pumping is split between the artesian and alluvial aquifers in an 8:3 ratio (8,000 acres artesian; 3,000 acres alluvial).

Water Quality

Water quality components of concern in surface water in the project area are mercury, DDE and total dissolved solids (TDS). Mercury has been found in fish tissue samples from Brantley Reservoir, resulting in a "not supported" water quality ranking for warm water fisheries in the reservoir. In 2006, high levels of DDE were reported in fish caught at Brantley Reservoir. DDE is a breakdown product of DDT, a banned pesticide that is a probable human carcinogen (New Mexico Environment Department 2006; Schiffmiller 2006). TDS are commonly measured by electrical conductivity (EC), essentially a measure of the dissolved salts present in the water. EC is usually measured in units of microsiemens per centimeter (µS/cm). On the Pecos River, EC normally increases the further downstream measurements are taken due to agricultural runoff. EC for Brantley Reservoir is summarized in Table 2.

Table 2. Existing electrical conductivity in Brantley Reservoir (µS/cm).

Water quality measurement	Minimum	Median	Maximum
Inflow EC	921	5,390	11,496
Outflow EC	1,516	4,675	7,465
Surface EC	1,548	3,768	6,679
Bottom EC	1,772	5,179	7,696

Source: Carlsbad Project Water Operations and Water Supply Conservation EIS, 2006**;** Reclamation 2006a and 2006b.

Water quality in Brantley Reservoir varies throughout the year. Normally, winter-spring water quality has higher EC due to agricultural return flows with high EC entering the reservoir. Currently CID "manages" water quality issues by diluting excessive EC values with block releases of cleaner water from upstream storage, prior to irrigation season (Reclamation 2006b).

The *Groundwater Quality in the Seven Rivers Area Southern Roswell Basin, New Mexico 2005 Annual Report* reported EC for existing wells in the Seven Rivers Wellfield area (McCord and Hall 2006). Information from that sampling effort is in Table 3.

Table 3. Average electrical conductivity (EC) in sampled Seven Rivers wells, 2005.

Sample Date	Average EC in Artesian Wells (µS/cm)	Average EC in Shallow Wells (µS/cm)
May 2005	2,230	3,280*
September 2005	2,233	2,815

*Only one shallow well was sampled for EC in May 2005. Source: McCord and Hall 2006.

Sulfate, total dissolved solids (TDS), and chloride also was reported for Seven Rivers area wells during the 2005 reporting effort for the Seven Rivers Pipeline (see Table 4). Although there are no water quality standards for EC anywhere in the Pecos River basin, beginning with the Near Puerto de Luna gage and continuing to Orla (with the lone exception of the Brantley Reservoir release), there are standards for TDS, chloride, and sulfate (NMWQCC, 2002a), each of which relates to EC. None of the standards for TDS, chloride, or sulfate is exceeded. Although the concentrations of each constituent are high in the mainstem of the Pecos River and generally increase in a downstream direction, the standards also are high and increase downstream. Standards are higher downstream because high concentrations are considered natural. The Clean Water Act recognizes that such natural conditions exist and makes an exception in the water quality standards to accommodate such conditions (Reclamation 2006a and 2006b).

Environmental Consequences

Surface Water

Under both the No Action Alternative and the Proposed Action, the augmentation water becomes Carlsbad Project Water once it enters Brantley Reservoir and is distributed at CID's discretion. As described in the Proposed Action, augmentation pumping would be based on Carlsbad Project water supply levels (acre-feet) listed in the Settlement Agreement (see Table 1). Based on Settlement Agreement modeling, the average annual volume of water that would be discharged into Brantley Reservoir would be about 12,000 acre-feet (see Figure 5).

Table 4. Concentrations of various constituents in sampled Seven Rivers wells, 2005.

Sample Date	Artesian Wells (mg/L)	Shallow Wells (mg/L)
TDS		
May 2005	1,814	2,099*
September 2005	1,724	2,157
Chloride		
May 2005	25	439*
September 2005	24	163
Sulfate		
May 2005	1,163	1,568*
September 2005	1,085	1,264

*Represents single-well sampling results. Source: McCord and Hall 2006.

In both alternatives, streamflows between Acme and Artesia are not expected to be significantly affected. Changes to irrigation return flows currently entering the Pecos River would be the same for both alternatives. Over the long term, flow in the Pecos River is expected to increase.

Under the No Action Alternative, augmentation water would be discharged via an outfall/stilling basin structure into the South Seven Rivers arroyo channel 1.5 miles west of Brantley Reservoir. This arroyo is an ephemeral drainage that rarely flows. Therefore, the arroyo would carry water more frequently than under normal conditions. For the No Action Alternative, the total discharge capacity for the augmentation wellfield would be 25,000 gpm which would be discharged into the arroyo.

Under the Proposed Action, the augmentation water would be delivered directly to Brantley Reservoir and would have no effect on surface water in the South Seven Rivers arroyo.

Groundwater

As discussed in the previous *Surface Water* section, pumping from the augmentation wellfield would be similar under both the No Action and the Proposed Action alternatives. During pumping, water levels in the aquifer would decrease. During pumping tests, constant rate aquifer drawdown was 69 feet to 230 feet. Aquifer drawdown would occur during augmentation pumping; when well pumps are not operating, water levels would eventually recovery. The pumping with either alternative is not expected to adversely affect other groundwater users.

The Proposed Action is part of the Settlement Agreement's implementation. The purpose of the Settlement Agreement is to a) comply permanently with the Pecos River Compact and Amended Decree and, b) avoid the need for priority administration of water in the Pecos River Basin. Pumping is expected to occur more frequently in the first 10 years of the Settlement Agreement's implementation, and decrease thereafter as cumulative State line flows increase (see Figure 18 in Appendix C). The general trend for both the artesian and shallow aquifers is one of increasing storage, due to the combined effects of retired PVACD lands and lower augmentation pumping requirements (Reclamation 2006a and 2006b; Carron 2004). Aquifer storage is discussed in greater detail in Appendix C (see Figures 4 and 5 of Appendix C).

Water Quality

Both the No Action Alternative and the Proposed Action could result in changes to the water quality in Brantley Reservoir, as well as the quality of subsequent releases to the Pecos River and CID. Discharged

water would dilute some constituents, and likely would be beneficial to general water quality in Brantley Reservoir and downstream. For example, based on the information in Table 2 and Table 3, the average EC in Brantley Reservoir is greater than the average measured for augmentation well water; therefore augmentation pumping is expected to result in some net decrease in EC. The amount of benefit would vary depending on the volume and quality of water in the Reservoir when pumping is initiated (which varies by time of year), as well as the volume and quality of discharge from augmentation pumping (which would vary according to CID supplies and the Settlement Agreement).

Land Use and Recreation

Affected Environment

Lands in the project area are managed by the State of New Mexico (including State Parks and New Mexico Department of Game and Fish), the Bureau of Land Management (BLM), Reclamation, and private companies and individuals. Use of these lands varies considerably and includes agriculture, recreation, oil and gas extraction, and wildlife habitat management.

Agricultural uses. Irrigated agricultural uses in the project area consist primarily of pecan orchards. The New Mexico Department of Game and Fish operates a bird farm within the project area, raising food materials for game birds.

Recreation uses. Brantley Reservoir is the site of Brantley Reservoir State Park, a popular recreation destination managed by the New Mexico State Division of Parks and Recreation under agreement with Reclamation. Park amenities include a visitor center, group picnic shelter, shower, restrooms, and a playground. Camping facilities at the park include 51 developed sites, all with electric hookup, and a RV dump station. The reservoir is a popular fishing destination. Brantley Reservoir provides year-round fishing for white bass, catfish, largemouth bass, walleye, and crappie (Reclamation 2006b). The New Mexico Department of Game and Fish bird farm is used for bird-watching and limited hunting. Historical patterns of recreation use observed by Reclamation and New Mexico State Division of Parks and Recreation indicate that recreation use is primarily affected by extreme lake levels above or below the conservation pool during the spring and summer months (Reclamation 2006).

Brantley Wildlife Area consists of 28,000 acres along the Pecos River and Brantley Reservoir. This area is located 15 miles north of Carlsbad and provides boating, camping, fishing, hunting, photography, trapping, and wildlife watching opportunities for the public (Reclamation 2006b).

Wildlife Habitat: The project area provides important habitat for birds, mammals, amphibians, reptiles, and fish. The flat to rolling terrain of the project area supports Chihuahuan scrub-shrub, Chihuahuan Desert grassland, and Chihuahuan desert scrub vegetation communities. Riparian vegetation and occasional wetlands occur along the South Seven Rivers arroyo and along the edges of Brantley Reservoir. Primarily stocked sport fish occupy the reservoir. The reservoir and surrounding areas provide habitat for migrating birds, particularly waterfowl (Marron 2006a, 2007). Additional information on wildlife habitat is found in the *Wildlife* Section.

Environmental Consequences

Under both the No Action Alternative and the Proposed Action, land use and recreation in the project area would remain largely unchanged. Temporary construction disturbance and intermittent operations and maintenance disturbance to the bird farm and wildlife habitat adjoining the project area would occur under both alternatives. Brantley Reservoir State Park amenities would likely be positively affected by augmentation well pumping, which would result overall in a higher reservoir pool. Augmentation pumping under the No Action Alternative would be less than under the Proposed Action due to losses in the South Seven Rivers arroyo; therefore, the benefits to recreation would be lower.

Construction and maintenance access would be along existing rights-of-way. For the Lewis Farm System, ownership of a portion of County Road 33 (also known as Sweetwater Road) would be transferred from the Eddy County to the adjacent landowner. Reclamation holds a perpetual easement for access over the road known as County Road 33. An encroachment agreement will be provided to NMISC for placement of its pipeline with Reclamations senior rights. The NMISC will be responsible to ensure Reclamation and NMDGF unrestricted access and will repair the road to a condition as found or better. Reclamation will not be subject to agreements between NMISC and third parties.

Geology and Soils

Affected Environment

Surface geology in the project area is characterized by alluvial deposits underlain by carbonate and evaporite rocks of the Permian period (SCS 1971). No active landslides or faults have been identified in the project area.

Soils in the project area are predominantly alluvial derived from various source materials. The Harkey and Pima soils are deep (greater than 60 inches), well drained soils found on low terraces along major streams. They have a high susceptibility to water erosion and a moderate susceptibility to wind erosion. Suitability for topsoil is good. Reagan soils are deep, well drained soils found on plains west of the Pecos River. They have a moderate susceptibility to water erosion and a low susceptibility to wind erosion. Suitability for topsoil is fair and is limited by carbonate content and salinity. The Reeves soils are deep, well drained soils found on low terraces along major streams. They have a moderate susceptibility to water and wind erosion. Suitability for topsoil is fair and is limited by salinity (SCS 1971).

None of the dominant soils are classified as “hydric” by the NRCS. The Harkey very fine sandy loam map unit is classified by the NRCS as “prime farmland if irrigated”. Prime farmland has high potential for crop production due to soil quality, availability (not urbanized), and are not excessively erodible or saturated/flooded for long periods (7 CFR 657.5). The Pima and Reeves soils are farmland of statewide importance.

Under the Farmland Protection Policy Act, any federal agency involved in a proposed project that may convert farmland to non-agricultural uses must complete U.S. Department of Agriculture Form AD-1006, Farmland Conversion Impact Rating. In the Farmland Protection Policy Act, farmland is prime farmland, unique farmland, and farmland of statewide or local importance.

Environmental Consequences

Neither the No Action nor the Proposed Action Alternative would affect farmland. The pipelines and powerlines would follow existing farm road disturbances through irrigated agricultural areas. Mitigation strategies would be to:

- Implement standard airborne dust abatement practices during construction.
- Maintain adequate soil moisture on unpaved haul roads to minimize visible dust emissions.
- Halt earth-moving activities during periods of high winds (greater than 25 miles per hour).
- Stabilize and reseed disturbed sites as appropriate.

Air Quality

Affected Environment

Air quality is determined by the ambient concentrations of pollutants that are known to have detrimental effects. The EPA has promulgated National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: carbon monoxide, nitrogen dioxide, particulate matter (PM10 and PM2.5), ozone, sulfur dioxide, and lead. Eddy County is in attainment of standards for all criteria pollutants.

The EPA has also established classes of air quality. Class I status under Section 162(a) of the Clean Air Act is designated for specified geographic areas where the cleanest and most stringent protection from air quality degradation is considered important. Class I areas include national parks over 6,000 acres and national wilderness areas over 5,000 acres. No Class I areas are near the Seven Rivers augmentation pipeline. The closest Class I area is Carlsbad Caverns National Park, 50 miles south of the project area (NMED 2004a).

Air Quality Control Regions (AQCR) have been established by the New Mexico Environment Department. AQCR 155 contains Eddy County, and is described by the New Mexico Environment Department in the following paragraphs. The elevation in the project area is about 3,500 feet. Vegetation is generally grassland dotted with yucca, mesquite, or cholla; and AQCR 155 contains the most extensive areas of croplands in New Mexico. Mean monthly temperatures in the region range from 37° F in January to 80° F in July. Average annual precipitation is 11.5 inches in Eddy County and average wind speeds are 11 miles per hour (NMED 2004b). On a regional scale, periodic high winds can contribute to temporary increases in the levels of atmospheric dust.

Environmental Consequences

During construction, sources of air pollution include particulate emissions from construction operations and tailpipe emissions from construction equipment and vehicles. Tailpipe emissions would persist only during active construction. Primary sources of fugitive dust would include earth moving associated with trench excavation and filling. Construction-related road dust could also be generated by traffic using haul roads in the work area. Soils that are destabilized by ground-disturbing activities would likely become a passive source of wind-blown dust until stabilization efforts can be implemented.

Dust picked up and dispersed by construction traffic and wind at disturbed sites could increase the concentration of total suspended particulates. These effects would be temporary and highly localized. After disturbed sites are stabilized, atmospheric dust is expected to return to background levels. Mitigation strategies that would be implemented for the project area:

- Implement standard airborne dust abatement practices during construction.
- Maintain adequate soil moisture on unpaved haul roads to minimize visible dust emissions.
- Halt earth-moving activities during periods of high winds (greater than 25 miles per hour).
- Disturbed sites would be stabilized and reseeded as appropriate.

Vegetation

Affected Environment

The western half of the project area—west of U.S. 285—is occupied by a mixture of Chihuahuan desert grassland and Chihuahuan desert scrub vegetation. Common species in the shrub-dominated areas are mesquite (*Prosopis gladulosa*), snakeweed (*Gutierrezia microcephla*), soaptree yucca (*Yucca elata*), creosote bush (*Larrea tridentate*), bladderpod (*Lesquerella* sp.), fetid marigold (*Dyssodia papposa*), and scattered burro grass (*Scleropogon brevifolius*). Adjacent to U.S. 285, patches of tarbush (*Flourensia cernua*) also occur. Grassland areas are documented by burro grass, three-awn (*Aristida* sp.), bladderpod, snakeweed, alkali sacaton (*Sporobolus airoides*), and other herbs and small shrubs. A large portion of the project area is vegetated by developed agricultural lands, specifically nut orchards and fields planted with grain crops. Roads serving the agricultural lands occur throughout the project area. In the northeast portion of the project area near County Roads 31 and 33, vegetation is dominated by weedy species (Marron 2006a, 2007).

The South Seven Rivers arroyo is an ephemeral drainage with variable vegetation. Riparian vegetation types along the arroyo and along the shoreline of Brantley Reservoir include a salt cedar-cocklebur community (*Tamarix chinensis* and *Xanthium strumarium*); burro bush community (*Hymenoclea*

monogyra); seep willow-grass community (*Baccharis salicifolia* and alkalai sacaton), and herbaceous community (barnyard grass—*Echinochloa crus-gallii*; bearded sprangletop grass—*Leptochloa fasicularis*) (Marron 2006a, 2007).

Environmental Consequences

The Proposed Action and No Action Alternative would result in the temporary removal or disturbance of a band of vegetation (50 feet in width) along the proposed pipeline. For the No Action Alternative, the pipeline and powerline disturbances would be 57.2 acres. The Proposed Action alternative would have pipeline and powerline disturbances of 88.0 acres. Vegetation impacts are detailed in Table 5 below.

Table 5. Vegetation impacts from No Action and Proposed Action.

Vegetation Type	Impacts from No Action Alternative (acres)	Impacts from Proposed Action (acres)
Pipeline alignments		
Orchard/agricultural roads	0.0	19.2
Riparian areas, including wetlands	0.1	0.1
Chihuahuan desert community	34.8	44.3
New power supply lines*		
Orchard/agricultural roads	0.0	2.0
Chihuahuan desert community	22.4	22.4
Total	57.2	88.0

* New powerline impacts occurring outside of pipeline impacts.

Wetlands

Affected Environment

The U.S. Army Corps of Engineers defines wetlands as areas with inundated or saturated soils fed by surface or groundwater that support hydrophytic vegetation (Environmental Laboratory 1987). Wetland environments provide food for wildlife, cover for nesting bird species, and help filter the water and clean the environment.

The South Seven Rivers arroyo, an ephemeral waterway, Brantley Reservoir, and adjacent wetlands are considered jurisdictional Waters of the U.S. All jurisdictional wetlands and other waters of the U.S. are protected resources under Section 404 of the Clean Water Act. Activities that result in the discharge of fill material into wetlands or waters of the U.S. are regulated by the U.S. Army Corps of Engineers (Corps). Delineation, avoidance, and mitigation measures are required (Section 404[b][1] of the Clean Water Act) for wetlands and other waters of the U.S. to minimize potential impacts and to provide compensation for any unavoidable impacts through restoration or creation activities.

Using methods outlined in the 1987 *Corps of Engineers Wetlands Delineation Manual*, wetlands in the Analysis Area were determined based on the presence of three wetland indicators: hydrophytic vegetation, wetland hydrology, and hydric soils. Dominant hydrophytic vegetation includes plant species such as cocklebur (*Xanthium strumarium)*, salt cedar (*Tamarix chinensis)*, barnyard grass (*Echinochloa crus-galli)*, and bearded sprangletop (*Leptochloa fascicularis).* Wetland hydrology is indicated by drift lines, sediment deposits, inundation, and saturated soil in the upper 12 inches. Hydric soil is indicated by low chroma soils, and gley mottling in some areas (Marron 2006b).

Environmental Consequences

The proposed pipeline project has potential to impact two wetland areas. The pipeline would cross the South Seven Rivers arroyo in two places, and end at the Brantley Reservoir Seven Rivers Outfall and the Lewis Farm Outfall. Wetlands were found at the South Seven Rivers arroyo crossing, and the Brantley Reservoir outfall. The wetland impacts from the No Action alternative would be the same as the Proposed Action. The No Action alterative would include only the southern outfall location (see Table 6).

Table 6. Projected wetland impacts for the No Action Alternative and Proposed Action.

Location	Wetland Impacts			
	No Action Alternative		Proposed Action	
	(sq. ft.)	(acres)	(sq. ft.)	(acres)
South Seven Rivers arroyo crossing 1	3,000	0.068	3,000	0.068
Brantley Reservoir outfall wetland			1,312	0.03

Source: Marron 2006b.

The NMISC has received authorization from the U.S. Army Corps of Engineers to complete the work required for the Proposed Action under Nationwide Permits (NWP) 7 and 12 (Action No. SPA-2007-72-ELP; see Appendix A). As mitigation for impacts to the South Seven Rivers arroyo and Brantley Reservoir shorelines wetlands, NMISC would implement wetland restoration and habitat enhancement activities. Approximately 4,350 square feet of disturbed wetland and shoreline habitat would be restored by planting approximately 95 coyote willow whips and 12 cottonwood trees (as cottonwood poles). In addition, the following best management practices would be implemented to prevent impacts to water quality:

- Construction equipment would be inspected prior to being used at the Sever Rivers Drainage crossings and at the South Brantley Reservoir Outfall to ensure that there are no leaks of oil, fuel, or hydraulic fluid.
- South Seven Rivers arroyo is an ephemeral drainage flowing principally after convectional storm events during the summer months. Construction at the drainage crossing would occur when the drainage was not flowing.
- During construction, the top ten inches of soil would be removed and set to the side. The pipeline would be installed below the grade of the channel in an excavated trench. Once the pipeline is installed, the trench would be filled and the top ten inches of soil would be placed on top of the excavation, returning the grade of the channel to pre-excavation conditions.

Threatened, Endangered and Sensitive Species

Affected Environment

Federally threatened and endangered species are protected under the Endangered Species Act (ESA) of 1973 as amended (16 U.S.C. 1531 et seq.). The ESA defines an endangered species as "a species in danger of becoming extinct throughout all or a large portion of its range" and a threatened species as "a species likely to become endangered in the foreseeable future" (ESA 50 CFR 17.3). Section 4 of the ESA prohibits "take" of any federally listed species. Take is defined as to harm, harass, pursue, hunt, shoot, wound, kill, trap, capture or collect wildlife being addressed. Potential effects to a federally listed species or its habitat resulting from a project with a federal action require consultation with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the ESA.

Candidate species are plants and animals for which there is sufficient information on their biological vulnerability to support federal listing as endangered or threatened (ESA 50CFR 17.3), but listing is precluded by other higher priority listing activities. No regulations require consultation for effects to

candidate species; however, if a candidate species becomes listed during project planning or construction, consultation with the USFWS would be required.

Migratory birds, including raptors, and any active nests are protected under the Migratory Bird Treaty Act (MBTA). The MBTA prohibits activities that may harm or harass migratory birds. While destruction of a nest by itself is not prohibited under the MBTA, nest destruction that results in the unpermitted take of migratory birds or their eggs is illegal and fully prosecutable under the MBTA (Migratory Bird Permit Memorandum, U.S. Fish and Wildlife April 15, 2003). The regulatory definition of a take under the MBTA means to pursue, hunt, shoot, wound, kill, trap, capture, or collect; or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect. In New Mexico, most birds except for non-native species that have been introduced, and grouse or pheasant species (Order: galliformes) are protected under the MBTA (§§ 703-712). Additionally, Executive Order 13186 direct federal agencies to take certain actions to implement the MBTA (86FR 3853). To avoid direct impact to migratory birds protected by the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703, et seq.), clearing and grubbing of woody vegetation would be scheduled between April 15 and August 15, outside of the normal breeding season for many avian species. Should vegetation removal and construction take place between April 15 and August 15, preconstruction nesting bird surveys should be conducted to identify potential MBTA issues. Any positive preconstruction survey results or observations should be brought to the attention of USFWS in order to determine methods of MBTA impact avoidance.

Approximately 64 species of plants and animals are designated as threatened, endangered, candidate, or state-listed sensitive in Eddy County. Of the 64 species, 7 species are likely to occur in the project area. Six species have been documented in or near the Analysis Area and one species has not been documented but has suitable habitat in the project area

Table 7. Threatened, endangered, candidate, or state-listed sensitive species documented in the project area.

Species	Scientific Name	Status	Habitat Present	Occurrence Documented in the Area
Yellow-billed cuckoo	*Coccyzus americanus*	FC	Y	Y
Western burrowing owl	*Athene cunicularia hypugaea*	SOC	Y	Y
Bald eagle	*Heliaeetus leucocephalus*	FT	Y	N
Interior least tern	*Sterna antillarum*	FE	Y	Y
Black tailed prairie dog	*Cynomys ludovicianus*	SOC	Y	Y
Big scale logperch	*Percina macrolepida*	ST	Y	Y
Pecos bluntnose shiner	*Notropis simus pecosnesis*	FT	Y	Y

FE = Federal Endangered; FT = Federal Threatened; FC = Candidate for listing under ESA; SOC = Species of Concern; SE=State Endangered; ST = State Threatened
Source: Marron 2006a, 2007.

The Western U.S. distinct population segment (DPS) of the yellow-billed cuckoo is a Candidate species under the ESA. It is known to occur in riparian habitats in southern and central New Mexico. Suitable habitat for the species occurs in mature salt cedar thickets along the lower South Seven Rivers arroyo east of U.S. Highway 285 and along the edges of Brantley Reservoir. During a field review for the project in July 2006, a cuckoo was heard calling south of the Lewis Farm Outfall area (Marron 2006a, 2007). All of

the trees and shrubs that would provide suitable habitat in the project area were surveyed, and no yellow-billed cuckoo nests were observed within 100 feet of the outfall area. Nesting season for the yellow-billed cuckoo is from May through August.

The western burrowing owl is a state-listed sensitive species. This owl occurs on plains, treeless valleys, and mesas. It prefers areas with prairie dogs or other burrows that it can use for nesting and shelter. This species is found throughout the mid- and lower elevations of New Mexico. A nesting pair of western burrowing owl was observed along the access road to Well Site E just south of the well. No owls were found along the pipeline alignments, although many suitable burrows were present throughout the project area (Marron 2006a, 2007).

The bald eagle is a federally listed threatened species. Although it is proposed for delisting, it remains protected under the ESA. No eagle nests or individuals were observed in the project area. Habitat for the eagle is present because of the large water supply and proximity to large roosting areas. Roosting areas, feeding areas, and nests are protected under the ESA.

The Interior least tern is a federally listed endangered species. This waterbird nests on sandbars and reservoir shorelines, creating a shallow "scrape" in sandy, unvegetated areas in which they lay their eggs. Large, open areas that contain 0 to 15 percent vegetation coverage are considered optimal nesting habitat for the species. Nesting individuals have been reported on the shores of Brantley Reservoir intermittently from 2003 through 2006. Brantley Reservoir's documented nesting area is on the west shoreline. Nesting Season is between late April and August throughout the species' range (USFWS 1990). No Interior least tern individuals were documented to occur in the project area up the South Seven Rivers drainage. A large, unvegetated are that potentially provides habitat for the tern is present at the mouth of the South Seven Rivers arroyo (Marron 2006a, 2007).

Habitat for the Interior least tern would not be directly impacted by pipeline and outfall construction activities. The outfall on the southern pipeline, which is located between two areas that Reclamation created and is required to maintain for Interior Least tern nesting, and other nearby construction activities should be completed prior to the onset of the tern nesting season, which begins approximately mid-May. Should this work be completed before the Interior Least terns arrive and there are no other adverse impacts from construction noise to terns, then Reclamation can make the determination that the project will have "no effect" to the species. Alternatively, should construction of the southern pipeline outfall continue past approximately mid-May, then this activity "may effect" the terns and Reclamation and NMISC will have to enter into Section 7 (ESA) consultation with the Service, a process that can take up to 135 days to complete.

The Black tailed prairie dog is a state-listed sensitive species. This large rodent inhabits short-grass plains in most of New Mexico, where it excavates burrows and forages for green plants. A small colony of Black tailed prairie dogs is located north of the proposed pipeline alignment east of the Pad G site. During the Biological Assessment in 2006, the burrows appeared abandoned (Marron 2006a, 2007).

The big scale logperch is a state threatened species. The species is mostly commonly found in riverine habitats, specifically with fast-flowing moderately deep water above gravel and cobble substrates. This species also is known to occur in Brantley Reservoir. This fish feeds on aquatic invertebrates (Marron 2006a, 2007).

The Pecos bluntnose shiner is a federally threatened species and a New Mexico threatened species. It is a small fish that is native to the Pecos River in New Mexico. The USFWS designated the Pecos bluntnose shiner as a federally threatened species, with critical habitat, in 1987. Both the upper critical habitat and

the lower critical habitat are north of Brantley Reservoir, outside of the project area (Marron 2006a, 2007).

Environmental Consequences
No habitat or individuals of the species discussed in the previous section are anticipated to be directly impacted by either the Proposed Action or No Action Alternative. Prior to construction, surveys should be completed for the yellow-billed cuckoo, burrowing owls, black-tailed prairie dogs, bald eagles, willow flycatchers, interior least turn, Bell's vireo, Black terns, and all migratory bird nests. If active nests are present, construction would be phased or scheduled to avoid disturbing the active nests.

Indirect effects could occur if discharge from the pipeline causes the reservoir water level to rise while the tern is nesting along the shoreline. However, pumping and augmentation activities are not expected to cause increased water levels during nesting season. As noted in Table 1 and the associated discussion, pumping likely would occur in November and continue as needed. The nesting season for the Interior least tern is late April to August; therefore, the augmentation pumping is not expected to affect tern nesting or foraging.

Wildlife

Affected Environment
A wildlife survey of the project area was conducted during the spring of 2006, and a large number of vertebrate species were found. Only a small portion of the vertebrate species found occupy the upland habitats in the project area. The greatest diversity of species occurs in the wetland and riparian areas surrounding the South Seven Rivers arroyo and along the shores of Brantley Reservoir.

Birds
The arid uplands portion of the project area supports species such as scaled quail, roadrunner, western kingbird, cactus wren, northern mockingbird, black-throated sparrow, and pyrroluxia. Species such as the orchard oriole, Bullock's oriole, summer tanager, and great-tailed grackle have habitat in the orchard portion of the project area. Species that inhabit the reservoir edge habitat include snowy egret, great blue heron, American coot, killdeer, blue grosbeak, and red-winged blackbird. Species of birds-of-prey with habitat in the project area include northern harrier, red-tailed hawk, Swainson's hawk, prairie falcon, American kestrel, osprey, western burrowing owl, and barn owl (Marron 2006a, 2007).

Mammals
Mammals that inhabitat the project area include desert cottontail rabbit, black-tailed jackrabbit, black-tailed prairie dog, mule deer and white-tailed deer, southern plains woodrat, coyote, and raccoon (Marron 2006a, 2007).

Reptiles and Amphibians
Several species of herptiles are present in the project area, including the spadefoot toad, prairie lizard, collard lizard, little striped whiptail, bull snake, and diamond back rattlesnake (Marron 2006a, 2007).

Aquatic Organisms
Aquatic animals depend on the aqueous environment to provide food, oxygen, and shelter. Fish species representing many families, including the minnow (*Cyprididae*), sucker (*Catostomidae*), catfish (*Ictaludridae*), perch (*Percidae*), sunfish and bass (*Centrarchaidae*), and livebearer (*Poeciliidae*) families occur in Brantley Reservoir. These include both native and introduced species and populations. A variety of aquatic invertebrates occupies riparian and lacustrine systems such as Brantley Reservoir. These include nemotodes, mollusks, and arthropods such as insects (Marron 2006a, 2007).

Environmental Consequences

The installation of the pipeline and associated facilities for both the No Action Alternative and the Proposed Action would require excavation and temporary disturbance. Small mammals and reptiles are especially vulnerable to being trapped in open trenches. Therefore, under both alternatives, open trenches would be constructed to reduce small mammal access and/or to allow small mammals to escape. Fencing would help prevent entrapment of animals in construction trenches. Activity and disturbance associated with the construction would temporarily displace many species, including birds, small mammals, and reptiles. Once construction and revegetation activities are complete, these animals are likely to reinhabitat the area quickly.

In many portions of the project area, the installation of the pipeline and associated facilities would temporarily replace shrubby vegetation with herbaceous vegetation, temporarily reducing the amount of nesting habitat available for birds. The habitat would eventually return to its preconstruction condition.

If construction of the project occurs during the nesting season for migratory birds (April through September), then a survey for migratory bird nests would be completed. Active migratory bird nests cannot be removed without a permit from the USFWS. If active migratory bird nests are encountered along the pipeline during construction, Reclamation would consult with the USFWS to develop measures to avoid impacts to nesting migratory birds.

There were no fishery studies completed for the survey. However, the outfall of water into the lake pumped from wells could affect conditions for fish species in the lake, particularly near the outfalls. In general, as noted in the *Water Quality* section, the water pumped from augmentation wells is of better quality than exists in Brantley Reservoir. Based on this information, impacts to fisheries are likely to be temporary and insignificant. The major water chemistry component that is not known is temperature. It would be helpful to measure water temperature between the well output and the lake conditions to confirm that impacts would be insignificant.

Noxious Weeds

Affected Environment

The New Mexico Department of Agriculture has selected aggressive noxious weeds for control, containment or eradication pursuant to the Noxious Weed Management Act of 1998 (NMDA 2006). A noxious weed is a plant not indigenous to New Mexico and has been targeted for management because of its negative impact on the economy or environment (NMDA 2006). Noxious weeds generally are aggressive and difficult to manage.

During the vegetation inventory, 2 Class C noxious weeds—Field bindweed (*Convolvulus arvensis)* and Salt cedar (*Tamarix chinensis)*—were documented in the project area (Marron 2006a). Class C weeds are described by NMDA as "species that are wide spread in the state. Management decisions for these species should be determined at the local level based on feasibility of control and level of infestation." Field bindweed is a creeping introduced perennial forb species with white or pink flowers, dark green waxy leaves and a deep seated taproot. Salt cedar is a woody introduced shrub species that creates monocultures along stream sides, river channels and lake sides. This species has small pink clustered fragrant flowers and grayish green scaly leaves.

Environmental Consequences

The proposed action and no action alternatives, as with any ground disturbing activity, have the potential to support the infestation and spread of noxious weeds. Implementation of Best Management Practices for weed control should be implemented for all construction and ground disturbing activities.

Cultural Resources

Cultural resources are defined as the expressions of the human culture and history in the physical environment, including culturally significant landscapes, historic and archaeological sites, Native American and other sacred places, and artifacts and documents of cultural and historical significance. Historic properties are defined as historic or prehistoric sites, structures, buildings, districts or objects that are listed in or are eligible for the National Register of Historic Places (NRHP).

Affected Environment

The affected environment for cultural resources is identified as the area of potential effects (APE), in compliance with the National Historic Preservation Act (36 CFR 800.16). The APE is defined as the geographic area within which federal actions may directly or indirectly cause alterations in the character or use of historic properties. The APE for this proposed action is limited to the proposed pipeline corridor, access roads, and staging areas.

The project area is set in the small rural community of Seven Rivers, currently used for ranching, farming, and orchards. Historic habitation of the Seven Rivers area began around 1870, when the cattle industry in southeastern New Mexico established. Four prehistoric periods predate the ranching industry in the project area. Cultural evidence of the Paleoindian period (ca. 10000 to 5200 BC), the Archaic period (5200 BC to AD 750), Formative period (AD 500 to 1375), and the Proto/Ethnohistoric period (AD 1375 to 1750) may be found in this area of southeastern New Mexico (Marron 2006c).

A records search and 100 percent pedestrian survey was conducted for the project. A review of the records search found 8 previously recorded sites within the project APE. The pedestrian survey documented 12 additional sites. Nine of the 20 previously recorded and newly record sites are considered eligible for the NHPA under criterion D, information potential. These sites are representative of various prehistoric and historic occupations (Marron 2006c).

Environmental Consequences

The No Action Alternative and the Proposed Action would have similar effects on cultural resources in the project area. The No Action Alternative and the Proposed Action may affect two cultural resources that are eligible for listing in the NRHP. It is anticipated these two sites would be avoided during construction. The sites would be monitored during construction. The Proposed Action would adversely affect one eligible cultural resource site along the pipeline route (LA 154410). A Cultural Resources Memorandum of Agreement (MOA) would be implemented between Reclamation, the New Mexico State Historical Preservation Office (SHPO), and Interstate Stream Commission with regard to resolving adverse effects on historic resources along the entire length of the pipelines on both private and federal lands. Reclamation is preparing and implementing a MOA to follow the normal regulatory process as described by the Advisory Council on Historic Preservation in 36 CFR 800.5 and 36 CFR 800.11. SHPO and Reclamation have made the determination that both the Proposed Action and No Action Alternative would have the potential for having adverse effects on some of the archaeological sites, which calls for a mitigation strategy. The mitigation strategy in this case is a data recovery plan since facility relocation is not an option. The proposed data recovery plan outlines a method to conduct limited excavations at one eligible cultural resource site along the pipeline route (LA 154410). The excavation would remove the features of LA 154410, which would otherwise be destroyed by construction. The Data Recovery Plan is in Appendix B.

Once the MOA is signed by the three agencies (Reclamation, NMISC, and SHPO), the Advisory Council on Historic Preservation (ACHP) can request to be a signatory. However, the ACHP has concluded that Appendix A, Criteria for Council Involvement in Reviewing Individual Section 106 Cases of the ACHP regulations “Protection of Historic Properties” (36 CFR Part 800) does not apply and that the potential

adverse effects from this undertaking can be resolved successfully without ACHP involvement (see Appendix B).

Socioeconomics

Affected Environment

Eddy County has a land area of 4,182 square miles, and in 2000 had a population of 51,658—a population density of 12.4 persons per square mile. The county's population grew by 6.3% between 1990 and 2000. The median household income in 1999 was $31,998, 94% of the New Mexico state average household income. In 1990, mining and retail trade employed the greatest number of people in the County and accounted for 33% of employment (U.S. Census Bureau 2000a and 1990). In 2000, 13.6% of families and 17.2% of individuals in Eddy County were below poverty level, compared with national percentages of 9.2 and 12.4%, respectively (U.S. Census Bureau 2000b).

Environmental Consequences

The No Action Alternative and Proposed Action are not anticipated to have any long-term impact on socioeconomic resources in the project area. Short-term benefits for the county include revenues generated from construction, which would be very similar for the No Action Alternative and Proposed Action. There would be a minor, short-term economic benefit for local businesses due to construction workers' expenditures on lodging and food. Most of the work force would likely commute from lodging venues in Carlsbad or Roswell. Ongoing operations and maintenance requirements of the pipeline may provide some economic benefit to Eddy County. Both alternatives would allow the NMISC to partially fulfill their responsibilities under the Settlement Agreement. The Seven Rivers Augmentation pipeline would contribute to the economy of Eddy County by providing additional irrigation water for use on Carlsbad Project lands. The Proposed Action would be more efficient at delivering water to Brantley Reservoir than the No Action Alternative. Otherwise, the short- and long-term economic benefits from the project would be similar.

Environmental Justice

Executive Order (EO) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," was issued by the President of the United States on February 11, 1994. This order established requirements to address Environmental Justice concerns within the context of agency operations. As part of the NEPA process, agencies are required to identify and address disproportionately high and adverse human health or environmental effect on minority or low-income communities. Federal agencies are directed to ensure that federal programs or activities do not result, either directly or indirectly, in discrimination on the basis of race, color, or national origin. The order also requires that "the responsibilities set forth shall apply equally to Native American programs".

Affected Environment

In Eddy County in 2000, 13.6% of families and 17.2% of individuals were below poverty level, compared with national percentages of 9.2 and 12.4%, respectively. About 41% of individuals reported being of Hispanic or Latino decent, and 56% reported being white, not of Hispanic decent (U.S. Census Bureau 2000b).

Environmental Consequences

Implementation of the proposed action would not disproportionately (unequally) affect any low-income or minority communities within the project area. The reason for this is that the proposed project would not involve major facility construction, population relocation, health hazards, hazardous waste, property takings, or substantial economic impacts. This action would therefore have no adverse human health or environmental effects on minority and low-income populations as defined by environmental justice policies and directives.

Indian Trust Assets

Indian Trust Assets (ITAs) are legal interests in assets held in trust by the United States through the Department of the Interior, Bureau of Indian Affairs, for Indian tribes or individual Indians. This trust responsibility requires that all federal agencies, including Reclamation, ensure their actions protect Indian Trust Assets.

"Assets" are anything owned that has monetary value. The asset need not be owned outright but could be some other type of property interest, such as a lease or a right of way. They can be real property, physical assets, or intangible property rights. Common examples of trust assets may include lands, minerals, hunting and fishing rights, water rights, other natural resources, and money. "Legal interest" means there is a primary interest for which a legal remedy, such as compensation or injunction, may be obtained if there is improper interference. Trust assets do not include things in which a tribe or individual have no legal interest, such as off-reservation sacred lands in which a tribe has no legal property interest. It should be noted that other federal laws pertaining to religious or cultural laws should be addressed if impacts to such lands were to occur from Reclamation actions.

Affected Environment

No ITAs have been identified in the project area.

Environmental Consequences

No impacts to ITAs are anticipated from either alternative.

Irretrievable Commitment of Resources of the Proposed Action

The implementation of the Project will result in the commitment of resources such as fossil fuels, construction materials, and labor. In addition Federal funds will be expended for the construction of the proposed project.

Cumulative Impacts

In addition to project-specific impacts, Reclamation analyzed the potential for significant cumulative impacts to resources affected by the project and by other past, present, and reasonably foreseeable activities in the watershed. According to the Council on Environmental Quality's regulations for implementing NEPA (50 CFR §1508.7), a "cumulative impact" is an impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. It focuses on whether the proposed action, considered together with any known or reasonable foreseeable actions by Reclamation, other Federal or state agencies, or some other entity combined to cause an effect.

Two Environmental Assessments, the Pecos River Restoration at Bitter Lake National Wildlife Refuge EA and the Pecos Supplemental Water and Exchange EA, will be tiered to the Carlsbad Operations and Water Supply Conservation EIS and the actions described in these EAs are considered as reasonably foreseeable actions in this EA.

Pecos Supplemental Water and Exchange EA

This project is needed to comply with the 2006-2016 Biological Opinion for the Carlsbad Project Water Operations and Water Supply Conservation Environmental Impact Statement (EIS), June 2006. The Biological Opinion and EIS commit Reclamation to operate the Carlsbad Project with a target flow of 35 cubic feet per second (cfs) at the Taiban Gage and to keep the river continuous in order to conserve the federally protected Pecos bluntnose shiner. The purpose of the project is to provide adequate water to

keep the river continuous, meet the contracted irrigation needs of the Carlsbad Project, avoid hindering New Mexico delivery requirements to Texas, and establish partnerships in the basin.

The Bureau of Reclamation is proposing to obtain supplemental water to provide the operational ability to release approximately 2,500 acre-feet of water out of Sumner Lake per year to keep the river continuous, while also ensuring that there is enough water at Brantley Reservoir to meet the contracted irrigation needs of the Carlsbad Project. A variety of supplemental water sources may be required to meet this goal. Currently, the identified supplemental water sources are NMISC Upper Critical Habitat Pipeline, 7 Rivers, and Karr Farm Ponds. Scoping for this project was completed November 2006, and a draft EA will be available late March/Early April 2007, with a final expected June 2007.

Pecos River Restoration at Bitter Lake National Wildlife Refuge EA

The purpose of the Pecos River restoration is to improve riparian and in-channel habitat, extending the reach of connected good quality habitat for the benefit of native aquatic and riparian plant and animal communities. This action meets requirements 2006-2016 Biological Opinion for the Carlsbad Project Water Operations and Water Supply Conservation Environmental Impact Statement (EIS), June 2006. Restoration actions would correct or improve degraded ecological conditions within the Bitter Lake National Wildlife Refuge (NWR) section of the Pecos River caused by excavating straight channels, encroaching nonnative vegetation, and parts of the river to more natural flow conditions within the context of the modern hydrological regime, including reconnecting the river to the floodplain. The proposed action would support the need of the USFWS to implement Bitter Lake NWR comprehensive conservation plan goals and objectives and would support broad Service mandates to restore, preserve, and enhance riparian habitat and the overall mission of the NWR system.

Reclamation has created 56.6 acres of nesting and brood-rearing habitat for Interior Least Terns on the western shoreline of Brantley Reservoir, at and above the Lake's conservation storage pool elevation. Reclamation will create a third, 28-acre site for nesting and brood-rearing in winter 2007, prior to the species' arrival in May. This total of 84+ acres of nesting and brood-rearing habitat will be maintained through regular vegetation removal for the next 10 years. In addition, Reclamation will monitor for possible tern nesting activity thought this period of time. This activity meets RPM numbers 1 and 2 for the Interior Least Tern from the 2006-2016 Biological Opinion.

Based on Reclamation resource specialists' review of the proposed action alternative, Reclamation has determined that this action would not have a significant adverse cumulative effect on any resources. The two projects that are reasonably foreseeable and that could potentially result in a cumulative effect are beneficial to the resources found in the project area and documented in this EA.

Chapter 4. Consultation and Coordination

List of Preparers

Name	Agency	Education	Responsibilities
Marsha Carra	Reclamation	BS Geography/Anthropology	NEPA Specialist
Gary Dean	Reclamation	BS Fish Biology	ESA Project Lead for Pecos
Rob Doster	Reclamation	PhD Biology	Wildlife Biologist
Kim Greenwood	Reclamation	MA Journalism/Anthropology	Project Lead
Jeff Hanson	Reclamation	PhD Anthropology	Lead Anthropologist
Mark Hungerford	Reclamation	BS Anthropology	Archaeologist, Project Lead for Pecos
Tim Murrell	Interstate Stream Commission	Master of Community and Regional Planning	NEPA Specialist
Aleta Powers	ERO Resources Corporation	MS Environmental Sciences	NEPA Specialist

List of Agencies and Persons Consulted

Steve Massey, Manager
Eddy County
101 W. Greene, Ste. 225
Carlsbad, NM 88220

Carlsbad Irrigation District
William Ahrens, President
201 South Canal
Carlsbad, NM 88221

U.S. Fish and Wildlife Service
Ms. Marilyn Meyers
New Mexico Ecological Services Field Office
2105 Osuna Road NE
Albuquerque, NM 87113

New Mexico Department of Game and Fish
Mr. Shawn Denny
One Wildlife Way
Santa Fe, NM 87507

New Mexico Department of Game and Fish
Pecos Valley Wildlife Area Supervisor
Richard Artrip, Manager
PO Box 124
Lakewood, NM 88254

Lt. Col. Bruce Estock
U.S. Army Corp of Engineers
4101 Jefferson Plaza NE
Albuquerque, NM 87109

Michelle Ensey
New Mexico of Cultural Affairs
Historic Preservation Division
Bataam Memorial Building
407 Galisteo Street, Suite 236
Santa Fe, NM 87501

Jack Callaway
Central Valley Electric Cooperative, Inc.
1505 N. 13th
Artesia, NM 88211

Gill Moutrey
Seven Rivers, Inc.
P.O. Box 1598
Carlsbad, NM 88221

Chapter 5. Related Environmental Laws and Directives

The following is a list of selected statutes, regulations, and EOs that apply to actions discussed in this EA:

National Environmental Policy Act (NEPA) of 1969, as amended

Fish and Wildlife Coordination Act (FWCA) of 1934, as amended

Endangered Species Act (ESA) of 1973, as amended

Migratory Bird Treaty Act (MBTA) of 1918, as amended

Clear Air Act (CAA) of 1963, as amended

Clean Water Act (CWA) of 1977, as amended

National Historic Preservation Act (NHPA) of 1966, as amended

Native American Graves Protection and Repatriation Act (NAGPRA)

Resource Conservation and Recovery Act (RCRA), as amended

EO 11988 (Floodplain Management)

EO 11990 (Wetlands)

Secretarial Order 3175 (Indian Trust Assets)

EO 12898 (Environmental Justice)

Chapter 6. Literature Cited

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U.S. Department of the Interior, Bureau of Reclamation (Reclamation). 2006a. Long-term Miscellaneous Purposes Contract Final Environmental Impact Statement Eddy County, New Mexico. Statement Filing Number: FES 06-19. Joint Lead Agencies: U.S. Department of the Interior Bureau of Reclamation, Technical Service Center, Denver, Colorado and New Mexico Office of the State Engineer, Interstate Stream Commission, Santa Fe, New Mexico. Available at: http://www.usbr.gov/uc/albuq/library/eis/carlsbad/cmpc.html

U.S. Department of the Interior, Bureau of Reclamation (Reclamation). 2006b. Carlsbad Project Water Operations and Water Supply Conservation EIS. Statement Filing Number: INT-FES-06-10. Joint Lead Agencies: U.S. Department of the Interior Bureau of Reclamation, Technical Service Center, Denver, Colorado and New Mexico Office of the State Engineer, Interstate Stream Commission, Santa Fe, New Mexico. Available at: http://www.usbr.gov/uc/albuq/library/eis/carlsbad/feis/index.html

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Appendix A. Corps 404 Nationwide Permit

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
EL PASO REGULATORY OFFICE
PO BOX 6096
FORT BLISS TX 79906-0096

February 20, 2007

Operations Division
Regulatory Branch

Peggy Ulman
Marron and Associates, Inc.
7511 Fourth Street NW
Albuquerque, NM 87107

Dear Ms. Ulman:

This replies to your January 5, 2007, letter regarding the New Mexico Interstate Stream Commission's proposed installation of a pipeline system to convey groundwater from wells to Brantley Reservoir, near Carlsbad, Eddy County, New Mexico. We have assigned Action No. SPA-2007-72-ELP to this activity. The proposed pipeline would require crossing two ephemeral streams, and installing an outfall structure in a wetland area adjacent to Brantley Reservoir.

The Corps of Engineers has published Nationwide Permits pursuant to Section 404 of the Clean Water Act (33 CFR 330). Nationwide Permit No. 12 authorizes discharges of dredged or fill materials into waters of the United States for Utility Line Activities. Nationwide Permit No. 7 authorizes discharges of dredged or fill materials into waters of the United States for Outfall Structures and Maintenance. Summaries of Nationwide Permit Nos. 12 and 7 are enclosed for your information.

The New Mexico Interstate Stream Commission's utility line and outfall structure can be constructed under authority of the nationwide permits. The permittee must insure compliance with all conditions of the permits, including submittal of the enclosed Compliance Certification required by General Condition No. 14. In addition to the conditions described in the permit summaries, the following Special Conditions must be met:

SPECIAL CONDITONS for SPA-2007-72-ELP

1. The Permittee shall implement the Wetland Restoration and Habitat Enhancement (stipulated on page 20-22 of the Wetland Determination and Delineation for the Proposed Seven Rivers Pipeline in Eddy County, New Mexico - prepared by Marron and Associates, Inc., November 2006) proposed as mitigation for the permanent loss of 1312 square feet of wetland associated with the

installation of the outfall structure (copy enclosed). The mitigation plan can be summarized as follows: Approximately 4150 square feet of disturbed wetland and shoreline habitat would be restored by planting approximately 95 coyote willow whips and 12 cottonwood trees (as cottonwood poles).

2. The Permittee shall follow the planting techniques and installation timeline as stipulated in the referenced document in Special Condition 1, including an annual submittal of a report, with photographs, to the El Paso Regulatory Office for three years (beginning at the completion of the installation of the mitigation) to demonstrate mitigation success. Success criteria for the coyote willow and cottonwood tree plantings will be reasonable and practicable, and in the event the plantings, or a significant portion thereof, fail to survive, replanting may be required to maintain permit compliance.

Portions of the proposed project are located in ephemeral streams. Water quality certification for activities in ephemeral streams was issued by the New Mexico Environment Department (NMED) on March 15, 2002, for use of this nationwide permit (copy enclosed). Please note the special conditions in the certification.

Other portions of the proposed project are located in jurisdictional wetland. You are required to contact the NMED prior to discharging dredged or fill material to obtain a water quality certifcation for these portions. It is the understanding of the Corps you have initiated this process. Under separate cover I am providing the NMED (POC Chris Canavan 505-647-7926) information about this project.

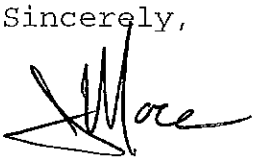
General Condition No. 11 requires that no activity is authorized under any Nationwide Permit which is likely to jeopardize the continued existence of a listed or proposed threatened or endangered species, as identified under the Federal Endangered Species Act, or which is likely to destroy or adversely modify the critical habitat of such species. We have determined that your proposed work, as described, will have no effect on any listed or proposed endangered or threatened species or its critical habitat.

This verification will be valid for 2 years unless the nationwide permit is modified, reissued or revoked. The verification will remain valid if, during that time, the nationwide permit is reissued without modification or the activity complies with any subsequent modification of the nationwide permit authorization. If the nationwide permit

authorization expires, is suspended, revoked, or modified such that the activity would no longer comply with the terms and conditions of the nationwide permit, the provisions of 33 CFR 330.6(b) will apply.

If you have any questions regarding these regulations, please feel free to write or call me at (915) 568-1359 or by e-mail at james.e.mace@usace.army.mil.

Sincerely,



James E. Mace
Chief, El Paso Regulatory Office

3 Enclosures:

1. Nationwide Permit Summary
2. Compliance Certification form
3. WQ Cert Ltr

Copies furnished:

NMED, Las Cruces

USACE, El Paso

Certification of Compliance
with Department of the Army Nationwide Permit

Action Number: **SPA-2007-72-ELP**

Name of Permittee: **New Mexico Interstate Stream Commission**
Attn: Timothy R. Murrell

Nationwide Permit: **No. 12, Utility Lines**
No. 7, Outfall Structures and Maintenance

Upon completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the following address:

District Engineer
Albuquerque District, Corps of Engineers
ATTN: Regulatory Branch
4101 Jefferson Plaza, NE
Albuquerque, New Mexico 87109-3435

Please note that your permitted activity is subject to a compliance inspection by an Army Corps of Engineers representative. If you fail to comply with this permit you are subject to permit suspension, modification, or revocation.

Please enclose photographs showing the completed project (if available).

I hereby certify that the work authorized by the above referenced permit has been completed in accordance with the terms and conditions of the said permit, and required mitigation was completed in accordance with the permit conditions.

Date Work Started _____

Date Work Completed _____

_____ _____

Date Signature of Permittee

Appendix B. Cultural Resource Documentation

Preserving America's Heritage

March 6, 2007

Ms. Connie L. Rupp
Area Manager
Bureau of Reclamation
Albuquerque Area Office
555 Broadway Boulevard NE, Suite 100
Albuquerque, NM 87102-2352

Ref: Proposed Seven Rivers Water Pipeline Project
Eddy County, New Mexico

Dear Ms. Rupp:

We are in receipt of your notification dated February 9, 2007, and supporting documentation indicating that the referenced undertaking will adversely affect properties eligible for listing in the National Register of Historic places. Based upon the information you provided, we have concluded that Appendix A, *Criteria for Council Involvement in Reviewing Individual Section 106 Cases*, of our regulations, "Protection of Historic Properties" (36 CFR Part 800) does not apply to this undertaking. It is our understanding, based on conversations with your office and the New Mexico State Historic Preservation Officer (SHPO), that the potential adverse effects from this undertaking can be resolved successfully without ACHP involvement. However, should circumstances change and you determine that our participation is required, please notify us.

Pursuant to 36 CFR 800.6(b)(1)(iv), you will need to file the final executed Memorandum of Agreement, developed in consultation with the New Mexico SHPO and other consulting parties, and related documentation with us at the conclusion of the consultation process.

Thank you for providing us with the opportunity to review this undertaking. If you have any questions or require further assistance of the ACHP, please contact me at 202-606-8582, or e-mail me at nbrown@achp.gov.

Sincerely,

Nancy J. Brown
Historic Preservation Specialist
Federal Property Management Section
Office of Federal Agency Programs

Ysleta del Sur Pueblo
Tribal Council
119 S. Old Pueblo Rd. • P.O. Box 17579 • El Paso, Texas 79917 • (915) 859-8053 • Fax: (915) 859-4252

ORIGINAL

March 7, 2007

Ms. Connie L. Rupp, Area Manager
United States Department of Interior
Bureau of Reclamation
Albuquerque Area Office
555 Broadway Blvd. NE, Suite 100
Albuquerque, NM 87102-2352

Dear Ms. Rupp:

This is in response to your correspondence received in our office on February 14, 2007 in which you provide Ysleta del Sur Pueblo the opportunity to comment on the Seven Rivers Pipeline Project.

While we believe that this project will not adversely affect traditional, religious or culturally significant sites of our Pueblo and have no opposition to it, we would like to request consultation should any discovery made during this project be determined to fall under NAGPRA guidelines. Copies of our Pueblo's Cultural Affiliation Position Paper and Consultation Policy are available upon request.

Thank you for allowing us the opportunity to comment on this project.

Sincerely,

Arturo Senclair
Tribal Governor

AS:svg

DRAFT DATA RECOVERY PLAN

Introduction

The proposed data recovery plan is to conduct limited excavations at LA-154410 on the Seven Rivers Pipeline Project. LA-154410 is a newly recorded archaeological site. It was recorded by Marron and Associates, Inc. on September 8, 2006. Marron recorded the site during a Class III cultural resource survey for the New Mexico Interstate Stream Commission. The Seven River Pipeline Project is a 42-inch waterline that runs though Bureau of Reclamation, State and private land. The area of potential effect or the construction easement is 30m wide along the pipeline alignment. The depth that the pipeline will be buried will vary from 3 feet to 18 feet. LA-154410 is a prehistoric site that the alignment will run though (See map for LA-145510). As the pipeline passes though the site, it will impact two features (F.1 and F.2). To mitigate this impact Reclamation has developed a data recovery plan for LA-154410.

Reclamation also recommends that all sites identified in Marron and Associates cultural resource report, except LA-112630, LA-154405, LA-146114, LA-139063, LA-155596, LA-155597 and LA-83766, are monitored during construction and all historic structures within the APE should be avoided. Monitoring on LA-146114 should take care to avoid Area 2 and monitoring on LA-154409 should help to avoid all features on this site. Monitoring of LA-146115 should be done to ensure avoidance of Area 1. If they can not be avoided, then a mitigation plan for these sites will be necessary. If this is the case, all work on these sites will stop until mitigation plans are finished and applied. If artifacts are encounter during monitoring, they will be given a point province, bag and label. All artifact recovered from this project will be given to Reclamation. LA-154402, LA-154403, LA-154406, LA-154409 all have acequias on them. Reclamation recommends that all of these acequias be avoid. These acequias are consider active by the area residents and are more than 50 years old. Six historic building were identified during this survey. Building 1 though 5 may be eligible under Criterion A; they could be considered a historic district. Because of this, Reclamation recommends that Building 1 though 5 are eligible for consideration for the National Register. Building 6 is not recommended for listing on the National Register because it is no longer in context and has been modified. All of these historic structures should be avoided. Reclamation recommends that all sites identified in Marron and Associates cultural resource report and Addendum A except LA-139063, LA-155596, LA-155597 and LA-146113, are eligible for listing in the National Register. The New Mexico Interstate Stream Commission will have their contractor provide additional archival research on all sites that are of an undetermined eligibility to mitigate potential effects.

Environmental Setting

Overview: The majority of the following sections were taken from Salo, Lintz and Gibbs "Prehistoric Properties in the McMillan-Avalon Segment of the Middle Pecos River: National Register of Historic Places Multiple Property Documentation Form and Corresponding Nominations." The southwestern deserts of North America rank among the most diverse ecosystems in the world, a condition that provides some offset to the general lack of abundance of resources for the inhabitants of a marginal environment. Southeastern New Mexico is an arid to semi-arid region in the northern reaches of the Chihuahuan Desert. Water is scarce in the Desert Southwest, and access to this resource has long been the driving force shaping the interrelationships among plants, animals, and human lifeways. Although shifting climatic conditions have altered past environments, the region has generally remained warm and dry throughout its period of human occupation. Opportunistic decisions prompted by ever-changing conditions and priorities link people to their environment and contribute to cultural variability. The dry lands of the northern Chihuahuan Desert contain sparse, but diverse, plant and animal life within a setting of sharp ecological contrasts.

Physiographic and Topographic Setting: In southeastern New Mexico, there are three, interconnected, major physiographic features: the Pecos Valley, the Llano Estacado (Staked Plains), and the Sacramento Slope. The Pecos Valley is bordered on the east by the Llano Estacado, a part of the High Plains section of the Great Plains province. The Sacramento Slope lies west of the Pecos Valley.

All of the study area lies within the Pecos Valley. The Pecos River and the associated landforms and terraces form a broad north-south corridor through southeastern New Mexico. The river starts in the Sangre de Cristo Mountains where it flows south and eastward for approximately 900 miles. It enters the Rio Grande near Langtry, Texas. Today the Pecos River is a tamed watercourse with multiple dams controlling its flow (Sheridan 1975).

Permian bedrock underlies most of the Pecos Valley. Its chief constituents are dolomite, limestone, sandstone, shale, and gypsiferous and saline evaporatives (Hawley 1986). Dissolution of these bedrock units is a constant process and may have begun in the Jurassic period. Numerous dissolutions and sinking depressions, including the valley occupied by the Pecos River and the Carlsbad Caverns, developed in these Permian units. At least three massive collapses under the lower Pecos Valley north of Carlsbad occurred during the Quaternary period. This allowed the ancestral lower Pecos River to cut downward and capture the headwaters of east-flowing streams crossing the plains (Hawley et al. 1976).

Modern day land use in Eddy County consists of cattle ranching, irrigated crops, oil production, potash, and salt mining. The principal irrigated crops are cotton, alfalfa, sorghum, and grains. Most of the oil-bearing areas are east of the Pecos River, around Artesia, Hobbs, and Carlsbad. The potash and salt-bearing areas are located in the east-central part of the area (Chugg et al. 1971).

Climate: As noted above, the study area lies within the Chihuahuan biotic province (Brown 1994; Dice 1943). The climate of this area is typical of other arid regions of the American Southwest and northern portions of Mexico. The climate of southeastern New Mexico is semiarid and continental, having moderated winters and hot summer days followed by cool nights. From 1961-1990, the average precipitation per year in the study area was 13.32 inches. Most of the delivery comes during June through September, with the months of August and September being when most of the rain falls in this part of New Mexico because dominant southwesterly winds bring moisture from the Gulf of California. Most of the rainfall is delivered through heavy thunderstorms (Chugg et al. 1971). The lowest annual precipitation recorded was 2.16 inches at Lake Avalon just south of the study area in 1917 (Chugg et al. 1971). Average regional snowfall ranges from 1 to 8 inches. As much as 40 inches, however, has fallen in one year at the towns of Hope and Artesia (north of the study area).

Soils: Seven soil associations are found in the Eddy County area. These are

1. Limestone rock land-Ector association (rock land and very shallow, stony and rocky, loamy soils over limestone; on hills and mountains),
2. Reagan-Upton association, (loamy, deep soils and soils that are shallow to caliche; from old alluvium),
3. Reeves-Gypsum land-cottonwood association (loamy soils that are very shallow to moderately deep over gypsum beds, and gypsum land),
4. Kimbrough-Stegall association (loamy soils that are very shallow to moderately deep to caliche; from old alluvium),
5. Kermit-Berino association (sandy deep soils from wind-worked mixed sand deposits)**,**
6. Simona-pajarito association (sandy, deep soils and soils that are shallow to caliche; from wind-worked deposits), and
7. Arno-Harkey-Anthony association (loamy, deep soils from recent mixed alluvium) (Chugg et al. 1971).

The study area lies primarily within the Arno-Harkey-Anthony association. This association consists of deep, nearly level soils on flood plains of the Pecos River. Elevation at this association ranges from 3,000 to 4,200 feet. The major soils of this association developed in calcareous alluvium of mixed origin. The degree of salinity of the soils and the depth of the water table are variable (Chugg et al. 1971).

Arnos soils are deep, light colored, and saline. The water table is usually below a depth of six feet throughout the year, but in areas near the backwaters of Lake McMillan, the water table fluctuates with the rise of the water in the lake. Harkey soils are deep, well drained, and moderately dark colored, and they occur primarily in low terraces. These soils are generally moderate to strongly saline. Anthony soils are deep, well-drained, and light colored that occur on low terraces, and are easily eroded by wind and water. These soils occur in low terraces along the Pecos River, generally south of Lake McMillan. Because of their physical characteristics, Anthony soils are used for irrigated crops, native pasture, and wildlife habitat (Chugg et al. 1971).

Biotic Province

Southeastern New Mexico is an extension of the Chihuahuan Biotic Province and is characterized as arid with vegetation that is characteristic of southwestern mountains and deserts (desert scrub). Fauna predominantly includes rodents (squirrels, pocket mice, rats and mice) and bats, numerous species of lizards, snakes and amphibians (toads, spadefoot toads) plus a variety of waterfowl and birds (Blair 1950; Dice 1943). Specific environmental details are enumerated below.

Vegetation: The study area lies within three vegetation communities: Creosote Desert scrub, mixed scrub (yucca, mesquite, creosote bush), and Mesquite grasslands. Creosote Desert scrub, which dominates most of the vegetation communities in the Chihuahuan desert of New Mexico, is the dominant vegetation community found in the study area. Plants present within the study area include tarbush (*Flourensia cernua*), ocotillo (*Fouquieria splendens*), creosotebush (*Larrea tridentata*), black grama (*Bouteluoa eriopoda*), fluffgrass (*Erioneuron pulchellum*), Alkali sacaton (*Sporobolus airoides*), sand dropseed (*Sporobolus cryptandrus*), broom snakeweed (*Gutierriza sarothrae*), honey mesquite (*Prosopis glandulosa*), saltcedar (*Tamarix ssp)*, whitethorn acacia (*Acacia constricta*), pricklypear cactus (*Opuntia ssp*), and soaptree yucca (*Yucca elata*).

Wildlife: The Chihuahuan Desert of south-central New Mexico contains a diversity of physical environments for wildlife. Physiographic features such as scarps, plateaus, plains, mountains, and drainage systems also influence wildlife distribution. The most common faunal species in the study area are Pronghorn (*Antilocapra americana*), Desert cottontail (*Sylvilagus audubonii*), black-tailed jackrabbit (*Lepus californicus*), coyote (*Canis latrans*), great blue heron (*Adren herodias*), snowy egret, black tern (*Chlidonias niger*), mallard (*Anas platyrhynchos*), American coot (*Fullica americana*), turkey vulture (*Cathartes aura*), red-tailed hawk (*Buteo jamaisensis*), osprey (*Pandion haliaetus)*, American kestrel (*Falco sparverius*), scaled quail (*Callipepla aquamata*), mourning dove (*Zenaida macroura*), western meadowlark (*Sturnella negleta*), barn swallow (*Hirundo ruatica*), cactus wren (*Campylorhyncus brunneicapillus*), northern mockingbird (*Mimus polyglottos*), loggerhead shrike (*Lanius ludovicianus*), greater roadrunner (*Geococcyx californicus*) curved-bill thrasher, (*Toxsostome curvirotre*), chipping sparrow (*Spizella passerina*), and the yellow-rumped warbler (*Dendroica coronuta*). Historically Buffalo (*Bison Bison*) roomed this area.

Aquatic: Numbers of fish species present in a particular basin depend more on geology, climatic and evolutionary history, and size and complexity of the watershed than on elevation or terrestrial vegetation (Brown 1994). The Pecos River contains a diversity of aquatic organisms. Forty-six species, distributed within 13 families, have been reported from the Pecos River. The most common species in the Pecos River are minnows and carps (Brown 1994). This is not surprising

since the majority of native fishes that occur in the Southwest consist of the minnow and sucker families (Brown 1994).

Molluscs: Several fossil mollusc locations have been sampled throughout southwestern New Mexico from the Texas State line to the headwaters of the Pecos River. The sampled locales represent a range of environments, including terrace and lacustrine deposits, cave deposits and archaeological sites (see Leonard and Frye 1975; Metcalf 1974; Murray 1985). Habitat conditions for some kinds of molluscs (e.g., soft mud and muddy conditions) are still present today within the study area, but with closure of Lake Brantley, some riffles have disappeared. In general, the number of molluscan species has declined throughout the Chihuahuan desert. Part of the reason for this decline is the loss of habitat for the terrestrial species (Metcalf 1974). The loss of aquatic species may also be due to contamination by herbicides or insecticides and the introduction of non-indigenous bivalve species (Leonard et al. 1975).

The northern and southern portions of the region exhibit notable geographic differences in the distribution of molluscan fauna. The northern sampling localities (in De Baca, Curry, Roosevelt, and Chaves counties) had more molluscs and represented more species than the sampling localities in the southern areas (Eddy and Lea counties) (Katz and Katz 1994). Shell assemblages found near the current study area include *Heliodiscus eigemnanni, Ausscinea sp, Gryaulus parvus, Pirene mercatoria, Gastropoda pellucida, Amblema sp., Lampsilis sp., and Ligumis sp.* The molluscan collection from archaeological sites along the Pecos River in Eddy County is presented in Table 1. This collection contains eight families, of which three families are pelecypods, two families are aquatic pulmonate snails, and three families are terrestrial snails.

Paleoenvironment: Although the Southwest has generally remained dry throughout the Holocene, paleoenvironmental studies show that climatic fluctuations of the past notably altered the environment at different times. Subsequent changes in the distribution of key floral and faunal resources would have impacted prehistoric economies and land use strategies. Paleoenvironmental research in the Southwest is largely limited to primary areas of archaeological interest, and therefore little has occurred in southern New Mexico. Still, much of the previous work broadly applies to the region as a whole. Among the data used for paleoenvironmental research, packrat midden and dendroclimatological studies in particular have provided important insights.

Table 1
Molluscan Fauna from Archaeological Sites along the Pecos River in Eddy County, New Mexico

Family	*Scientific name*
Pelecypods (bivalves)	
Unionidae (Fresh water mussels)	*Cyrtonaias tampiconensis*
	Popenaias popei
	Lampsilis teres
	L. sp.
Sphaeriidae (Fingernail clams)	*Sphaeirum sp.*
Corbiculidae (Asiatic clams)—recently introduced	*Corbicula fluminea*
Aquatic pulmonates (snails)	
Planorbidae	*Helisoma trivolvis*
Physidae	*Physa sp.*
Terrestrial Snails	
Polygiridae	*Polygra texasiana*
Succineidae	*Succinea grosvenori*
	S. avara
	S. luteola
Spiraxidae	*Euglandina sp.*

Source: Katz and Katz (1985)

Shortly after the end of the Pleistocene, mesic forests prevailed in the Southwest, but the vegetation soon shifted toward the drier, scrubbier deserts of the present. The geologic-climatic work of Antevs (1948) laid the initial framework for climatic reconstruction in North America, particularly in the western United States. Although these results are dated, Antev's model provides a base-line reference point for the more recent environmental studies of the region. Antevs (1948, 1955) divided the post-glacial times of the last 10,150 years, or the "Neothermal," into three different periods: the Anathermal, Altithermal, and Medithermal. The Anathermal represents the period from 10,150 to 7,500 years ago, within which cool and wet conditions diminished as a result of increasing aridity. The Altithermal extends from 7,500 to 4,500 years ago and is associated with an arid period. Also known as the "Long Drought," the Altithermal is the most controversial of Antevs' climatic periods as more research that is recent (discussed below) indicates that extremely dry summer conditions were not as widespread as first thought. The Medithermal represents the last 4,500 years and is characterized by variable climatic conditions of intermittent droughts and wet periods.

Better methods of paleoclimatic reconstruction using data such as macrobotanical remains, pollen, and tree-rings provide increasingly detailed accounts of past environments. Packrat middens are important sources of macrobotanical remains, and midden studies provide better resolution to broad climatic trends. Packrat middens, composed of vegetation within a 100-m area of the nests, are also good calibrators of palynological studies, which rely on samples that can be biased by airborne pollen from many miles away and from different elevational zones. Most notably, Van Devender and Spaulding's (1979) packrat midden study of the Southwest details Holocene climate and vegetation. Large-scale vegetation changes occurred rapidly around 11,000 years ago with the abrupt replacement of Pleistocene piñon-juniper forests by juniper and juniper-oak/oak-juniper woodlands and grasslands. Desert scrub vegetation grew at roughly 1,200 m amsl below its current elevation, maintaining only a patchy distribution in low desert

areas, and not extending into the high desert of the northern Chihuahuan Desert. The 11,000-year mark is considered by Van Devender and Spaulding (1979) to represent the start of the vegetative Holocene.

Woodlands gradually retreated to higher elevations through the early Holocene, with the xeric oak-juniper woodlands of the northern Chihuahuan Desert disappearing by 8,400 to 8,100 years ago (Van Devender et al. 1987:332). Van Devender and Spaulding (1979) originally considered the onset of the middle Holocene to be 8,000 years ago. More recently, Van Devender et al. (1987:345) state that this date may be late based on new data showing that desert scrub and grassland communities were displacing the woodlands of 1,250 and 1,500 m between roughly 9,000 to 8,000 years ago across much of the Southwest. The desert scrub communities of the middle Holocene approximated modern composition in most areas. Middle Holocene packrat middens frequently contain creosote, with ocotillo, a plant absent from late Wisconsinan and early Holocene middens, emerging as a common desert shrub up to 1,350 m in elevation. The northern Chihuahuan Desert of the middle Holocene, however, was not typical of the greater Southwest, consisting of high desert grasslands. Another major shift in Southwest vegetation occurred at the beginning of the late Holocene just over 4,000 years ago, as most desert scrub communities became essentially modern with an increased abundance of plants such as ocotillo, sotol, mesquite, and lechuguilla. The range of creosote expanded substantially from the middle to late Holocene. The northern Chihuahuan Desert was the last Southwestern region to complete the transition to current conditions. Modern grassy desert scrub conditions in southern New Mexico and west Texas replaced the grasslands of the middle Holocene between 1,500 to 2,000 years ago, which covered much of the terrain between 1,200 to 2,000 m. Creosote, lechuguilla, mariola, and white thorn are notable plants that encroached on the grassland communities from patchy distributions in microhabitats.

Packrat midden studies reveal Southwestern biogeography, and by extension, the climatic trends that influenced plant distributions. The loss of piñon and other mesic species from middle elevation woodlands occurred around 11,000 years ago, but a more modern structure of both vegetation and climate did not appear until about 8,000 years ago with the beginning of the middle Holocene. At this time the modern precipitation pattern of monsoonal summers and drier winters was increasing, while the more seasonally uniform precipitation of the late Wisconsinan-early Holocene came to an end. These climatic patterns are indicative of shifts in winter and summer storm tracks across North America, which themselves result from interaction between changes in ocean and continental temperature. The specifics of these interactions are not yet fully understood by researchers. It does appear, however, that as oceans warmed following the North American glacial retreat, Pacific-generated frontal systems lost the strength that previously pushed them across the Southwest as far as the Texas Trans-Pecos. Simultaneously, the larger and warmer Gulf of Mexico and Gulf of California more effectively channeled tropical moisture into the Southwest during the summer. As these precipitation patterns shifted through the middle and late Holocene, desert scrub conditions expanded. Middle Holocene climate does not appear to have been as dry as inferred by Antevs' (1948) Altithermal, and Van Devender and Spaulding (1979:709) dismiss the notion of a "Long Drought" in the Chihuahuan Desert. The establishment of monsoonal summers ensured relatively wet summers compared to those of the Great Basin and Mohave deserts, which are more indicative of the Altithermal. The shift to modern vegetation at the beginning of the late Holocene just over 4,000 years ago (Van Devender and Spaulding 1979; Van Devender et al. 1987) roughly correlates with the onset of Antevs' Medithermal. Late

Holocene climate will be discussed further below. As mentioned above, the shift from grassland to more desert scrub in the northern Chihuahuan Desert was the last of the major vegetation changes in the Southwest. The relatively high elevation, susceptibility to severe winter freezes, and the erosion of well-developed soils in the middle and late Holocene in this region make it uniquely suited for such a biome (Van Devender and Spaulding 1979:709; Van Devender et al. 1987:348).

Holocene vegetation changes also had important impacts on animal life. Juniper and juniper-oak woodlands and tall grass prairies were present, but dwindling and ultimately disappeared in the Southwest

by 8,000 years ago, until these conditions supported more diverse populations of large herbivores. Mammoth (*Mammuthus* sp.) lived shortly into the Holocene, and bison (*Bison* spp.) populations became expansive alongside the grasslands. The retreat of grasslands and woodlands into the higher elevations was pronounced by 8,000 years ago. Large mammals of these times, such as pronghorn antelope, mule deer, and bighorn sheep, became more restricted in their range, retreating with these environs up mountain slopes, while small mammals such as jackrabbit, cottontail rabbit, and small rodents flourished in the basins. Changes in the focus of human subsistence efforts from big game to small game and an expanded plant food base are closely related to these environmental shifts.

Packrat midden studies show large-scale climatic trends in the Southwest that are useful for archaeologists, but more detailed understanding regarding the timing and duration of climatic events is required to support many hypotheses about cultural ecological relationships. Dendroclimatological research by Grissino-Mayer et al. (1997) on a network of tree-ring and archaeological sites in southern New Mexico provides detailed information for the past 1,373 years. Grissino-Mayer et al. (1997) gauge rainfall amounts by year for the past 1,373 years and hypothesize about the implications of periods of abundant rainfall and drought on prehistoric, especially Mogollon, cultures in the Southwest. Tree-ring data were collected at locations in the Organ, San Mateo, and Magdalena Mountains, in addition to data from 12 archaeological sites in the Sierra Mimbres and Sacramento-Sierra Blanca-Capitan Mountains of south-central and southwestern New Mexico. Grissino-Mayer et al. (1997:56-61) recognize three climatic episodes in particular that they find coincident with prehistoric cultural changes in southwestern New Mexico. These episodes of precipitation scarcity and plentitude are as noteworthy for their seasonal variance as for their divergent totals since the seasonal timing of precipitation impacts the local resource structure.

Generally, dry conditions prevailed from 1,250 to 1,000 years ago, with a severe, century-long drought occurring between 1,055 and 955 years ago. This may lend support to archaeological research, which indicates that environmental stress at the time of this drought prompted greater regional interaction with neighboring groups. Favorable conditions of greater, less seasonally variable rainfall following this drought between 955 and 785 years ago appear to correspond with an efflorescence of Mogollon population and culture. Increased population density, more intensive farming, and shifts to Mimbres pottery and above-ground living structures are key changes of Classic Mimbres times between 1,000 and 850 years ago. The onset of these advances appears to conflict with the timing of the drought to some extent, but Grissino-Mayer et al. (1997) note that, although dry, rainfall amounts were increasing from roughly 1,000 years ago. Within the wet period, however, an extreme 16-year drought (A.D. 1080 – 1095/870 - 855 years ago) occurred with low, and highly variable, rainfall. Population movement toward regional centers, particularly Casas Grandes, Mexico, corresponded with the 16-year drought and continued to roughly 700 years ago, when another drought, called the "Great Drought" (A.D. 1227 – 1251/723 – 699 years ago) because of its severity, occurred coincidentally with the collapse of Casas Grandes and the beginning of population migration and aggregation into outlying areas.

From 700 years ago to the present, cooler and wetter conditions were typical, although periodic decadal-length droughts occurred. A large portion of this period (ca. A.D. 1350 – 1750/600 – 200 years ago) is labeled the "Little Ice Age" by some researchers. No close correlation between these seemingly favorable conditions and cultural shifts stand out as population aggregation continued, followed by European encroachment. This contrasts with the increased population density and techno-stylistic ceramic changes concurrent with the previous wet period of 100 to 200 years earlier. Grissino-Mayer et al. (1997:62; also see Grissino-Mayer 1995) hypothesize that the lack of a similar response to favorable conditions is related to dissimilarity in rainfall variability despite similar annual precipitation totals. While the previous wet period exhibited a stable climate with reliable summer monsoonal rainy seasons, past fire scars on trees indicate that Little Ice Age precipitation was more evenly distributed across the year. Moreover, it is possible that tree-ring widths from this time period are exaggerated as a result of lessened evapotranspiration in a cooler environment rather than actual precipitation. In short, the paleoclimatic

record of the Little Ice Age is poorly understood and provides a tenuous basis on which to infer cultural-climatic relationships.

The archaeology of the Pecos River and of southeastern New Mexico is not necessarily tied to the environment in the ways Grissino-Mayer et al. (1997) suggest. There is no one-to-one relationship between environmental and cultural change, and the role of archaeological study is to consider what constitutes a drought or a wet period relative to the cultural buffering mechanisms in place at any given time. Still, south-central and southwestern New Mexico are neighboring areas, and the findings of Grissino-Mayer et al. (1997) provide good starting points for understanding how the archaeology of southeastern New Mexico may address regional issues related to prehistoric interaction and land use

Cultural-Historical Overview

Humans have visited and lived in southeastern New Mexico for over 10,000 years. The following is a brief culture history of the area. The cultural periods used in the overview are presented in Table 2. This sequence includes information derived from the general region, as well as specific information on Archaic periods from Brantley Reservoir (Katz and Katz 1994), and from the ceramic phases based on the eastern extension of the Jornada Mogollon (Sebastian and Larralde 1989).

Table 2
Cultural Periods and Associated Dates for Southeastern New Mexico

Cultural Period		Associated Dates
Paleo-Indian		ca. 10,000 – 5500 B.C.
Clovis		ca. 10,000 – 9000 B.C.
Folsom		9000 – 8200 B.C.
Late Paleo-Indian		8200 – 5500 B.C.
Archaic		5500 B.C. – A.D. 600/900
Early Archaic	(Archaic I)	5200 – 3200 B.C.
Middle Archaic		3200 – 1000 B.C.
	(Archaic 2)	1700 – 1000 B.C.
Late Archaic		1000 B.C. – A.D. 600/900
McMillan Phase	(Archaic 3)	1000 B.C. – A.D. 1
Transitional	(Archaic 4)	A.D. 1 - 500
Ceramic		A.D. 600/900 – 1540
Querecho		A.D. 600/900 - 1150
Maljamar		A.D. 1150 – 1300
Ochoa		A.D. 1350 – 1450
Athabaskan		A.D. 1450 – 1540
Protohistoric		A.D. 1540 – 1650
Historic		A.D. 1650 – present

Paleo-Indian Period (ca. 10,000 – 5500 B.C. / 12,000 – 7,500 years ago)

The Paleo-Indian period represents the earliest known occupation in the area. People during this period relied on mega fauna (predominantly mammoth and *Bison antiquus*) as well as broader-based hunting-and-gathering for their subsistence needs. The Paleo-Indian period is divided into three subperiods marked by different technological complexes. The earliest of these is the Clovis, dating between circa 10,000 and 9000 B.C. This is followed by the Folsom (9000-8200 B.C.), and finally, the Late Paleo-Indian complexes (8200-5500 B.C.).

Paleo-Indian artifacts included distinctive lanceolate projectile points, side scrapers, end scrapers, gravers, modified flake tools, and drills. These tools are sometimes found associated with the remains of extinct mega fauna species. Typically, Paleo-Indian sites are located near playa lakes and relict streambeds or along small rises and ridges. These sites are usually ephemeral, however, and may be difficult to recognize. Differences in topographic settings and artifact and faunal assemblages have led archaeologists to interpret Paleo-Indian sites in terms of function classes, based on the activities inferred to have taken place there. Typical site types of this period include campsites, kill sites, processing sites, and quarry sites (Irwin-Williams 1979).

During the Paleo-Indian period, the climate was vastly different than it is today. It has been marked by continuous environmental change over several thousand years. During the earlier phases, the environment was wetter and cooler. Throughout the course of the Paleo-Indian period, the climate became increasingly arid with greater seasonal variation. These conditions resulted in shifting vegetation patterns and faunal extinctions, which, in turn, affected Paleo-Indian subsistence strategies, settlement patterns, and lithic technologies (Haynes 1975).

Clovis

The earliest Paleo-Indian presence in southeastern New Mexico is defined as the Clovis period. Sites associated with this period are identified by the Clovis point (a basally fluted, lanceolate projectile type), sometimes found in association with mammoth remains. Clovis sites are generally thought to consist of remains that are indicative of kill and butchering activities. These sites are believed to be most often located on landforms with high relief overlooking playas, streams, or marshes. Sites attributed to the Clovis period typically date between circa 10,000 and 9000 B.C. (Sebastian 1989a:24).

Folsom

Around 9000 B.C., the environment changed of southeastern New Mexico. There was a decrease in effective moisture. The Folsom period probably represents an adaptation to this changing environment by human groups. Groups associated with these adaptations are identified by the Folsom projectile point and other diagnostic tool forms. Although this point, like the earlier Clovis, is also a basally fluted, lanceolate form, Folsom points are smaller, have longer channels or flutes, and are parallel flaked, and the lateral grinding extends higher up the point's margin. The few radiocarbon dates available for this period suggest that there is a second type of point, the Midland, which is roughly contemporaneous with Folsom points. The major difference between the two is that the Midland type is not fluted (Sebastian and Larralde 1989:31).

Current evidence suggests that hunting the extinct *Bison antiquus* was a primary subsistence activity during Folsom times, although it is likely that these groups also practiced extensive resource gathering. Sites characteristic of the Folsom period typically date between 9000 and 8200 B.C. (Sebastian and Larralde 1989).

Late Paleo-Indian Complexes

Projectile points associated with the Late Paleo-Indian complexes (8200 - 5500 B.C.) are characterized by a significant increase in morphological variability. The variability in point styles has formed the basis for the definition of a number of different complexes including Firstview, Plainview, Frederick, Agate Basin, Hell Gap, Alberta, and Cody.

Archaic Period (5500 B.C. – A.D. 600/900 / 7,500 – 1,000 years ago)

The Archaic period, lasting some 5,000 to 6,000 years, is ascribed more longevity than other prehistoric cultural period. Despite the fact that many sites in southeastern New Mexico have been assigned to the Archaic period, relatively little is known about this time period. Subsistence adaptations, during the Archaic period, are thought to have generally changed from a reliance on big game hunting to a more broad-based hunting and foraging strategy. Archaic period occupations are distinguished from earlier and later occupations by side- and corner-notched projectile points, bifaces, flake scrapers, and drills. These sites typically consist of lithic and fire-cracked rock scatters that are often situated in areas that overlook drainages.

Sites of this period are usually divided into three general temporal categories: Early, Middle, and Late. This is based on the morphological changes in projectile point types and a number of chronometric dates. In their overview of southeastern New Mexico, Katz and Katz (1994:106-107), however, identified four Archaic phases (some of which include local phase sequences): Archaic 1 through Archaic 4.

Early Archaic (5200 - 3200 B.C.; Archaic 1 of the Katz and Katz 1994:106 sequence) remains appear to be associated with a climatic shift from the relatively moist and cool late Pleistocene to the comparatively arid Altithermal. This transition is thought to have occurred throughout the course of the Early Archaic and appears to have significantly impacted faunal populations. As the Early Archaic progressed, however, increasingly drier conditions led to the extinction of most large faunal species. Johnson (1983) suggests that the shift to a more generalized hunting-and-gathering subsistence strategy, particularly systematic plant-use, was an adaptive response to nutritional stress created by these changing climatic conditions.

Sites of this temporal period may be differentiated from Paleo-Indian and later Archaic occupations by morphologically discrete projectile point types, including straight-stemmed, concave-based varieties (e.g., Bajada) or large, straight-based types (e.g., Jay). Although these projectile point types have not been associated with dated contexts in the region, they date from approximately 5500 B.C. to 3200 B.C. in the Colorado Plateau region (Irwin-Williams 1979). Katz and Katz (1994:106) report that Jay points have been recovered from the Pecos River in Eddy County.

The Middle Archaic, which dates from 3200 to 1000 B.C., has been characterized as a time of shifting subsistence strategies. During the Middle Archaic, there was a change from the manufacture of large, straight-stemmed projectile points, characteristic of the Early Archaic, to smaller or medium-sized, shouldered, and concave-based types (e.g., San Jose, Pedernales, Hanna). In their sequence, Katz and Katz (1994) do not have a phase for this time period.

The climate during the Late Archaic (1000 B.C. - A.D. 600/900) is thought to have been similar to modern conditions. Material culture associated with the Late Archaic includes grinding stones, bifacial tools, and scrapers, as well as baskets, cordage, and snares. The diverse artifact assemblages evident during this time suggest a broader-based subsistence strategy, with an increased emphasis on small game and wild plants. The Late Archaic is also characterized by a substantial increase in medium-sized, corner- and side-notched projectile point styles (e.g., Marcos, Williams, Shumla, and Ensor). These points resemble those associated with the Plains or Central Texas Archaic (Rodgers 1987).

The Katz and Katz's Archaic 2 phase, 1700-1000 B.C., has "no diagnostic projectile points" (Katz and Katz 1994:107). This phase is based on several dated isolated burned rock hearths. Archaic 3 (1000 B.C. - A.D. 1) was earlier defined as the McMillan phase (Katz and Katz 1985). This phase includes several diagnostic dart points. Using a typology developed by Leslie (1979), points associated with this phase include Darl, 8D, and 9. In their overview of the Carlsbad area, Katz and Katz (1994) also employ a

fourth archaic division, the Terminal Archaic that they date to A.D. 1-500. Like the earlier phase, Leslie's (1979) point typology was used to distinguish diagnostic styles of the phase. These include 6C, 6D, 8A, San Pedro, and three varieties of the Pecos point.

Ceramic Period / Formative Period (A.D. 600/900 – 1540 / 1,300/1,050 – 410 years ago)

Beginning sometime between A.D. 600 and 900 and continuing to as late as A.D. 1550, the archaeological record of southeastern New Mexico reflects increasing regional and interregional variability. The Ceramic period, which is part of the Southwestern Formative period, begins with the advent of ceramics. The Ceramic period saw an increase in sedentism and decrease in population mobility, permanent structures, and the cultivation of rudimentary crops. In southeastern New Mexico, a very small percentage of the Ceramic period sites yield evidence of permanent structures. Material remains recovered at various sites have yielded evidence of a mixed subsistence of horticulture and hunter/gatherer food types (Sebastian and Larralde 1989:80). Sites in the area contain bison and deer, and to a lesser extent, small game animal remains. Sites on the Rio Hondo also revealed that the population also exploited river resources, such as fish and mussels (Sebastian and Larralde 1989:81). Another technological advancement in the Ceramic period was the advent of the bow and arrow, which increased hunting capabilities and allowed for a typically Archaic lifestyle coupled with the use of ceramics (Sebastian and Larralde 1989:82). Remains of temporary structures, such as pithouses and rock rings suggest a semi-nomadic lifestyle and included a range of subsistence strategies (Katz and Katz 1994:114).

Ceramics begin to appear in the region in about A.D. 500-750 with brownwares, including Jornada Brown, Middle Pecos Micaceous Brown, and Alma Plain (Katz and Katz 1994:113). Black-on-white pottery first appears in the area between A.D. 750-950, including Red Mesa Black-on-white and Cebolleta Black-on-white (Katz and Katz 1994:114). As the Ceramic period progresses, additional ceramic styles begin to appear. Chupadero Black-on-white, Three Rivers Red-on-terracotta, and El Paso Brownware appear in the region between A.D. 1075 and 1125 as do other graywares. As the Ceramic period comes to a close sometime between A.D. 1300 and 1375 (Katz and Katz 1994), more painted pottery, such as El Paso Polychrome and Chihuahuan wares begin to appear in the region.

The first true arrow points are documented in the Ceramic period, with styles such as the Scallorn, which has a concave base and corner notching. These points are reminiscent of earlier styles of projectile points, but get progressively smaller and thinner. The style of arrow points also begins to change in A.D. 1125 with the advent of side-notched rather than corner-notched points. Hunting continues to play a role during this period. Sites are located predominantly on ridges, cliffs, and arroyos to maximize hunting potential and the water resources of the area (Katz and Katz 1994:118).

The Eastern Jornada Mogollon

Perhaps one of the more influential groups in this area during the Ceramic period was the Jornada Mogollon. The eastern Jornada Mogollon sequence is divided into phases on the basis of changes in settlement patterns and ceramic assemblages. These phases include the Querecho (A.D. 950-1100/1150), Maljamar (A.D. 1100/1150-1300), and Ochoa (A.D. 1350-1450). Collins (1971:88) indicates that the eastern Jornada Mogollon diverged from the western Jornada Mogollon throughout these phases and probably maintained a greater reliance on hunting-and-gathering. Settlements of the Querecho phase are typically nonstructural, open sites that do not appear to correlate with any particular land forms and evidently functioned primarily as gathering campsites (Leslie 1979:187). Artifact assemblages consist of lithic and ceramic scatters and occasionally include groundstone fragments. Ceramics characteristic of this phase include El Paso and Jornada brownwares, Jornada Red-on-brown, San Andres Red-on-terracotta, and Chupadero Black-on-white (Collins 1971). According to Leslie (1979:190), a change in

groundstone morphology from flat, slab metates and manos to oval basin metates and convex-faced manos occurred during this phase.

The Maljamar phase marks a shift in settlement patterns from the predominance of nonstructural camps to the establishment of pithouse villages. Although nonstructural sites are not unknown during this phase, they appear to be relatively few in number. Pithouse villages with as many as 20 to 30 individual structures, usually rectangular in shape, are reported. Leslie (1979:190) suggests that corner-notched projectile points dominate the lithic artifact assemblages until the end of this phase when side-notched types become more frequent. Ceramic assemblages include El Paso Brownware, El Paso Polychrome, Mimbres Black-on-white, Playas Redware, San Andres and Three Rivers Red-on-terracotta, and Chupadero Black-on-white (Collins 1971:88).

At the end of the Maljamar phase, there appears to be a hiatus in occupation that lasted approximately 50 years. At present, the reasons for this apparent abandonment are not clear. Leslie (1979:191) speculates that the inhabitants may have been driven out by Plains groups from the north, although there is little evidence to substantiate this claim. Following this hiatus, the area is reoccupied either by groups that formerly inhabited the area or by groups from areas west of the Pecos River. Leslie (1979) terms this a transitional or Post-Maljamar/Pre-Ochoa phase. During this time, there was a significant increase in ceramic tradeware types. In addition to the types represented at Maljamar phase occupations, Glaze A Red and Yellow, Salado and Chihuahuan polychromes, and Lincoln Black-on-red appear for the first time. Leslie (1979:191-192) suggests that the appearance of these types may represent the migration of indigenous groups, although the establishment of exchange relationships with northern Mexican, western Mogollon, and Rio Grande groups provides an alternative explanation.

The Ochoa phase follows this transitional period. It is differentiated primarily on the basis of changes in architectural construction and an apparent decrease in ceramic diversity. Unlike the previous phases, Ochoa phase settlements consist of clusters of single surface rooms or contiguous room blocks. Early Ochoa phase ceramic assemblages are thought to exhibit diversity similar to those of the Maljamar and transitional phase assemblages. By the end of this phase, however, Ochoa Indented and Chupadero Black-on-white represent the dominant ceramic types.

The end of the Ceramic period is marked by the appearance of Athabaskan groups in the Southwest (Katz and Katz 1994). The Athabaskans, specifically the Apache, were a highly nomadic group of almost exclusive hunter/gatherers. Unfortunately, because of this, the Apache left extremely little cultural remains behind; they rarely used ceramics and their lithic technology was such that it is indistinguishable from nondiagnostic lithics of previous prehistoric periods. With the introduction of the horse in the latter parts of the Protohistoric period, the Apache became increasingly mobile and therefore, more difficult to identify in the archaeological record. The sites that can be attributed to the Apache do have some identifying features, most notably tipi rings, and some diagnostic artifacts, including Ochoa Indented pottery, and two types of projectile points: Washita and Toyah (Katz and Katz 1994:122).

Protohistoric Period (A.D. 1540 – 1650 / 410 – 300 years ago)

Spanish contact begins in A.D. 1540 with the arrival of Coronado and documentation of the indigenous people in the region. Contact between Europeans and the indigenous people in this area were limited in the first hundred years, so the archaeological record does not reflect the effects of Spanish contact. Sites dating from the early Historic period, A.D. 1500 – 1600 still have the same characteristics as those from the Protohistoric period, but two new types of projectile points appear in the archaeological record: the Garza and a different style of Toyah (Katz and Katz 1994:123). In A.D. 1600, delineation occurs in the archaeological record as the Apache began to utilize metal to make arrow points (Katz and Katz 1994:123). Site types occur as agave roasting sites and short-term camping sites. In additional, several

rock art sites and rock shelters may date to this period. In the spring of A.D. 1541, Francisco Vasquez de Coronado and his army of *conquistadores* began their search for the fabled wealth of Quivira. After leaving Pecos Pueblo, the expedition crossed the Llano Estacado north of the Melrose Range en route to the Querecho and Wichita villages of the Texas Panhandle and Southern High Plains region. According to one reconstruction of Coronado's route, the expedition crossed the plains via Frio Draw, passing through present Quay and Curry counties (Lintz et al. 1988:40; after Robinson 1974:45-46). On the return trip, a major portion of Coronado's command appears to have passed within a few miles of Melrose Range via the Portales Valley, before reaching the Pecos River south of present-day Fort Sumner.

Forty years later, in A.D. 1581, a small expedition of missionaries and soldiers, led by Fray Agustin Rodriguez and Captain Francisco Sanchez Chamuscado, traveled from the Galisteo pueblos to the Pecos River, reaching it somewhere in the vicinity of present-day Anton Chico (Sebastian and Larralde 1989:96; after Hammond and Rey 1966:88). The group then traveled down river before heading east to the Canadian River, where it is reported that they killed a number of bison (Sebastian and Larralde 1989:96). The return trip from the Plains to the Galisteo pueblos was apparently by the same route. The Chamuscado expedition returned to Mexico in the spring of A.D. 1582, leaving two friars (Rodriguez and Lopez) behind at the pueblo of Puaray to convert the Pueblo inhabitants (Hordes 1992:156; after Hammond and Rey 1966:6-13, 84-126; Sebastian and Larralde 1989:96).

Overlapping this period is the Spanish attempt to conquer the Indians. Multiple expeditions from A.D. 1580 to 1600 were aimed at Christianizing missions or were attempts at colonization. The ultimate goal of these expeditions was to convert the Indians so they could be used as a source of cheap labor and tribute (Katz and Katz 1985:17). Despite Spain's continued forays into southern New Mexico, the Pecos Valley remained unsettled during the seventeenth century. The Apaches claimed the area between the Rio Grande and the Pecos River, and the Spanish had little control over it (Katz and Katz 1985:27). Trade became an important factor in the Spanish dealings with the Indians. Pueblos in the region produced cotton and corn, which the Spanish traded or acquired through tribute offerings (Katz and Katz 1985:28). The trade activity introduced important items to the Indians in the area, most notably iron, livestock, and horses. The horse, in particular, revolutionized the lifestyle of the Apache, who now could raid with virtual impunity and could extend the range of their trading.

In the fall of A.D. 1582, growing concern for the friars' well being prompted a rescue expedition under the leadership of Don Antonio de Espejo and Friar Bernardino Beltran. The expedition traveled north along the Rio Grande as far as the Piro pueblos. At this point, it was learned that both friars had been slain by the inhabitants of Puaray. This news did not distract Espejo, who made lengthy excursions to Zuni and Hopi villages and to north-central Arizona before returning to Mexico in September 1583 via the Pecos River (Levine 1987:39-41; Sebastian and Larralde 1989:96; after Hammond and Rey 1966:27). While this expedition did not reconnoiter the plains extensively, there is an excellent account of the route down the Pecos provided by Espejo's chronicler, Diego Perez de Luxan (Levine 1987:41).

In A.D. 1590, an unauthorized colonization attempt was made by Gasper Castano de Sosa and a group of more than 170 immigrants (Levine 1987:41; Sebastian and Larralde 1989:96). This expedition followed the route north explored by Espejo some seven years before. De Sosa was subsequently arrested and sent back to Mexico for punishment (Hordes 1992:156; after Hammond and Rey 1966:28-50, 245-326).

Numerous other individuals explored the Southern High Plains during the Spanish exploration and early colonization periods and may have traversed areas near the Middle Pecos, though their exact routes are unclear. These include the travels of Capt. Francisco Leyva de Bonilla and Antonio Gutierrez de Humana, who in A.D. 1593 were in search of the fabled Quivira. Neither of these two explorers ever returned from the Arkansas River region of southern Kansas (Hays et al. 1989:103). In A.D. 1598,

shortly after the first legal colonization of the Rio Grande province, Vicente de Zaldivar Mendoza was sent onto the plains by Juan de Oñate to acquire buffalo meat and other provisions (Sebastian and Larralde 1989:96). Oñate himself traveled to the plains in A.D. 1599 and 1601 and reported encountering Apaches and Plains village groups (Hays et al. 1989:103; Sebastian and Larralde 1989:96-97).

Previous Archaeological Research in the Study Area

In the mid-1970s, Southern Methodist University (SMU), Dallas, Texas, conducted the first professional archaeological work undertaken near the study area. SMU conducted a series of reconnaissance and testing projects, between 1974 and 1976, in relation to the planning for the proposed Brantley Dam and Reservoir. This work was funded by the Bureau of Reclamation under the newly established Archaeological and Historical Preservation Act of 1974. Approximately 33,000 acres were surveyed and 92 sites were documented (Bousman 1974; Henderson 1976). In 1975 and 1976, SMU returned to conduct additional survey on an additional 1,700 acres. During the survey, 19 sites were recorded, including documentation of McMillan Dam (Gallagher and Bearden 1980). In addition to that survey, subsurface testing was conducted on 15 sites.

Between 1980 and 1984, the Agency for Conservation Archaeology at Eastern New Mexico University [Portales], and New Mexico Archaeological Services [Carlsbad], New Mexico, undertook 12 archaeological clearance projects for the Bureau of Reclamation (Etchieson 1983). During these surveys, an additional 56 sites were documented in the study area. The Incarnate Word College, San Antonio, Texas, conducted two surveys, between 1983 and 1985, totaling 5,100 acres, again for the Bureau of Reclamation (Katz and Katz 1985). These two projects documented forty-three sites. A thorough analysis, also, was conducted on 172 previously recorded sites within the Carlsbad Basin in the Brantley Dam area. The scope of the previously recorded site analysis focused on prehistoric sites.

In addition to the larger archaeological surveys, several studies were produced during small oil and gas development projects that have also taken place in the Brantley Dam vicinity since the middle 1970s (Laumbach 1975; Mimiaga 1976), and into the 1980s (Hunt 1983; Self 1983) and 1990s (Frizell et al. 1994; Martin 1992; Sanders 1994). These projects frequently involved previously recorded sites from the Brantley Dam studies.

In 1999, Sagebrush Consultants, Ogden, Utah, conducted a 1,500-acre survey along the Pecos River between Brantley Dam and Avalon Dam as part of Phase II of the Brantley and Avalon Reservoirs Research Management Plan and Environmental Report (Weymouth and Polk 2000). Sixteen previously recorded sites were revisited and 50 previously unrecorded sites were documented. The sites were not fully recorded and the Bureau of Reclamation contracted Geo-Marine, Inc., El Paso, Texas, through Statistical Research, Inc., Tucson, Arizona, to complete the work.

The project identified and assessed cultural resources on lands being transferred from the U.S. Bureau of Reclamation to the Carlsbad Irrigation District. This project was undertaken at the request of Carla Van West of Statistical Research, Inc., Tucson, Arizona, for Signa Larralde of the Bureau of Reclamation, Albuquerque, New Mexico. The work was conducted to comply with Sections 106 and 110 of the National Historic Preservation Act (NHPA) of 1966 (as amended through 1992), the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990, the New Mexico Graves law, and the Archaeological Resources Protection Act (ARPA) of 1979. The survey and assessment project involved four phases of investigations.

A series of specific questions can be formulated for each research issue. Compilations of archaeological information needed in the Carlsbad area has been developed by Geo-Marine, Inc in their nomination

"Prehistoric Properties in the McMillan-Avalon Segment of the Middle Pecos River: National Register of Historic Places Multiple Property Documentation Form
And CORRESPONDING nominations" These research questions are applicable here at LA-154410. Some have been modified. These research domains define the parameters of research questions, and it's possible that the data obtained may not be able to address every question.

1. Settlement Patterns
    - How does LA-154410 fit into the overall pattern of settlement in the region.

2. Seasonality
    - What is the season or seasons of site usage?
    - What is the duration of site usage?

3. Demography
    - What is the inferred size of the residential group?
    - Can the age grade and gender structure reflected by activities and artifacts on site?

4. Subsistence
    - What is the range of plant and animal resources consumed?
    - How were these resources procured and processed?
    - Were resources used immediately or stored and consumed later?
    - Can tool use-wear patterns provide insights into processing patterns?
    - Can residues and chemistry identify what subsistence materials were probably processed?

5. Trade
    - What kinds of non-local materials (marine shells, jewelry, pottery, minerals, flints/obsidians, feathers, medicinal plants, pipes) occur on LA-154410?
    - What do these materials tell us about direction of long distance contacts?
    - What does the frequency of these items reveals about the nature (direct, indirect, down-the-line, etc.) of long distance contacts?

6. Chronology
    - How many components are represented at LA-154410?
    - What is the relative age of the components based on diagnostic pottery and point forms?
    - Are there datable materials available to provide age determinations for components?
    - What is the absolute age of occupations on the site?

7. Environmental Change
    - What were the paleoenvironmental conditions like during periods of occupations?
    - What environmental proxies exist on or near site available to reconstruct environmental conditions?
    - What evidence exists for environmental change in the region?
    - When were the major mesic and xeric periods in the past?
    - Does the timing of environmental change coincide with cultural change?

8. Typology
    - Does the artifact assemblage reflect use of generalized or specialized implements?
    - If distinctive tools (pottery and projectile points) are present, do they change sufficiently to be a cultural diagnostic marker?

- Is diagnostic tool use sufficiently brief to serve as a time marker?
- Which tools best serve as time markers and when were their forms adopted/abandoned?

9. Intrasite Patterning
    - What is the internal structure and organization of activities on site?
    - Is there a correlation in the spatial distances between structures?
    - Does spatial consistency exist in the placement of structures, and specific activity areas?
    - Are activities structured by landform setting?

10. Cultural Affiliations
    - What cultural periods are reflected by diagnostic materials on site?
    - Do the materials represent a single, isolated component, multiple isolated components or multiple non-isolated palimpsests?
    - What evidence exists to identify components that are not reflected by cultural diagnostic materials?

11. Cross-Cultural Interaction
    - What inferences can be derived from the occurrence of foreign goods in the region?
    - How strong are the linkages between people residing in separate areas?
    - Do the outside connections reflect group immigration, or selective adoption of ideas and materials by indigenous people?
    - Is the project area a core residential region or a joint-use co-area shared (seasonally?) by multiple groups?

12. Raw-Material Procurement
    - What resources are available for people to utilize and how were they distributed on the land?
    - What resources were people actually using?
    - Is there a discrepancy in distance or direction between the choices in resource use?
    - What factors may have affected the decision-making process for raw material procurement?

13. Technology
    - What supporting technologies existed to fashion tools and features?
    - What technological steps were used to make tools and features?
    - What organization or labor was involved in making tools and features?
    - What knowledge and skills were used to make tools and features?
    - What stages of production occurred in various parts of the landscape?

Data Recovery Plan

The proposed data recovery plan seeks to conduct limited excavations at LA-154410 on the Seven River Well Pad Waterlines Project. This site was chosen for the following reasons. First, LA-154410 would experience some degree of damage from construction work and traffic, and therefore the cultural deposits there are at risk. Second, surface inspection of these areas has identified dense scatters of fire cracked rock and some lithic. This has led to the hypothesis that subsurface cultural deposits may be present.

Finally, the waterline that is to be constructed for water delivery needs to be laid mostly down the center of a deeply incised dirt road that runs though the site. There are areas where the pipeline is outside of the road but still within a meter of the roadway. The road appears to be below the cultural surfaces but this cannot be proven until a testing plan has been put into action. Verification or rejection of the predicted subsurface features will allow for an assessment of the site and give direction for the waterline location. Additionally, this data could increase the archaeological and educational value of the site by providing a window into the life ways and human ecology of the prehistoric period along the Pecos River in southern New Mexico.

Before any excavations would ensue, controlled surface collections at each excavation unit and all artifacts within the whole APE on LA-154410 will be made. All surface artifacts will be pin flagged. Diagnostic artifacts will be GPS-provenienced. Two 1 meter by 1 meter units will be excavated. These units will be excavated until sterile soil is reached. The locations of these units are as follows. One unit within feature 1 and one unit within feature 2. There will also be a 2 foot backhoe trench excavated down the proposed pipeline rout after the manual excavation of feature 1 and feature 2. The trench will be 30 inches deep and it will run the entire length of LA-154410 along the pipeline route.

If any subsurface features are located they will be excavated and recorded according to accepted archaeological practices. Excavation will leave most of the site intact and preserved. Units will be hand excavated at arbitrary 10-centimeter levels down to sterile soil. Previous work in the area suggests that sterile soil will be reached at approximately 15-25cm below ground surface. Excavation fill will be screened through ¼" hardware cloth or 1/8" hardware cloth if features are encountered. Soil samples from features will be collected for flotation analysis and/or radiocarbon dating. This analysis will be carried out by archaeological contractor. Samples of carbonized material will be collected and wrapped in aluminum foil.

All units will be mapped. For all feature units, artifacts encountered will be mapped, collected, and bagged according to unit, level and feature provenience. Based on previous excavations in the area and the presence of surface artifacts, it is anticipated that the following artifact classes will be recovered: chipped stone artifacts; flaking debris; and fire cracked rock. All opened units will be photographed using digital photography. Each photograph will include a metric scale, north arrow and mug board indicating excavation unit and number. Additional photographs will be taken to document the stages of fieldwork. Soil profiles for all units will be produced and feature plan views and profiles will be drawn. Natural stratigraphy and mapped feature fill will be labeled using a Munsell color chart and standard terms for soil texture. Once excavations are complete, all units will be back filled and all items will be removed from the site except a few datum stakes.

It is not anticipated that human remains will be encountered in these excavations. However, if they are, then excavation of that unit will immediately cease and Reclamation will be notified immediately. Law enforcement will be notified and State Historic Preservation Officer (SHPO) will be contacted by Reclamation. Consultation with Native American tribes pursuant to the Native American Graves Protection and Repatriation Act regarding inadvertent discovery will be undertaken by Reclamation. Tribal consultation regarding the disposition of the remains, including re-burial, will also be undertaken by Reclamation. In addition, tribal consultation regarding the implementation of this data recovery project will be undertaken pursuant to Section 106 of the National Historic Preservation Act. If any subsurface anomalies are identified during construction work on the waterline will stop until consultation over the subsurface cultural features has been concluded.

Monitoring

If artifacts are encounter during monitoring they will be given a point province, bag and label. If any features are encountered work will stop until a mitigation plan is put into place of this feature. Reclamation Soil samples from this feature will be collected for flotation analysis and/or radiocarbon dating. This analysis will be carried out by archaeological contractor. Samples of carbonized material will be collected and wrapped in aluminum foil.

Analysis

Subsequent to the excavations, all cultural material will be temporarily transported to the office of the contractor for analysis. Analysis will address the interrelated research domains.

Lithic Analysis

Analysis of ground stone and chipped stone will address the domains of subsistence resource use and social use of space on LA-154410. A descriptive analysis will include data on raw material type, tool form (e.g. mano or metate), number of worked facets and recycling. Chipped stone tools will be described by form, function and raw material type and flaking debris will be described by raw material type and tool production phase. The relative presence of tool types such as manos, metates, unifacial tools, retouch flakes and bifaces will allow inferences regarding the respective roles of hunting, crop cultivation and food processing. Analyses on tool morphology, raw material type and flaking debris characteristics will allow inferences regarding raw material procurement, tool production, use and discard. Further, these data, in combination with feature data, will aid in defining the life ways of prehistoric cultures in the project area. This in turn will allow inferences about the use of social space by the site's inhabitants.

Ceramics

If any ceramics are recovered from LA-154410 they will be analyzed in terms of surface and temper treatment, cultural historical type, vessel portion (lip, neck, body and base) and vessel type (e.g. jar, bowl). Sherds will also be measured by maximum length, width and thickness. Collectively, ceramic data will be useful in making inferences about feature chronology, function, and to help address the question of intra-site variability of activity areas.

Curation and Report.

Once analysis is complete, the cultural remains will be submitted to the Laboratory of Anthropology in accordance with their procedures manual for submission of archaeological artifacts and records. A draft report will not be submitted to SHPO for review. Pending revisions, a final report will then be submitted to SHPO. Reclamation recommends that the contractor present finding in a public form.

Personnel

The project will be directed by a contractor of NMISC choice. The contractor will follow accepted archaeological practices while conducting this excavation.

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Appendix C. Hydrology Modeling Report for Settlement Agreement

New Mexico Interstate Stream Commission

Model Evaluation of the Adjudication Settlement Agreement

Re: State *ex rel* State Engineer v. L.T. Lewis, et al.
Pecos Settlement

Expert Report

Prepared by:

John Carron, Ph.D.

Hydrosphere Resource Consultants, Inc.

March 10, 2003

Revised: September 27, 2004

Introduction (March 10, 2003)

As part of the Pecos River Adjudication Settlement Negotiations, Hydrosphere was asked to perform model simulations of the proposed Pecos River adjudication settlement terms. The parties to the adjudication negotiations were interested in understanding how the settlement terms would translate into actual water operations, and how those modified operations would impact water supply to the various water users in the Pecos River basin.

This report provides a brief background on the modeling tools, discusses how the adjudication settlement terms were translated into modeling assumptions and rules, outlines the analysis process including definition of the resources of interest, and presents the results of the analysis.

Introduction (September 27, 2004)

During the summer of 2004, the Interstate Stream Commission (ISC) asked Hydrosphere to re-evaluate the terms of the Adjudication Settlement using updated versions of the modeling tools used in the original report of March 10, 2003. The rationale for these additional modeling activities was set forth in Section 3 of the Settlement Agreement.

The original modeling tools have been updated and enhanced as part of several ongoing efforts, including two NEPA EIS programs and the Adjudication Settlement program itself. The models and associated data management tools have been reviewed by several entities involved in these processes, including the Bureau of Reclamation, U.S. Fish and Wildlife Service, the New Mexico State Engineer's Office and Interstate Stream Commission, and various private contractors to these and other interested parties.

Modeling Tools and Processes

A suite of models was used to evaluate the impacts of the proposed settlement terms. The models include a RiverWare model of river and reservoir operations between Santa Rosa Reservoir and Avalon Dam, two MODFLOW groundwater models of the

Roswell and Carlsbad groundwater basins (the RABGW and CAGW models, respectively), a Pecos River Compact accounting model, and various pre- and post-processing tools for performing data input/output functions and post-run analyses. A schematic of the spatial extent of the Pecos basin represented by the models is shown in Figure 1.

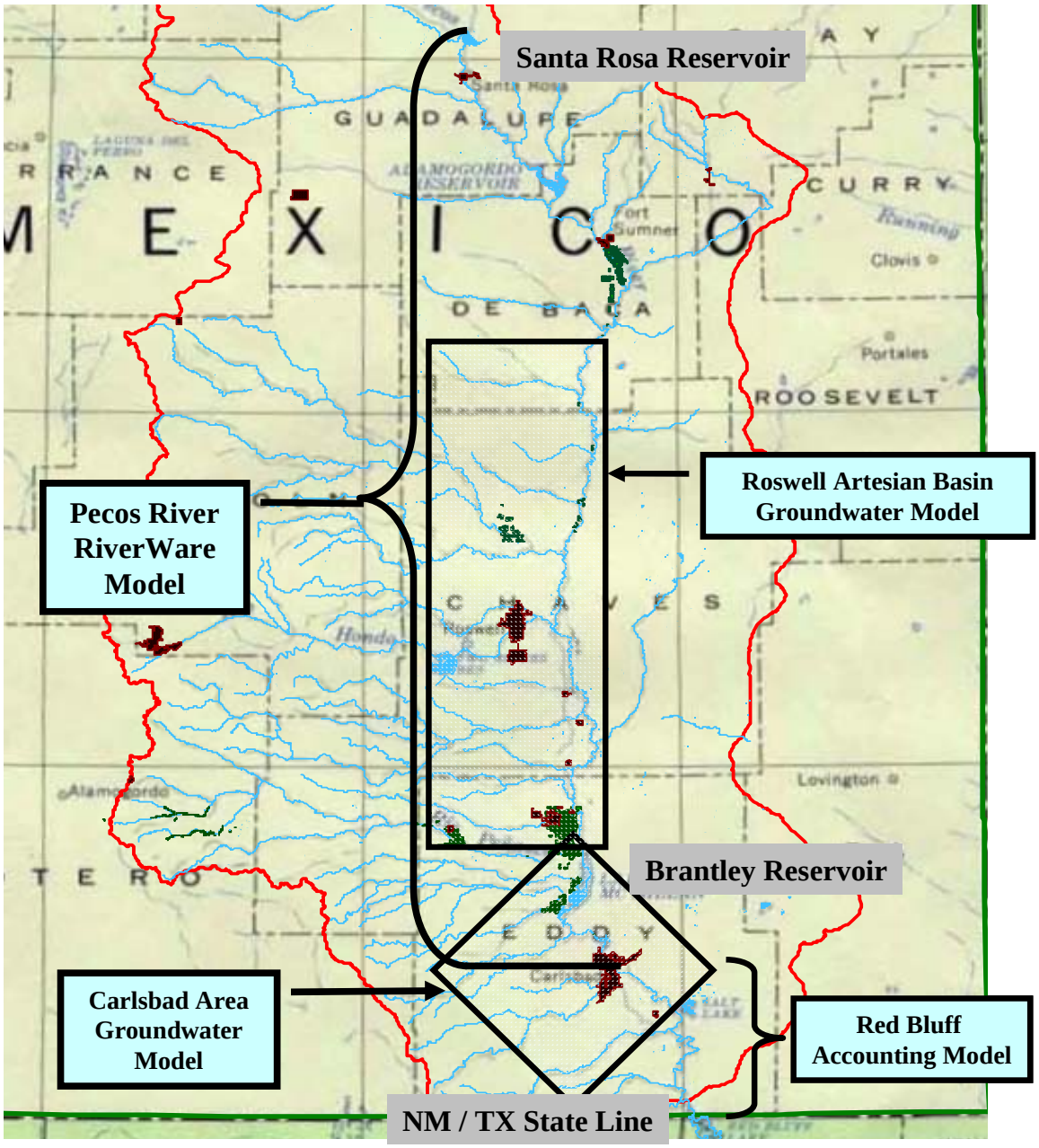

Figure 1. Spatial Extent of the Pecos River Modeling Tools.

Model Objectives and Assumptions

The purpose of this modeling exercise is to evaluate the impact of the Pecos River Adjudication Settlement agreement. The agreement anticipates a combination of land retirement and groundwater pumping with the objectives of: a) permanent compliance with the Pecos River Compact and Amended Decree and, b) avoiding the need for priority administration of water in the basin. Central to achieving these objectives is meeting certain threshold levels of water supply for the Carlsbad Irrigation District (CID). Maintaining these threshold levels is important because of CID's seniority in the basin (the need to avoid a water rights "call") and because water supply shortfalls have a direct impact to stateline flows, and hence Compact compliance.

Two model scenarios were developed for this evaluation. The Baseline scenario, as the name suggests, represents a baseline condition against which proposed actions may be evaluated. However, it only represents those conditions or activities in the basin which are permanent; thus, ongoing temporary leases of water by the ISC and bypass operations for ESA compliance are not considered part of the baseline. The second scenario - termed the Settlement scenario herein - simulates the operation of the system under the Pecos river Adjudication Settlement agreement (the Settlement). The Settlement scenario is essentially a translation of the Settlement agreement into model rules and data. Simulation of the two scenarios, and evaluation of their results, provides an estimate of the changes in water supply that is expected when the Settlement agreement is implemented.

The models rely on historical hydrology for inputs, with current or proposed operational rules superimposed on the hydrologic record. The models are reliable for estimating the long-term impact of implementing a proposed action, but they should not be used in any sense to predict water supply conditions at specific times and locations.

As stated previously, the Baseline scenario is intended to reflect the current operations of the system, minus any ongoing short-term leases or modified operations.

The Settlement scenario is based largely on the Baseline scenario, with certain modified operations. Model assumptions common to both scenarios include:

- Models are based on current / proposed operations and historical hydrology (1967-1996).
- January 1, 2004 reservoir storage levels are used as initial condition for all simulation runs.
- January 1, 2000 aquifer heads are used as initial conditions in the Carlsbad Area Ground Water model.
- January 1, 2000 aquifer heads are used as initial conditions in the Roswell Artesian Basin Ground Water model.
- No augmentation / bypass flows are allocated for the Pecos Bluntnose Shiner.
- Effects of permanent land retirements previously made through the PVACD conservation program and NM ISC are included.
- Acme to Artesia base inflows are generated by the RABGW model, and are based on combinations of historical and statistically generated pumping rates.
- No FSID lands were retired or leased for model runs.
- Total river pumper diversion rates are set at their combined decreed limit of approximately 4,800 acre-feet per year.
- CID allotments are based on 25,055 acres.
- Willow Lake, Harroun, ISC purchased River Pumpers are retired.

The Baseline scenario includes all of the above assumptions, plus:

- The baseline scenario employs 1967 - 1996 historical pumping for the artesian aquifer and alluvial pumping based on statistically-derived estimates using data from 1991-2000.
- CID allotments are based on 25,055 acres. Delivery of CID water to 18,000 acres of irrigated land.
- CID supplemental well pumping limited to 3.0 acre-feet per acre at farm headgate. Model assumes that 14,506 acres may be irrigated by supplemental wells, per latest Hydrographic Survey of decreed lands.
- Avalon releases are due to conservation storage spills only.

The Settlement scenario is modified from the above as follows:

- The settlement scenario assumes the retirement of 11,000 acres in the Roswell Basin; 3,000 acres irrigated by shallow aquifer, and 8,000 acres irrigated by artesian aquifer.
- The settlement RABGW model uses modified stress files; retirement of 11,000 acres and augmentation pumping are distributed uniformly across both the artesian and alluvial aquifers throughout Pecos Valley Artesian Conservancy District (PVACD). Land retirement and augmentation pumping is split between the artesian and alluvial aquifers in an 8:3 ratio (8,000 acres artesian; 3,000 acres alluvial).
- Augmentation pumping in the Roswell basin, from retired PVACD lands, up to 35,000 AF/year and 100,000 AF per 5-year accounting period, occurs when CID divertable supplies at Avalon Reservoir are less than the prescribed target supply volumes defined in the table below.

Table 1. CID Surface Water Supply Thresholds for Augmentation Pumping.

Target Date	Target Supply
March 1	50,000 acre-feet
May 1	60,000 acre-feet
June 1	65,000 acre-feet
July 15	75,000 acre-feet
September 1	90,000 acre-feet

- The model accounts for the purchase of 6,000 acres in CID (by ISC), and delivered or redistributed based on the logical rules below.
- CID allotments are based on 25,055 acres with delivery to 18,000 CID acres.
- CID supplemental well pumping limited to 3.697 acre-feet per acre at farm headgate, per Settlement agreement. Model assumes that 14,506 acres may be

irrigated by supplemental wells, per latest Hydrographic Survey of decreed lands.

- If there is a Compact delivery shortfall, remedy pumping occurs in the Roswell basin and that water is delivered directly to the state line. This pumping occurs in the fall and winter. A 10% transit loss is assumed for all remedy water.
- The distribution of water from 6,000 acres of CID land purchased by ISC is conditioned on the cumulative Compact credit and current water supply (ISC water "yield" = 1.176 x allotment):
  a. If CID irrigators' supply < 50,000 acre-feet, ISC water is reallocated to actively irrigated CID lands up to a total supply of 50,000 acre-feet. Once the 50,000 acre-foot supply level has been reached, ISC may take delivery of water until its allotment is equivalent to that of the irrigators.
  b. If Compact credit < 50,000 acre-feet, and CID irrigators supply > 50,000 acre-feet, deliver ISC water to stateline 5x annually.
  c. If 50,000 acre-feet < credit < 115,000 acre-feet, AND current supply < 90,000 acre-feet, ISC shall make its CID water available for re-distribution to CID irrigators.
  d. If 50,000 acre-feet < Compact credit < 115,000 acre-feet, AND current CID supply > 90,000 acre-feet, ISC may take delivery of additional water over 90,000 acre-feet until its allotment is equivalent to that of the irrigators. Once ISC's allotment is equal to the irrigators, water is alloted to all 25,055 acres equally.
  e. If credit > 115,000 acre-feet, ISC shall make its CID water available for re-distribution to CID irrigators up to the decreed limit (3.697 acre-feet/acre); If CID irrigators have their full allotment, excess water is held over in storage.

Model Analysis and Resource Indicators

Several key resource indicators were identified to evaluate and compare the results of the simulations. These include:

- Pecos river flows at Acme and Artesia.
- Augmentation pumping in the Roswell basin.
- Roswell basin aquifer storage.
- Base inflows in the Acme to Artesia reach.
- CID allotment and Main Canal deliveries.
- CID supplemental well pumping.
- Releases from Avalon Dam.
- Pecos River flow at the Red Bluff gage and total stateline deliveries.
- Pecos River compact obligations and departures.

The results of the model simulations, based on the above resource indicators, are discussed below.

Resource Indicator: Pecos River flows at Acme and Artesia

Flow statistics are generated from the RiverWare model at nodes representing the "near Acme" and "near Artesia" gages (Figures 2 and 3). Augmentation pumping is assumed delivered directly into Brantley Reservoir in the RiverWare model (with a 15% transit loss). Previously, we had estimated the impacts of augmentation pumping on flows at Artesia (Carron, 2003). However, it appears that much of the augmentation pumping will occur below Artesia. In early drafts of the Settlement agreement, there was a clause requiring a minimum flow at Artesia. This clause was not included in the final agreement. We have therefore not included estimates of augmentation pumping on flows at Artesia in this revised report.

Acme Flow Statistics (cfs)		
	Baseline	Settlement
Maximum	7356	6862
Average	114	118
Minimum	0	0
Acme Exceedence Values (cfs):		
50%	19.2	18.7
75%	10.0	9.7
90%	5.5	5.3
95%	3.4	3.3
99%	0.0	0.0

Figure 2: Flow Statistics at Acme.

Artesia Flow Statistics (cfs)		
	Baseline	Settlement
Maximum	10230	10224
Average	165	170
Minimum	9	7
Artesia Exceedence Values (cfs):		
50%	75.9	75.9
75%	50.5	49.2
90%	30.1	29.0
95%	23.2	22.1
99%	15.9	14.1

Figure 3: Flow statistics at Artesia.

Resource Indicator: Roswell Basin Aquifer Storage

Aquifer storage levels are derived from the RABGW model, and represent departures in storage from a pre-development condition. Figures 4 and 5 show the aquifer storage levels for both the artesian and shallow alluvial aquifers as a normalized percentage of the estimated pre-development aquifer storage. Note that the general trend for both aquifers is one of increasing storage throughout the simulation period, due to the combined effects of retired PVACD lands and lower augmentation pumping requirements. The simulations indicate that over the first 30 years following

implementation of the Settlement, the alluvial and artesian aquifers would recover approximately 10% and 20%, respectively, compared to the baseline.

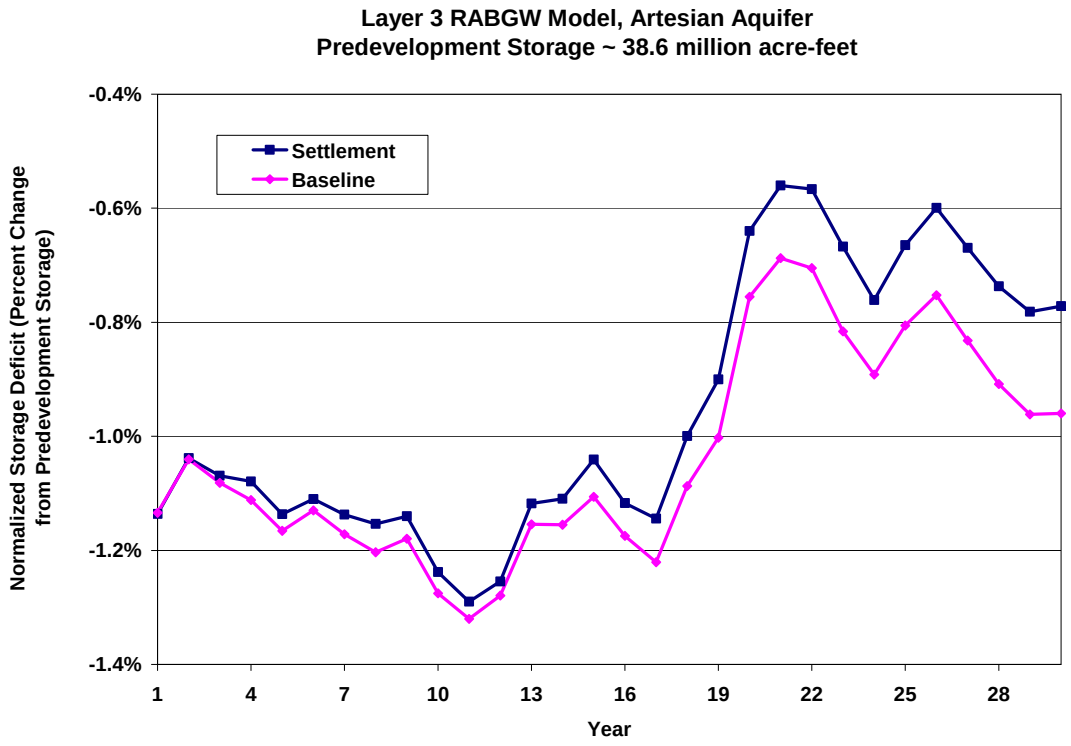

Figure 4: Artesian Aquifer Storage. (Comparison of storage deficit for the baseline and settlement scenarios, normalized against pre-development storage conditions.)

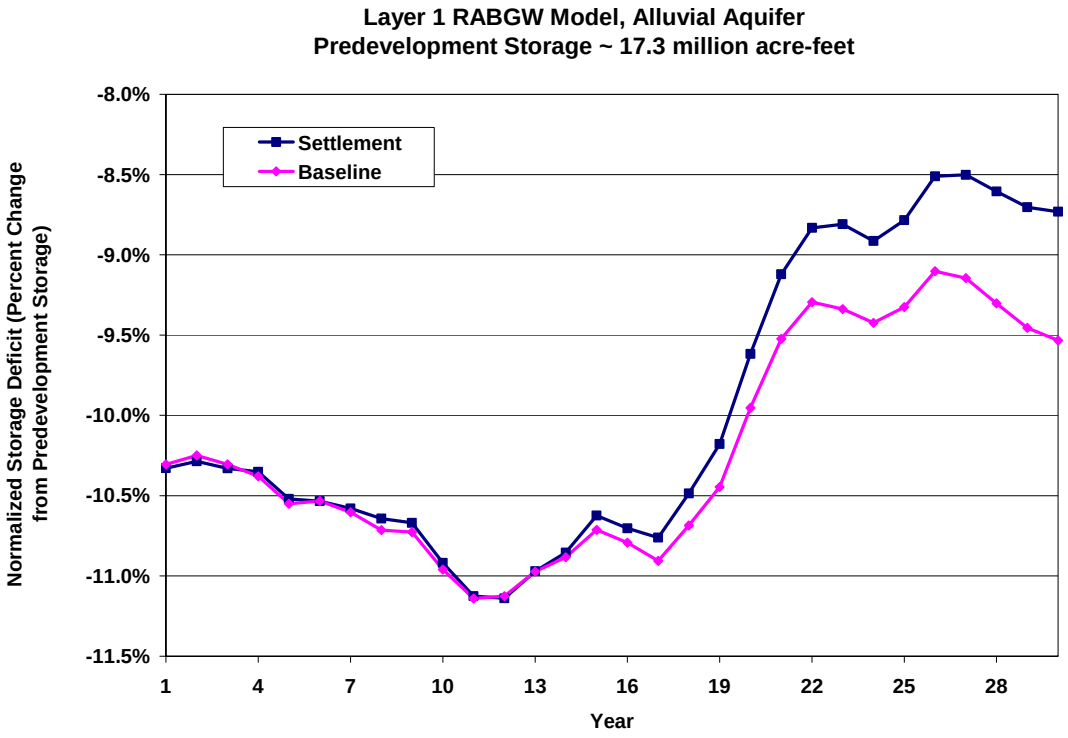

Figure 5: Alluvial Aquifer Storage. (Comparison of storage deficit for the baseline and settlement scenarios, normalized against pre-development storage conditions.)

Resource Indicator: Base Inflows in the Acme to Artesia Reach

Base inflows between Acme and Artesia are generated from the RABGW model and input to the RiverWare model as daily values. RABGW generates monthly average flows, which are distributed evenly over the month when converting from monthly to daily flow values. Annual volumes of baseflows from the RABGW model are shown in Figure 6. The Settlement results indicate an initial reduction in baseflows as compared to the baseline, due to significant augmentation pumping early in the simulation period, followed by a recovery of baseflows to levels equal to and then greater than the baseline. Over the long-term (i.e., beyond the 30-year simulation), we expect the baseflows to continue to increase above what would be seen under the baseline.

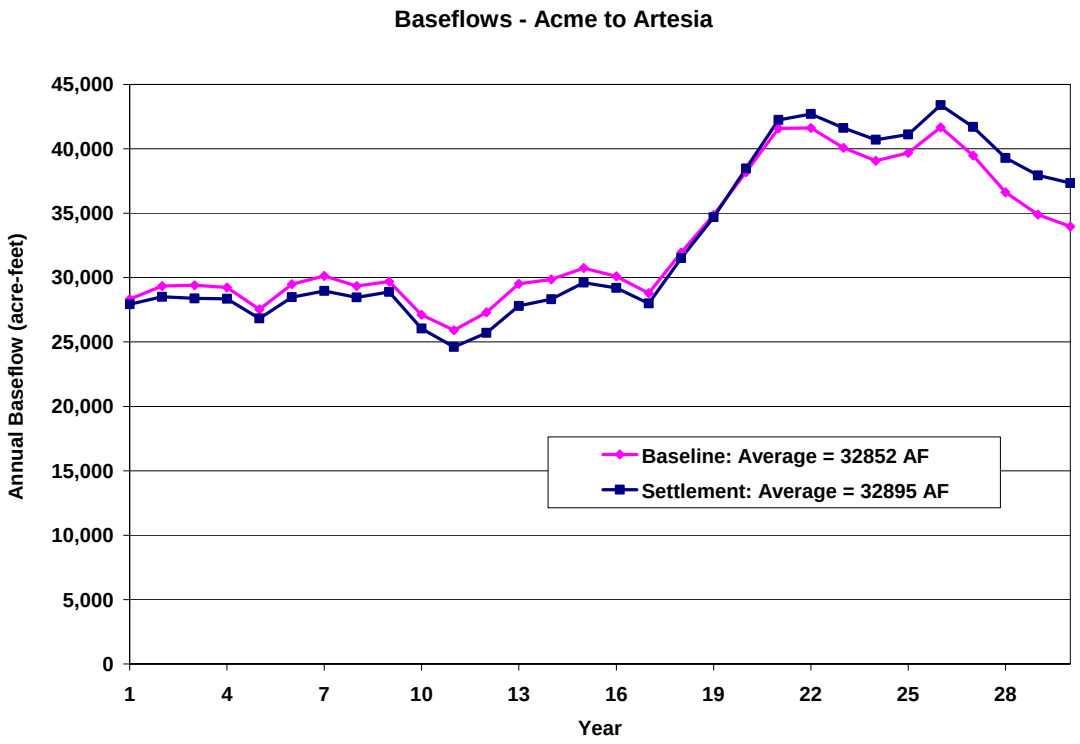

Figure 6: Acme to Artesia Base Inflows.

Resource Indicator: CID Allotment and Main Canal Deliveries

Under the Settlement, ISC would use its purchased PVACD water rights to augment CID's surface water supply it times when the natural CID surface water supply is less than the prescribed thresholds (refer to Table 1). Figure 7 illustrates the amount of augmentation pumping required to provide CID with 50,000 acre-feet of water on March 1 for each year of the simulation.

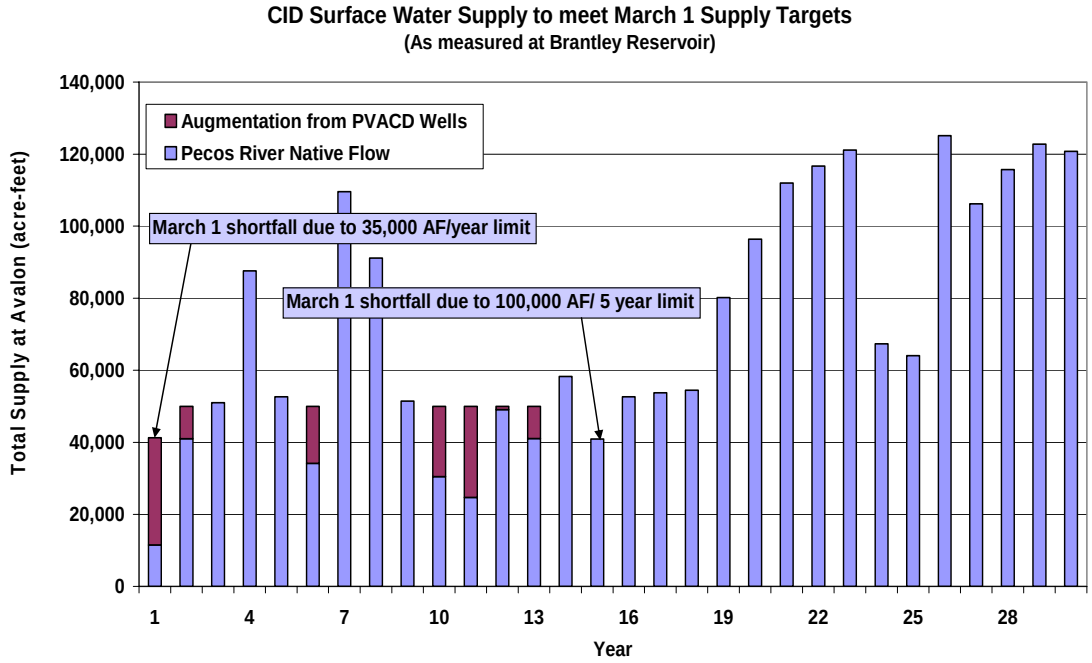

Figure 7. Augmentation Pumping required to meet 50,000 AF March 1 Supply Target.

Total annual water supply, including augmentation pumping, is shown in figure 8. The augmentation component of that supply is shown in figure 9. Note that in many years, there is augmentation pumping even though the total supply exceeds 90,000 acre-feet (Figure 8). In these years, the supply typically is low early in the year, which triggers augmentation, but later increases due to large precipitation and flood events. From figure 8, the impacts of the 35,000 acre-foot annual limit and 100,000 acre-foot 5-year limit can clearly be seen. In years 1 and 11, for example, the 90,000 acre-foot supply target cannot be met due to the annual augmentation pumping limit. Also compare the values to targets for years 10, 14, and 15 where the total supply is less than 90,000 acre-feet because augmentation pumping is constrained by the 5-year 100,000 acre-foot limitation.

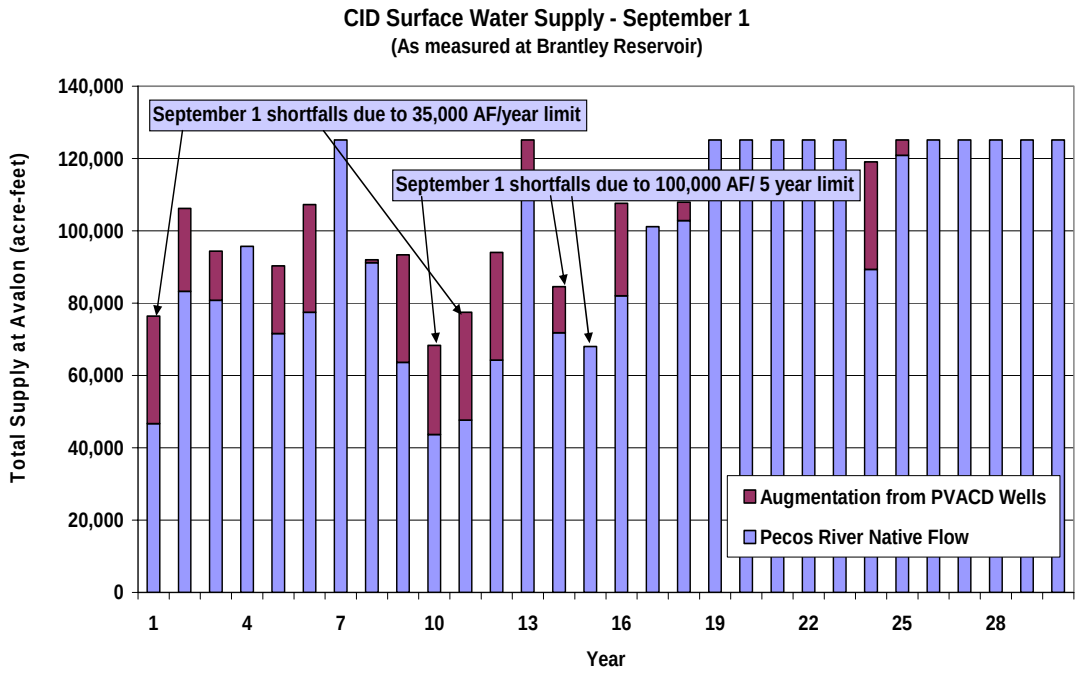

Figure 8. Total CID Supply from "Natural" and Augmentation Sources.

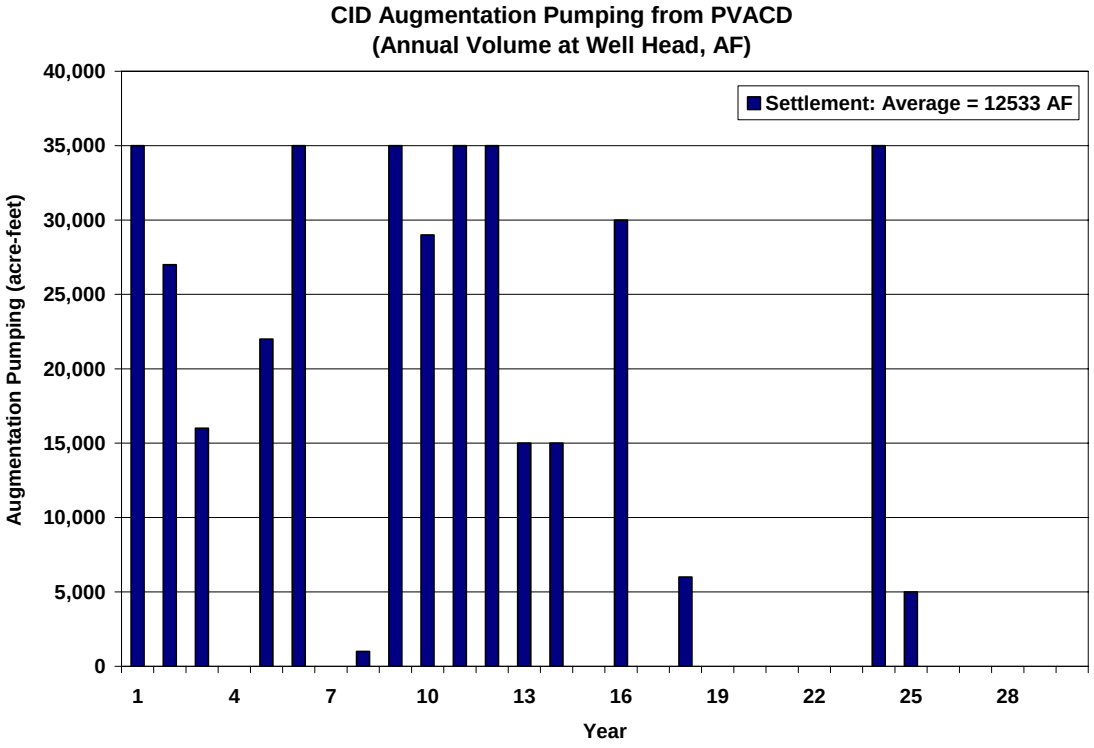

Figure 9: Settlement Scenario Augmentation Pumping from PVACD.

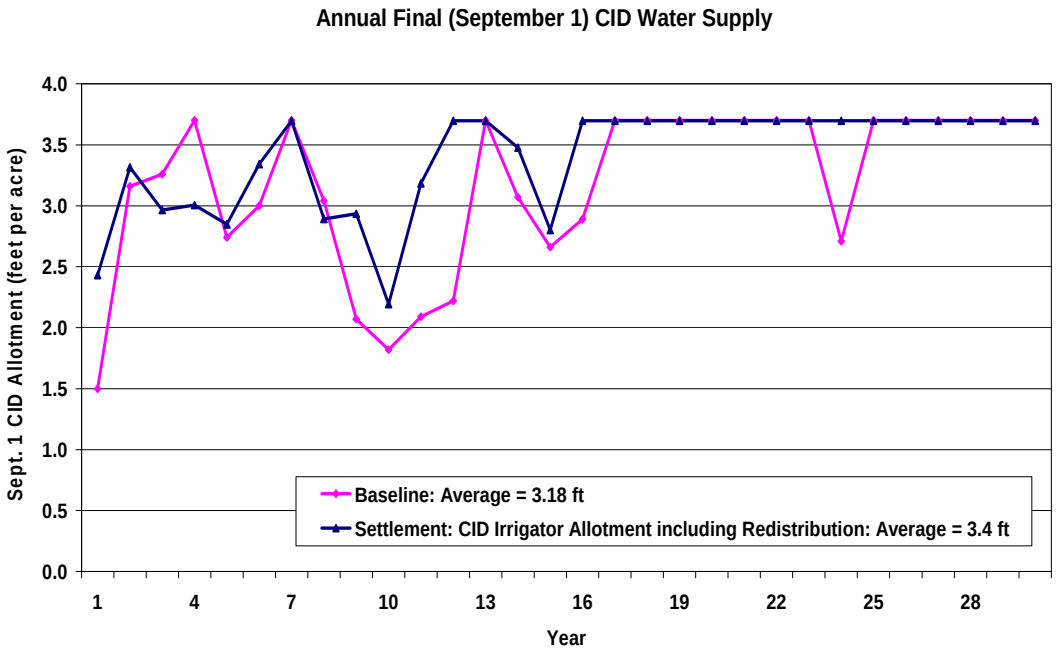

Figure 10: Comparison of CID Allotments under Baseline and Settlement Scenarios.

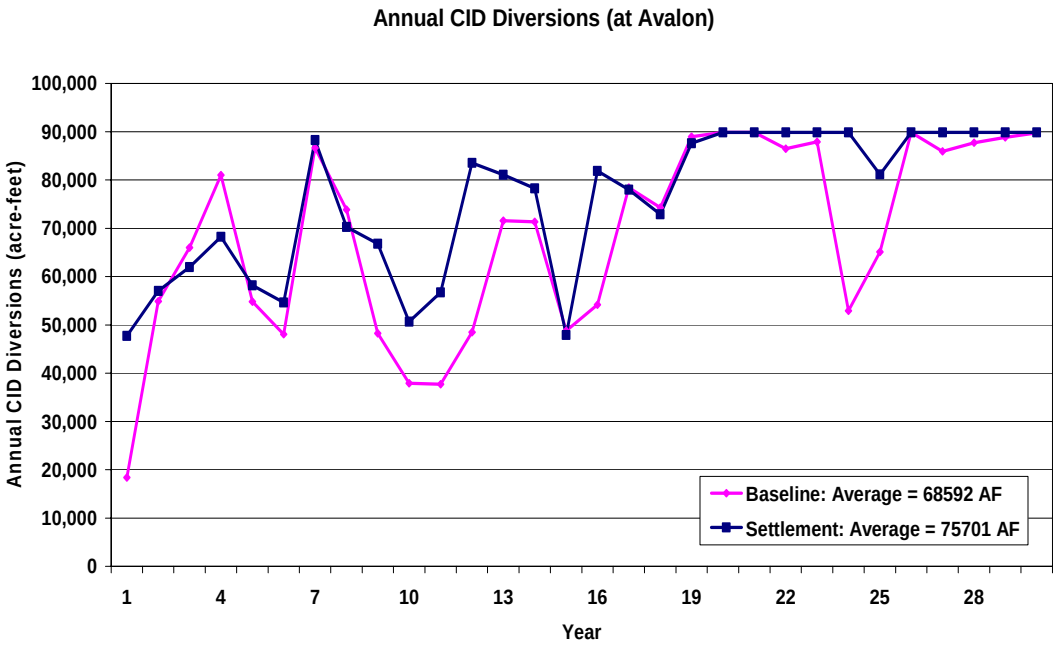

Figure 11: Comparison of Actual Diversions to CID Main Canal. Both scenarios assume 18,000 acres actively irrigated.

Another significant feature of the Settlement is the re-distribution of ISC's CID rights under certain water supply and Pecos River Compact conditions. Figure 10 shows the change in allotments under the two scenarios. The increase in total allotment reflects the combined impact of land retirement, augmentation, and redistribution. The average increase in water available for irrigators due to implementation of the Settlement is 0.22 feet per year. Notice also that the Settlement tends to significantly benefit CID in dry years. Under the baseline scenario, the minimum final allotment was 1.5 feet per year, while under the Settlement, the minimum was about 2.2 feet per year. This benefit extends into the early part of the irrigation season as well. The minimum March 1 allotment increased from 0.55 to 1.21 under the Settlement scenario. This increase in early-season allotment translates into a higher proportion of early-season irrigation water coming from surface supplies as opposed to supplemental wells.

Figure 11 shows the total actual diversions from Avalon Reservoir into the CID Main Canal. Total annual diversions increase by about 7,100 acre-feet annually, or about 10%. This is equivalent to about 0.29 feet per irrigated acre.

Supplemental well pumping results are shown in Figure 12. Under the proposed settlement, supplemental well pumping limits would be increased from 3.0 to 3.697 feet per acre, to offset any potential under-deliveries of surface water. Total supplemental well pumping is increased under the settlement scenario by about 1,800 acre-feet per year. It is worth noting that as much as 12,500 acre-feet per year of supplemental pumping is due to the increase in the decree limit for the supplemental well rights, and not because of a reduced CID water supply. If the 3.0 feet per acre limit was in place under the Settlement, supplemental pumping would in fact be significantly reduced.

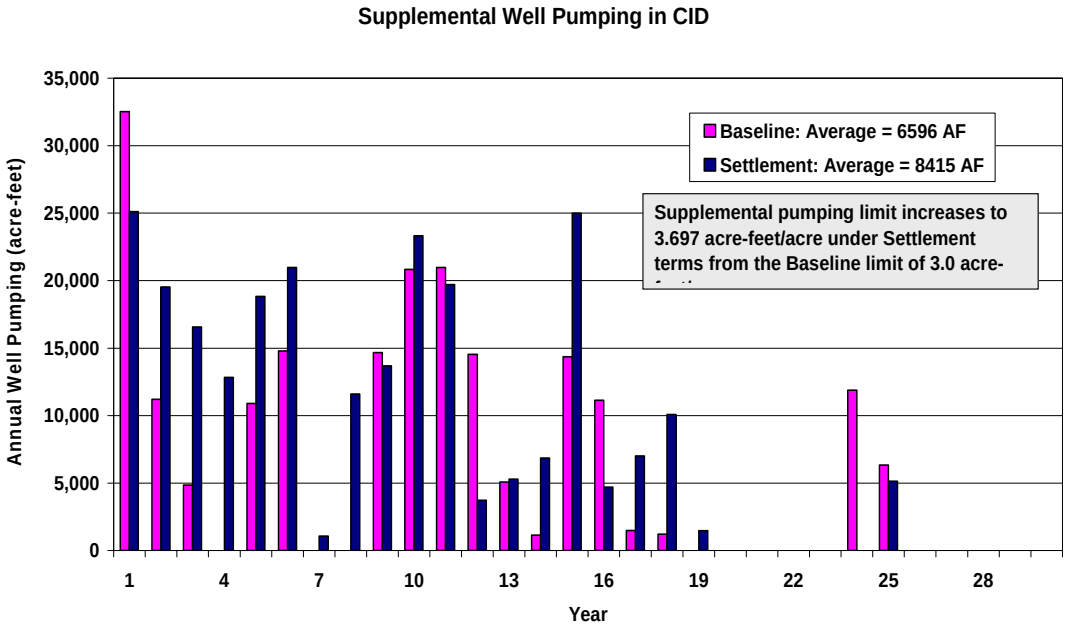

Figure 12: Comparison of CID Supplemental Well Pumping. (Increase in pumping under settlement is due to increase of pumping limit from 3.0 to 3.697 acre-feet per acre.)

Resource Indicator: Releases from Avalon under Settlement Terms

Under baseline operations, the only releases from Avalon dam, other than to the CID main canal, are due to conservation spills. The Settlement agreement includes provisions that allow ISC to release its share of the CID allotment directly from Avalon dam for purposes of complying with the Pecos River Compact. Figures 13 through 15 illustrate the impacts of the Settlement on Avalon Dam releases. Total releases from Avalon increase by about 6,600 acre-feet annually (Figure 13). This average does not include the remedy water bypasses totaling about 30,000 acre-feet in years when there is a Compact delivery shortfall (see below for details on the Pecos River Compact). Conservation spills decrease under the Settlement, on average, although the majority of the changes occur late in the simulation period after a sizeable Compact credit has been accumulated (Figure 14). Release of ISC's CID water averages about 10,500 acre-feet annually (Figure 15). Notice that the bulk of the ISC releases occur early in the simulation period, when the stateline Compact credit is small. Additional deliveries of

ISC water occur later in the model run only in years when CID's water supply is high (again, see discussion on Compact departure in the next section).

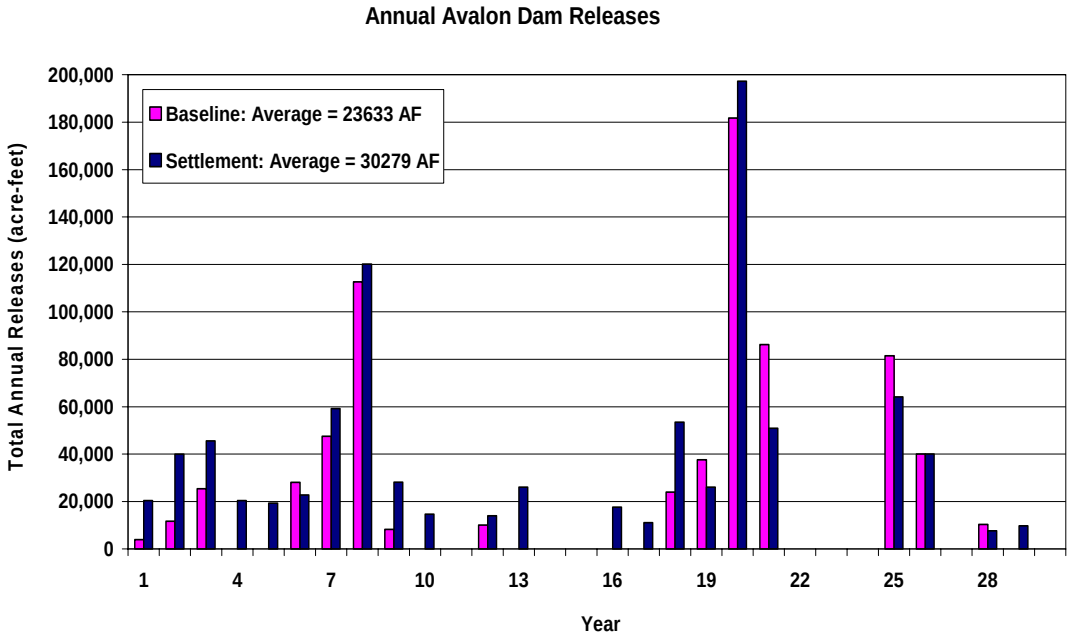

Figure 13: Total Avalon Releases to Pecos River.

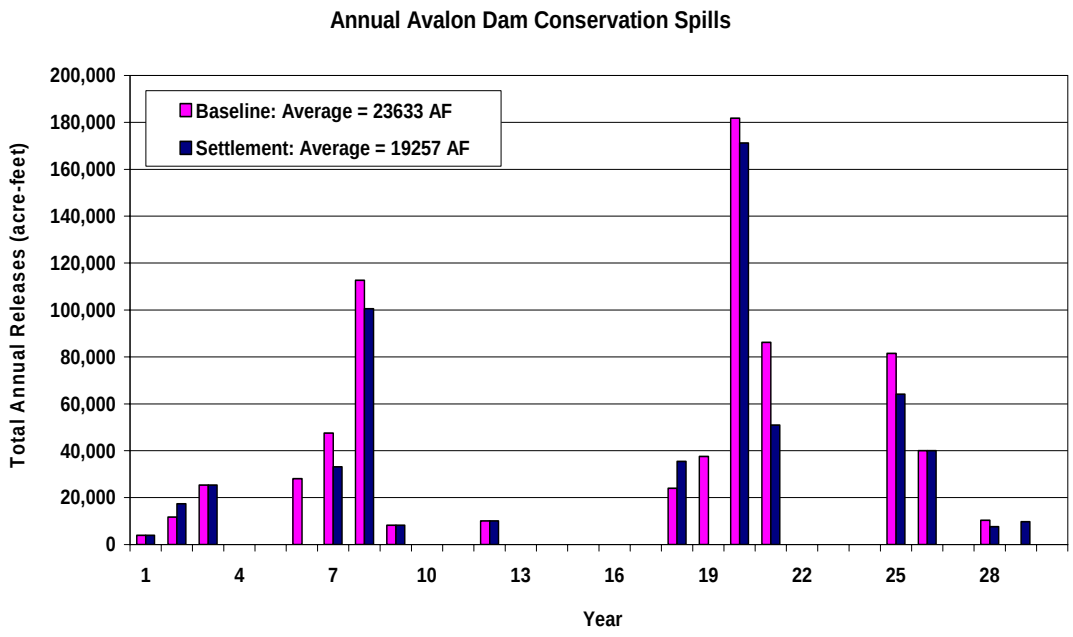

Figure 14: Avalon Releases to Pecos River due to Conservation Spills only.

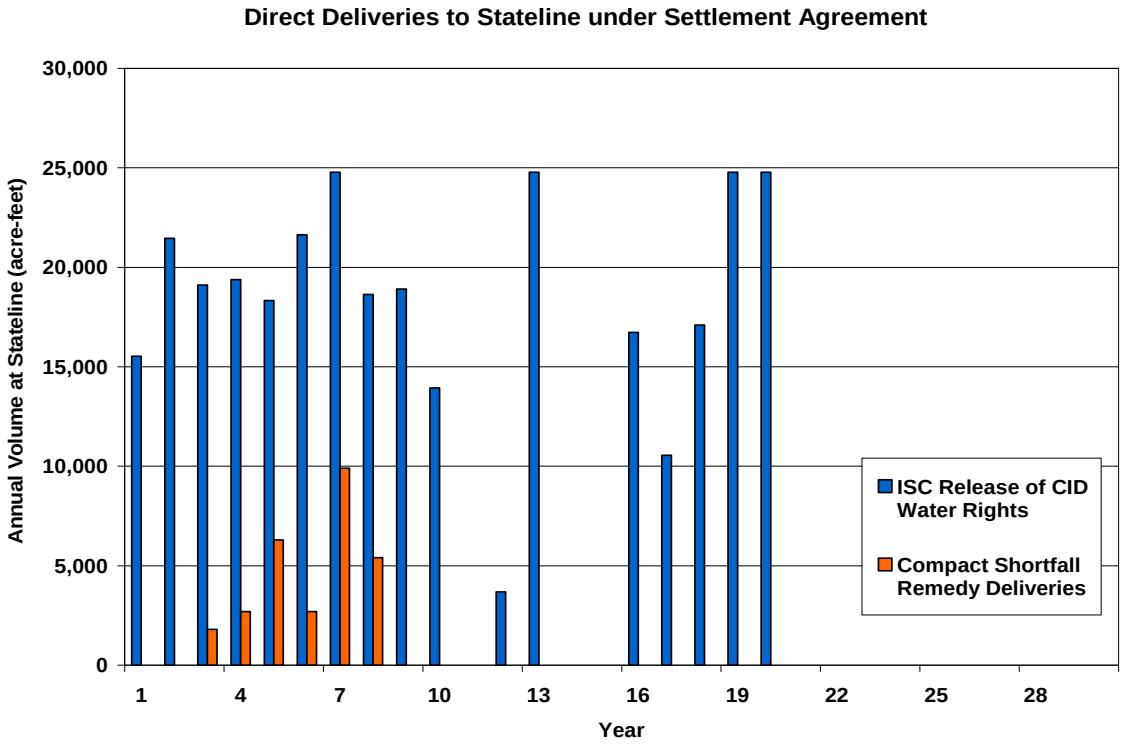

Figure 15: Stateline Deliveries of ISC's CID Water Rights and Remedy Water.

Resource Indicator: Red Bluff Flows, Stateline Deliveries, and Pecos River Compact

The final set of resource indicators pertain to New Mexico's obligations under the Pecos River Compact and Amended Decree. One basic tenet of the Settlement agreement is that by keeping CID's water supply whole as much as possible (which increases return flows to the Pecos River), and by direct delivery of a portion of the CID allotments which would be purchased by NM ISC, New Mexico can increase its Compact credit to a level that will allow it to more comfortably weather drought years without severely damaging the region's economy. The net impacts of the proposed settlement terms on stateline flows are shown in Figure 16. Average annual flows at the stateline would increase by about 9,500 acre-feet annually based on the model simulations. Additional water delivered to the stateline as a result of remedy pumping total almost 30,000 acre-feet (Figure 15). Corresponding to the increase in stateline flows is an increase in the average annual and cumulative departure from the Compact obligation, as shown in Figure 17.

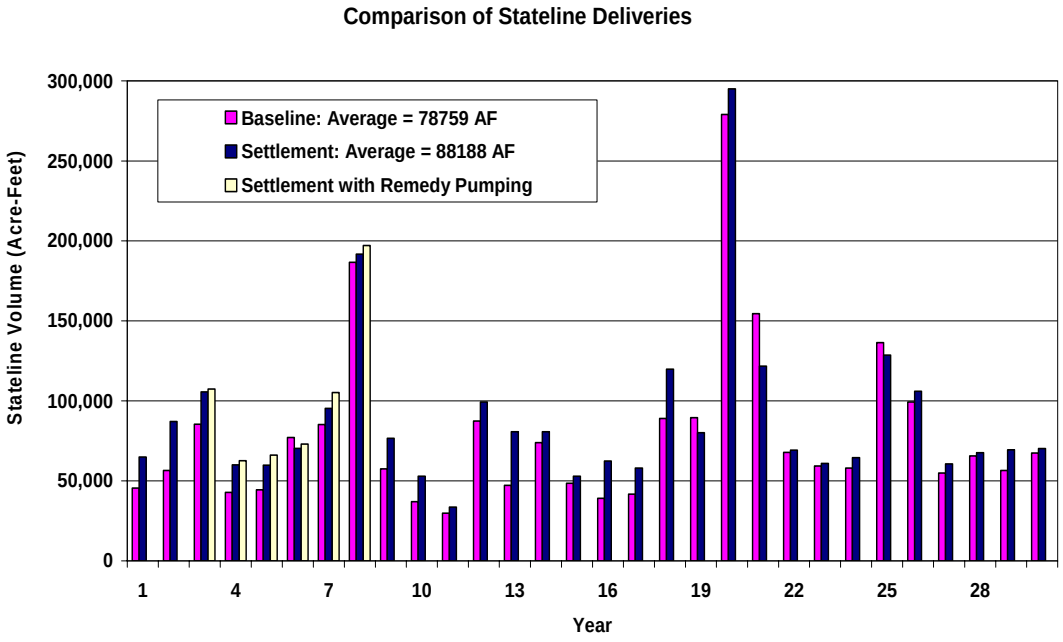

Figure 16: Total Flows at the Stateline (includes Red Bluff and Delaware).

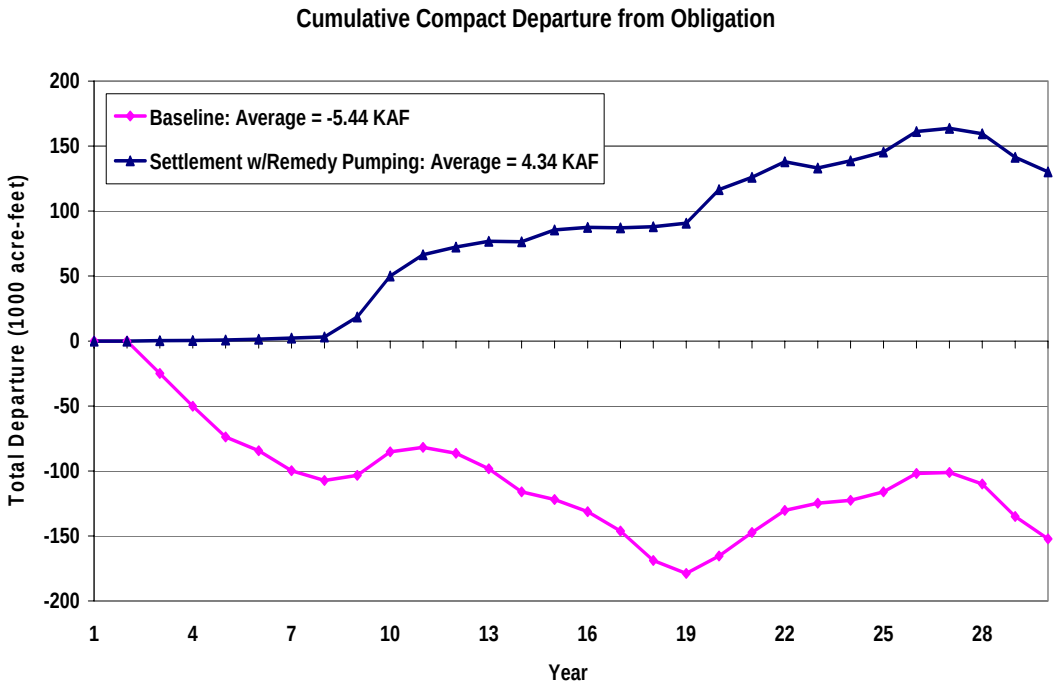

Figure 17: Comparison of Cumulative Compact Departure under the Baseline and Settlement Scenarios.

Finally, Figure 19 provides a breakdown of the additional sources of water that lead to the additional stateline flows. The graph shows the cumulative gain in stateline flows (in acre-feet) as the blue line, using the y-axis on the right. Using the left-hand y-axis, the columns show year-by-year changes under the settlement scenario for Avalon spills, baseflow gains, and ISC releases from Avalon, as compared to the baseline scenario. Early in the simulation period, deliveries of ISC's CID water directly from Avalon account for much of the gain in stateline flow. In the later two-thirds of the period, in addition to ISC releases, additional return flows and baseflow gains from the CID area account for much of the gain.

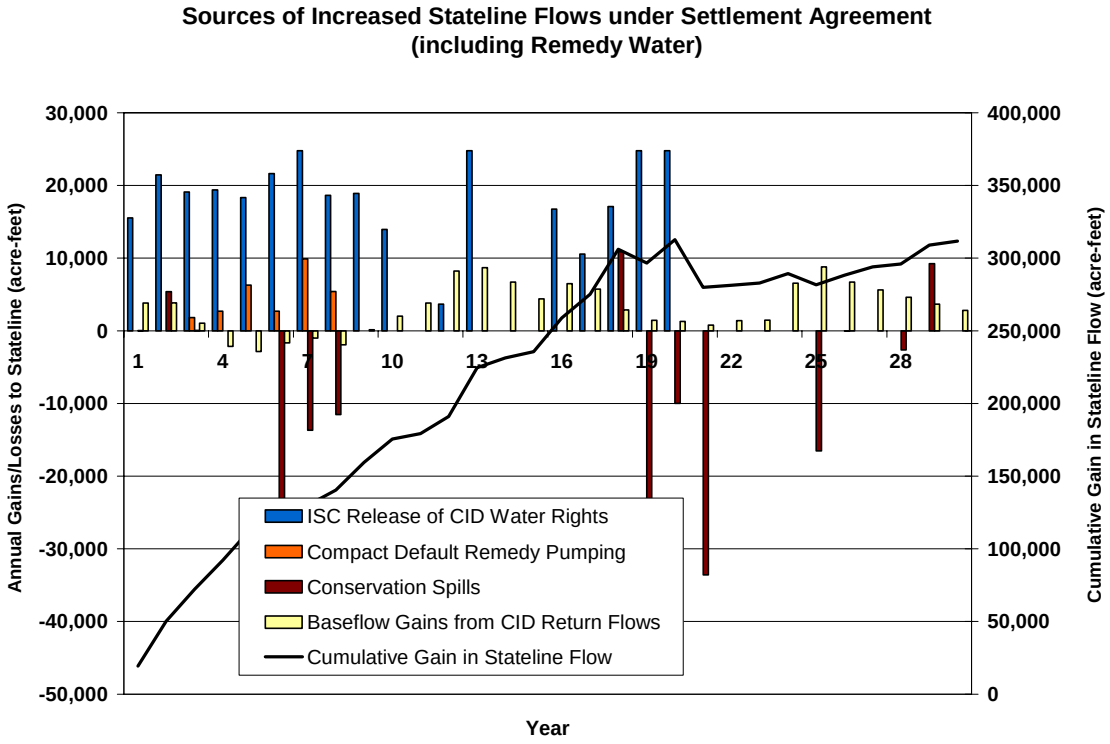

Figure 18: Sources of increased state line flow, and cumulative gain in state line Flow, Settlement scenario vs. Baseline scenario.

Summary and Conclusions

This report has presented results of two model simulations intended to evaluate the impacts of the proposed Pecos River Adjudication Settlement Terms. The model results indicate that implementation of the Settlement agreement will:

1. Have no significant impact to Pecos River flows at Acme and Artesia.

2. Increase the total annual surface water supply available to CID irrigators.

3. Significantly increase the CID system's resiliency to dry years.

4. Minimize the chances of a priority call by CID, through augmentation pumping to meet supply targets.

5. Over time, reduce total depletions in the Roswell basin and increase baseflows to the Pecos River.

6. Increase baseflows / return flows from the Carlsbad basin to the Pecos River.

7. Provide for the direct delivery of water from Avalon dam to the stateline.

8. Minimize the possibility of the State of New Mexico defaulting on its Pecos River Compact obligations, and most likely result in a cumulative credit over the long-term.

References

Barroll, Peggy. 2002. The Carlsbad Area Groundwater Flow Model. Hydrology Bureau, New Mexico Office of the State Engineer.

Carron, John. 2003. Pecos River Adjudication Settlement: Model Evaluation of Adjudication Settlement Agreement. Final Report. March 10, 2003. Hydrosphere Resource Consultants, Inc.

Hydrosphere Resource Consultants, Inc. 2003. The Carlsbad Area Ground Water Model Data Processing Tool: User's Manual and Technical Reference. Prepared for the New Mexico Interstate Stream Commission.

The Hydrology/Water Operations Work Group for the Carlsbad Project Water Operations and Water Supply Conservation NEPA Process (HWG). 2004. Volume 2: Pecos River RiverWare Model Report. Referred to herein as (HWG Volume 2, 2004).

The Hydrology/Water Operations Work Group for the Carlsbad Project Water Operations and Water Supply Conservation NEPA Process (HWG). 2004. Volume 3: Roswell Artesian Basin Groundwater Model Documentation. Referred to herein as (HWG Volume 3, 2004).

The Pecos River Adjudication Settlement Agreement, dated March 25, 2003, as entered into by the state of New Mexico ex rel. the State Engineer; The New Mexico Interstate Stream Commission; the United States of America, Department of the Interior, Bureau of Reclamation; the Carlsbad Irrigation District; and the Pecos Valley Artesian Conservancy District. Referred to herein as (Settlement Agreement, 2003).

Appendix D. Reclamation's ESA Assessment of the Seven Rivers Pipeline Project

ALB-187
ENV-7.00

MEMORANDUM TO THE FILES

To: ALBFILES

From: Gary L. Dean, Fish Biologist
Rob Doster, Wildlife Biologist

Thru: Lori Robertson, Environment Division Manager
CC: Connie Rupp, Area Manager
John Poland, Deputy Area Manager
Marsha Carra, Environmental Protection Specialist

Subject: Assessment of the Seven Rivers Pipeline Project

Pursuant to the requirements of the Endangered Species Act, Reclamation obtained a listing of the Endangered, Threatened, and Proposed species in Eddy County from the US Fish and Wildlife Service (Service) website, (http://www.fws.gov/southwest/es/newmexico/SBC_view.cfm?spcnty=Eddy) for the following assessment of the effects of the Seven Rivers Pipeline Project on listed species within the project area. Reclamation has determined that the Pecos bluntnose shiner (*Notropis simus pecosensis*) and the Interior Least Tern (*Sternula antillarum athalassos*), may be found within the project area, based on a biological survey[1] conducted by Marron and Associates, Inc.

It is Reclamation's determination that there will be "**no effect**" to the Pecos bluntnose shiner or its critical habitat from construction activities of this project. Also, there will be "**no effect**" to the Interior Least Tern from construction activities of this project, on Reclamation (Federal) lands, if completed prior to May 15, 2007. If these construction activities can not be completed prior to May 15, 2007, on Reclamation (Federal) lands, project work must cease till consultation with the Service can be completed or until the project would no longer pose a threat to any nesting birds in 2007.

I. INTRODUCTION

The purpose of this assessment is to determine the effects of Seven Rivers Pipeline activities that could affect the Pecos bluntnose shiner (shiner) and the Interior Least Tern (Least Tern).

II. DESCRIPTION OF THE PROPOSED ACTION

[1] "A Biological Survey and Evaluation of the Proposed Seven Rivers Pipeline Located in Eddy County, New Mexico," prepared for the State of New Mexico, Office of the State Engineer, NM Interstate Stream Commission, by Marron and Associates, Inc.

The proposed Federal action is for Reclamation to grant a license to the NMISC for pipeline construction and operation onto Federal property.

The purpose of the Proposed Action is to deliver water from the Seven Rivers augmentation well field to Brantley Reservoir for use as Carlsbad Project water.

The proposed pipeline from the Seven Rivers augmentation well field would address two primary needs along the Pecos River. The NMISC needs to:

1 Augment the CID water supply as partial fulfillment of the Settlement Agreement
2 Assist the NMISC in compliance with the Pecos River Compact and the Supreme Court Amended Decree, with or without the complete implementation of the Settlement Agreement.

The New Mexico Interstate Stream Commission (NMISC) is currently constructing a well field west of Brantley Reservoir, as required by the Carlsbad Project Settlement Agreement. Once completed, the well field will consist of ten wells. Five wells, all in the western section, have been completed at this time. Nine wells will be located on private property, most through easements with private landowners. One well is located on land owned by the NMISC.

The well field construction includes approximately 11 miles of buried pipeline network to connect all of the wells and deliver the water to Brantley. There will be two main pipeline segments. One segment, the Price and Home Farm Alignment, is designed to connect seven wells west of US 285 and one well east of US 285, in the northwestern section of Brantley Reservoir and deliver water to the Seven Rivers Outfall (UTM NAD 27: E556974/ N3605508) on the south side of the mouth of the drainage to Brantley Reservoir. The outfall occurs adjacent to an undesignated parking lot used for fishing and boat launching.

The Lewis Farm Alignment collects water from two wells and joins each pipeline into one pipeline to the north of the reservoir and delivers that water to a discharge point identified as the Lewis Farm Outfall (UTM NAD 27: E558607/N36667222) at the inlet of Brantley Reservoir. The outfall drains into a cut above the high-water mark of Brantley Reservoir and is covered with Johnson Grass (*Sorgum halepense*), Junglerice (*Echinochloa colonum*), and summer cypress (*Kochia scoparia*).

The pipelines will cross private property through easements with the private landowners. Both pipelines must cross Reclamation property for the water to efficiently reach the reservoir. The northwestern section of the Seven Rivers pipeline will cross approximately 1.3 miles of federal property as measured from the South Seven Rivers branch of Brantley Reservoir. The pipeline connecting wells in the northern section of the well field will cross approximately 1.4 miles of federal property as measured from the North Seven Rivers branch of Brantley Reservoir. The pipelines will be aligned along existing rights-of-way, when possible, to reduce the amount of new disturbance on federal property.

The pipelines will discharge groundwater at two locations adjacent to Brantley Reservoir. The western discharge location will be in the South Seven Rivers Channel, while the

northern discharge location will be in the North Seven Rivers Channel. The maximum pipe diameter will be 36 inches of HDPE or PVC pipe construction, designed to carry a total 14,000 GPM from the northwestern section and 6,000 GPM from the northern section, both under gravity flow conditions. The pipeline will be buried at a general depth of 10 to 36 inches, but may reach a maximum depth of 15 feet below the surface. Lateral disturbance of the surface will range from 6 to 30 feet from the center of the pipeline depending upon the topography.

Excavators, front-end loaders, and trucks will be used to install the pipe. The area of intense disturbance from excavation is expected to be 6 to 30 feet, with a maximum disturbance area of about 65 feet from the center of the pipe. The pipe is expected to be covered and leveled upon completion. Water at each outfall will discharge into concrete structures with baffles. A layer of riprap will overlie each outfall.

The construction of the pipeline is expected to start April 15, 2007 and be completed by May 15, 2007, prior to the terns nesting activities.

III. STATUS OF THE SPECIES/CRITICAL HABITAT

PECOS BLUNTNOSE SHINER

The Pecos bluntnose shiner was federally-listed as a threatened species under the ESA on February 20, 1987, by the Service. The shiner is endemic to the Pecos River and is presently found only in eastern New Mexico.

Background

The *N. simus* was first collected by Cope and Yarrow, at San Ildefonso, Santa Fe County, New Mexico in 1876 (Sublette et. al., 1990). Confusion regarding taxonomic status of *N. simus* was resolved when Chernoff et al. (1982) determined that two subspecies occurred: the Rio Grande form (*N. simus simus*) and Pecos form (*N. simus pecosensis*).

The Rio Grande form was historically found in the Rio Grande drainage from the Chama River, north of Santa Fe, New Mexico, downstream in the Rio Grande to El Paso, Texas.

The Rio Grande form is now extinct (Bestgen and Platania, 1990; Sublette et. al., 1990). The Final Rule determining the shiner as threatened indicates historic occupation of the shiner in the Pecos River between the towns of Santa Rosa and Carlsbad, New Mexico (USFWS, 1987). Collections of shiner during 1990's indicate a current range from Sumner Dam, New Mexico, downstream to Brantley Reservoir (Brooks et al., 1991; USFWS, 2001). "Some stretches of the Pecos River are frequently dry downstream from impoundments." (50 CFR § part 17).

The shiner is a member of the minnow family (Cyprinidae). It is relatively small, reaching lengths of up to 3.5 inches. Sublette et.al., (1990) described the shiner as having a spindle-shaped body, with a silvery head, back, and abdomen; sparsely scattered with small

melanophores along the head and sides. The mouth is large, appearing slightly subterminal with an overhanging blunt nose. Males and females look very similar, except in the breeding season when the female's abdomen becomes distended with eggs and the males develop fine tubercles (bumps) on the head and pectoral fin rays. The shiner primarily feeds on detritus, filamentous algae, and terrestrial invertebrates, such as Diptera, a large order of flies and midges. Its average life span is two to three years.

Distribution and Abundance

Historically, shiners ranged throughout the upper portion of the Pecos River in New Mexico from about the Gallinas Creek confluence, above Santa Rosa, to near the New Mexico-Texas border (USFWS, 2000). Their present range is listed as being from Sumner Dam to Brantley Reservoir, a distance of approximately 225 river miles; a 25 percent reduction from the historical range. However, the shiner may now be extirpated from the 14 mile section between Sumner Dam and the FSID Diversion Dam, (Platania and Altenbach, 1998).

Brooks et al. (1991) reviewed historic and recent surveys of fish communities in the Pecos River. These surveys included collections from Sumner Dam downstream to the Brantley Reservoir inflow. Intensive surveys and monitoring by the Service from 1992 through 2004 form the basis for current knowledge of shiner distribution and abundance.

The NMDGF (1982) reported that there was a substantial decline in the abundance of shiners from 1939 to 1986 (New Mexico Department of Game and Fish, 1982). Collections between 1986 and 1990 indicate a further decline in abundance and a reduction in range, although the species still exists within the designated critical habitat reaches (Brooks et al., 1991). Non-native species, including the plains minnow (*Hybognathus placitus*) and the Arkansas River shiner (*N. girardi*) (Sublette et. al., 1990), comprised a large portion of the shiner guild, and may have indicated interspecific competition as a factor in shiner reduction in abundance and distribution.

Shiner adults and larvae have been seen in the area of the Kaiser Channel above the Brantley inlet, but have little hope of survival when they reach the reservoir. The Service anticipated that shiner eggs and larvae were taken as a result of block releases during the spawning season. The block releases were suggested to transport the eggs and larvae downstream into Brantley Reservoir where death would occur, or where they would be unable to successfully develop and breed and thereby contribute offspring to the next generation. It was anticipated that killing of larvae and eggs would occur when they reach Brantley Lake through consumption by predatory fish, by exposure to higher salinity, or by other unsuitable habitat conditions in the reservoir.

Critical Habitat

Critical habitat for the shiner was designated to include two sections of the Pecos River. The upper end of the reach starts about two-thirds of a mile upstream from the Taiban Creek confluence and extends approximately 64 river miles downstream to the Crockett

Draw confluence. The second section starts at a point due East of Hagerman, New Mexico and extends 37 river miles downstream to the Highway 82 Bridge, East Artesia, New Mexico (USFWS, 1987). Unlike the upper reach the lower reach is largely dependent upon irrigation return flows and base inflows for much of its water supply.

INTERIOR LEAST TERN

The Interior Least Tern was federally listed as endangered June 25, 1985 (50 Federal Register 102).

Background

The Interior Least Tern was federally-listed in the states of Arkansas, Colorado, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana (in the Mississippi River and its tributaries north of Baton Rouge), Mississippi (Mississippi River), Missouri, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Tennessee, and Texas (except within 80 km of the Gulf Coast). Many subpopulations existed across these areas, but continued loss and degradation of its habitat led to low numbers within its range.

The Tern is state-listed as endangered in South Dakota, Iowa, Illinois, Missouri, Texas, Kansas, and Nebraska and is extirpated in Indiana. It is also listed endangered in New Mexico by the New Mexico Department of Game and Fish (NMDGF) (1976). Severe declines of Interior Least Tern populations were due to habitat loss from river channelization, dam construction, and regulated flows.

The Least Tern is the smallest member of the tern subfamily (Sternidae), measuring about 21 to 24 cm in length with a 51 cm wingspan. Sexes are alike with a characteristic black-capped crown and white forehead. The back and dorsal wing surface are grayish, with white breast, belly and underwings. Legs are shades of orange or yellow and the bill, which is black tipped, also varies from yellow to yellow-orange in color. Immature Least Terns have darker plumage than adults, a dark bill, and dark eye stripe.

The validity of the taxonomy of the least tern subspecies has been questioned and identification in the field is difficult, therefore the U.S. Fish and Wildlife Service designated as endangered those Least Terns occurring in interior North America.

Distribution and Abundance

New Mexico is located on the extreme southern and western periphery of the Interior Least Tern's historic range. Least Terns were first recorded breeding in New Mexico at Bitter Lake NWR (BLNWR), Chaves County, in 1949, (Jungleman, 1988). They have bred annually at or in the vicinity of BLNWR since 1949.

This refuge was established adjacent to the Pecos River in 1939. Numbers of breeding Least Terns at BLNWR have remained low and relatively constant. A small population of Least Terns has utilized this area for the past 51 years; the number of terns sighted at BLNWR during peak abundance fluctuates annually, with 60 sighted on September 5,

1961 and no birds sighted for several years. Since 1989, there have been 3 to 7 pairs nesting and as many as 5 chicks fledged in any given year. Least Terns were known to summer in the vicinity of Dexter National Fish Hatchery in 1996 and two pairs were located north of BLNWR along the Pecos in 1997.

While most of the past research has centered in and around Roswell, New Mexico, other sightings have been documented near Las Cruces, New Mexico (1980), in the Rio Grande Basin, White Sands (1981), Holloman Lake near Alamogordo (1980/1982), Bottomless Lakes State Park, and Wade's Bog (prior to 1973).

On June 9, 2004, five pairs of Interior Least Terns were observed in a backwater area of Brantley Lake (Eddy County, New Mexico). The nearest documented nesting has been at BLNWR, 60 miles north of Brantley Lake, since the mid 1980's. These north-bound birds were probably migrating to BLNWR, but stopped short as suitable habitat was present at Brantley Lake. At least 14 adults were observed with an estimated seven nests on the lakeshore.

Again, monitoring of the shoreline and adjacent areas of Brantley Lake for the possibility of nesting by terns began the second week of May 2005 and continued through July at approximately two-week intervals. Terns were first observed at the lake on 12 May with two adults present. Subsequent surveys in May, June, and July resulted in varying numbers of terns detected, ranging from a maximum of 18 (all adult) on 24 May to a low of 8 (4 adult, 4 sub-adult) on 13 July.

On the date the maximum number of terns was observed at Brantley Lake (24 May), many of the birds were observed in the Champion Cove area engaging in courtship behavior and mating. On 28 July the first juvenal-plumaged Interior Least Terns were observed. It was unlikely, however, that these terns originated at Brantley Lake as no evidence of nesting was found during the summer months. These juvenile birds likely were south-bound migrants, possibly originating from BLNWR Refuge.

The area of the Brantley Lake shoreline on the south side of the North Seven Rivers drainage inlet was the location of most observations of terns during summer 2005. This area remained mostly unvegetated, was not entirely submerged during the summer, and appeared to have the greatest likelihood for use in nesting by the terns. Despite the potential of this area as a nesting site for terns, it was not utilized as such and roosting was the only activity observed. In 2005, much of the 2004 breeding site remained overgrown with kochia (*Kochia scoparia*), common cocklebur (*Xanthium strumarium*), and bearded sprangletop grass (*Leptochloa fascicularis*).

In 2006, vegetation was cleared from two areas totaling 56 acres adjacent to the maximum reservoir storage pool (elevation 3256 feet), as described in the 2006 Biological Opinion for the operation of Brantley Lake (Fig. 1). These two areas were not utilized by terns for nesting in 2006, however at least two nests were attempted within the reservoir pool (Fig. 1). Those nests were ultimately lost to a rising reservoir in early June 2006. Approximately 12 adult Least Terns were observed at Brantley Lake at the time of nest initiation in summer 2006.

Life Requirements

Least Terns are piscivorous and are associated with shallow water areas of rivers, streams and lakes. Generally they feed close to their nesting areas and forage by hovering and diving for fish over standing or flowing water. They are believed to be opportunistic feeders, exploiting any fish species within a certain size range.

Least Terns spend about 4 to 5 months at their breeding sites, arriving from late April to early June. Courtship behavior occurs in the general vicinity of the nest site and involves fish presentations, nest scraping, copulation and a variety of vocalizations. Nests are a shallow and inconspicuous depression in an open sandy area, gravelly patch or exposed flat. Least terns generally nest in colonies; however, colonial nesting is not always the case at BLNWR with single pairs nesting up to 3.5 miles from the next closest nesting terns.

Reproduction

Interior least terns are migratory and breed along the Red, Missouri, Arkansas, Mississippi, Ohio, and lower Rio Grande river systems. Interior Least Terns breed on sand bars in rivers and lake or pond edges free of vegetation.

Least Terns lay 2 to 3 eggs beginning in late May with incubation lasting approximately 20 to 25 days. Tern chicks are semiprecocial and gradually wander away from the nesting territory as they mature. Fledging occurs at about 3 weeks with parental attention continuing until migration.

Critical Habitat

There is no designated critical habitat for the Interior Least Tern.

IV - EFFECTS OF THE PROPOSED ACTION

"Effects of the action" refers to the direct and indirect effects of a proposed action on listed species or critical habitat together with the effects of other activities that are interrelated or interdependent with that action.

The Proposed Action, as described above in section II, identifies when construction starts and ends and also identifies the boundaries of the project. This section describes the effects of the proposed actions on the shiner and tern and their critical habitats.

PECOS BLUNTNOSE SHINER

None of the proposed activities would occur near shiner critical habitat. The construction, operation, and/or maintenance activities of the pipeline that are associated with this project are terrestrial activities that occur within the Brantley Reservoir area and only reach the water's edge at the Brantley inlet and Seven Rivers drainage within the reservoir proper. Any shiner eggs or larvae that end up in Brantley Reservoir as a result of block releases or other inflows probably do not survive since they are not adapted to lake conditions. Take for shiners being incidentally transported into Brantley Reservoir has already been assessed in the Biological Opinion for the Bureau of Reclamation's Proposed Carlsbad Project Water Operations and Water Supply Conservation, 2006-2016. (Cons. # 22420-2006-F-0096) Based on the distribution of the shiner critical habitat in relation to the proposed action, the lack of viable shiners in Brantley Reservoir, and since no construction would occur within Brantley pool, there are no known effects to the shiner or its critical habitat that will occur.

INTERIOR LEAST TERN

There will be two discharge (outfall) areas, the Lewis Farm Outfall to the north which drains into directly into Brantley Reservoir at the inlet and the Seven Rivers Outfall which drains into the Seven Rivers Arroyo (drainage) and then into Brantley Reservoir to the northwest. At the present time, there is no tern nesting sites at the Lewis Farm Outfall.

The alignment of the Price and Home pipeline parallels the Seven Rivers drainage, passing through the drainage to the east and discharging at a location on the south side of the Arroyo, near the mouth of the drain into Brantley Reservoir. The outfall is directly above the southern most, habitat nesting area created by Reclamation for the terns in 2006. The outfall is also directly across the drainage adjacent to the southern most end of the northern habitat nesting area, also created by Reclamation. As described in Section II of the Description of the Proposed Action, the pipeline will be buried at a general depth of 10 to 36 inches. Lateral disturbance of the surface will range from 6 to 30 feet from the centerline of the pipeline depending upon the topography.

The nearest disturbance to either of the created habitats will be within 500 feet as the pipeline alignment approaches the outfall. No personnel, equipment, or vehicles will enter the established tern nesting site areas. Due to the heavy vegetation around each established nesting site, visuals of equipment to the terns will be kept to a minimum. Also, the vegetation surrounding the two sites will act as natural noise abatement to terns which might be assembling in the area prior to the nesting season. Given the minimal disturbance to the area and the timing of the construction activities, there will be no effects to the terns or their courtship or nesting behaviors.

V. DETERMINATION OF EFFECTS

The following determination of effects for the shiner and the tern consider the effects of the proposed action on the listed species together with the effect of other activities that are interrelated or interdependent with the action.

PECOS BLUNTNOSE SHINER

Because there is no critical habitat present, the Pecos bluntnose shiner does not presently survive in Brantley Reservoir and because construction will occur in the dry, implementation of the proposed action will have "**no effect**" on the shiner or its critical habitat.

LEAST INTERIOR TERN

Reclamation's proposed action, as identified in Section IV Effects of the Proposed Action, seeks to avoid jeopardizing the Interior Least Tern in the project area by completing construction on the Seven Rivers Pipeline Project, on Reclamation (Federal) lands prior to the Interior Least Terns nesting period (on or before May 15, 2007). By completing the above proposed construction prior to May 15, 2007, Reclamation has determined that there will be "**no effect**" on the Interior Least Tern or its existing created habitats. If these construction activities can not be completed prior to May 15, 2007, on Reclamation (Federal) lands, project work must cease till consultation with the Service can be completed or the project would no longer pose a threat to any nesting birds in 2007.

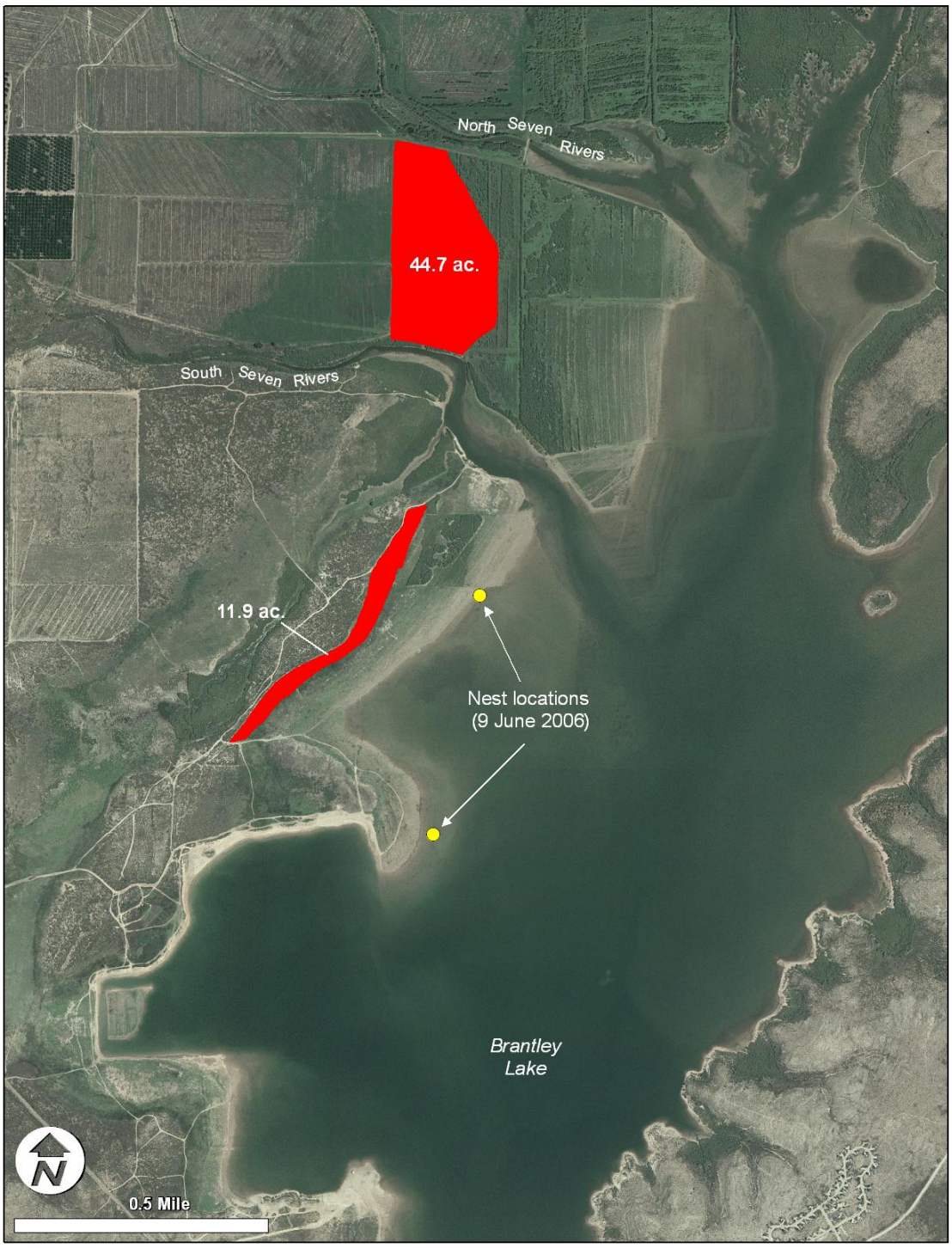

Figure 1. Locations of two created Least Tern nesting and brood-rearing habitat sites adjacent to Brantley Lake (red areas). Sites where terns attempted to nest in 2006 are indicated with yellow circles.