

RECLAMATION

Managing Water in the West

Long-term Lease of Groundwater Rights, Pecos River near Ft. Sumner, New Mexico

***DRAFT* - Environmental Assessment**



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

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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.

Long-term Lease of Groundwater Rights, Pecos River near Ft. Sumner, New Mexico

Environmental Assessment

Lead Agency:



United States Department of the Interior
Bureau of Reclamation
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Abstract

The US Department of the Interior, Bureau of Reclamation (Reclamation) is preparing an Environmental Assessment (EA) in accordance with the National Environmental Policy Act (NEPA) to evaluate the environmental and socioeconomic impacts from entering into a long-term lease with the New Mexico Interstate Stream Commission (ISC) for diverting ground water rights to the Pecos River near Ft. Sumner, New Mexico, and from formalizing a 1,000 acre-foot fish conservation pool (FCP) at Lake Sumner and/or Santa Rosa Reservoir. The actions are needed to provide Reclamation with the operational flexibility to meet a target flow of 35 cubic feet per second at Taiban Gage and to keep the river continuous for the irrigation season of 2007 and beyond. Based on the analysis, the proposed action would not result in any significant impacts to the environment.

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List of Acronyms and Abbreviations

AF	Acre-foot or acre-feet
APE	Area of potential effects
AWA	Additional water acquisition
AWN	Additional water need
BLM	Bureau of Land Management
BO	Biological opinion
CEQ	Council of Environmental Quality
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CID	Carlsbad Irrigation District
Compact	Pecos River Compact
EA	Environmental Assessment
EC	Electrical Conductivity
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FCP	Fish conservation pool
FSID	Ft. Sumner Irrigation District
ISC	Interstate Stream Commission
ITA	Indian trust Assets
NEPA	National Environmental Policy Act
NMDGF	New Mexico Department of Game and Fish
NMWQCC	New Mexico Water Quality Control Commission
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
OSE	New Mexico Office of the State Engineer
Reclamation	Bureau of Reclamation
ROD	Record of Decision
SWR	State Water Reserve
TDS	Total Dissolved Solids
Service	US Fish and Wildlife Service

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Chapter 1: Purpose and Need for Action

Introduction

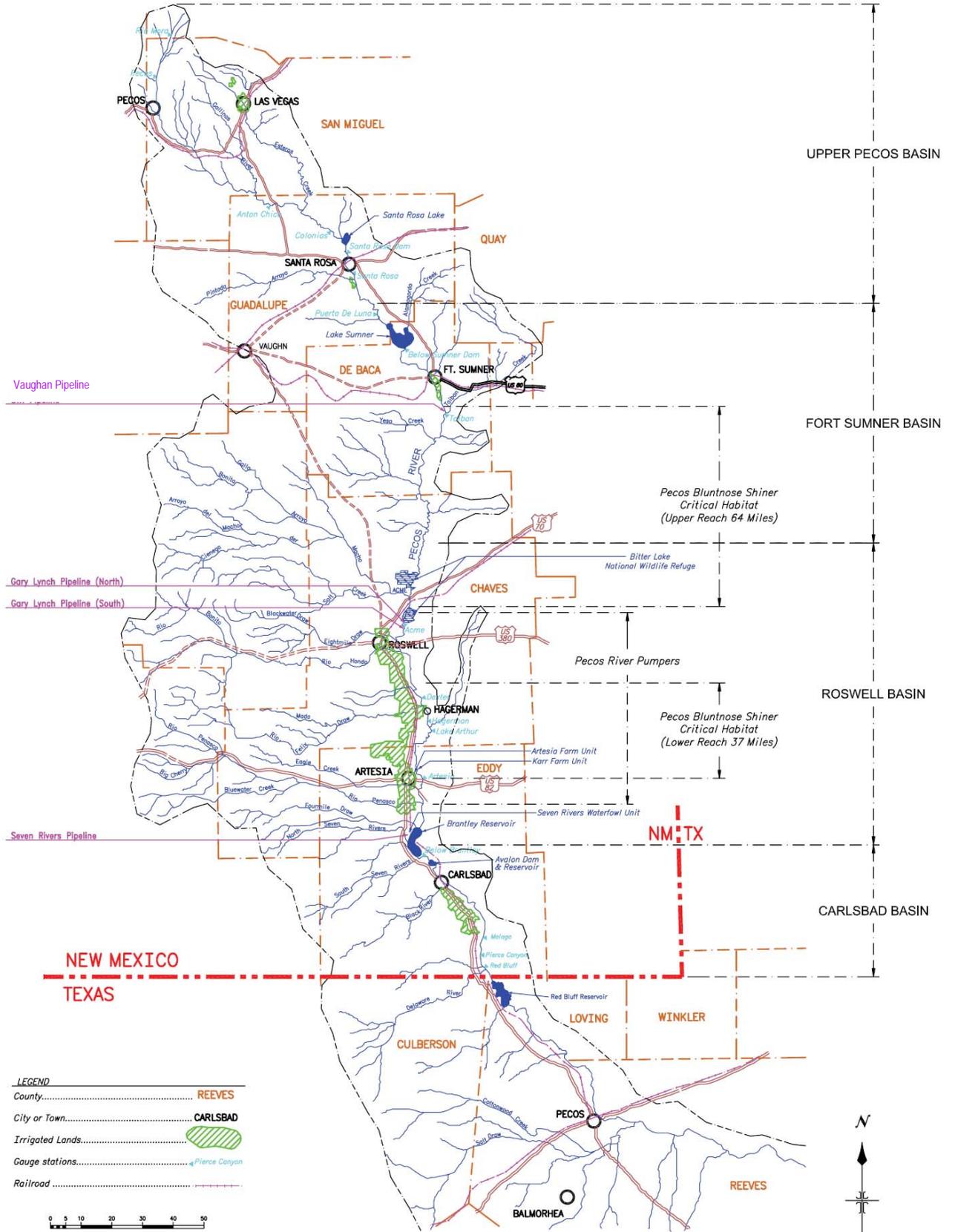
This Environmental Assessment (EA) has been prepared by the US Department of the Interior, Bureau of Reclamation (Reclamation) to evaluate the environmental and socioeconomic impacts from the following two actions:

1. Formalizing a 1,000 acre-foot fish conservation pool (FCP) at Lake Sumner and/or Santa Rosa Reservoir; and
2. Entering into a long-term lease of ground water rights with the New Mexico Interstate Stream Commission (ISC). The ground water would be pumped and released into the Pecos River near Ft. Sumner, New Mexico.

The Pecos River has its headwaters in the Sangre de Cristo Mountains in northern New Mexico. It meanders 500 river miles southward across the eastern part of the state until it crosses into Texas south of Carlsbad. From the Texas border, the river winds another 400 miles to its confluence with the Rio Grande near Langtry, Texas. The total drainage area at its confluence with the Rio Grande is approximately 33,000 square miles, with 19,000 square miles within New Mexico. The Pecos River system in New Mexico includes three major reservoirs: Santa Rosa Reservoir, Sumner Lake, and Brantley Reservoir; a fourth smaller reservoir (Avalon) just south of Brantley Reservoir is used by the Carlsbad Irrigation District (CID) for staging and diverting Brantley Reservoir releases (Figure 1).

In July 2006, Reclamation issued a Record of Decision (ROD) for the Carlsbad Project Water Operations and Water Supply Conservation Final Environmental Impact Statement (EIS) (US Bureau of Reclamation [Reclamation] 2006a). The ROD mandated changes in water operations within the Pecos River in order to conserve the federally threatened Pecos bluntnose shiner (*Notropis simus pecosensis*) (shiner) and its designated critical habitat, while conserving the Carlsbad Project water supply. Specifically, Reclamation established a target flow of 35 cubic feet per second (cfs) as measured at the Taiban gage (Pecos River Below Taiban Creek Ft. Sumner, NM, USGS gage number 08385522), committed to maintain the previously permitted 500 acre-foot (AF) fish conservation pool (FCP) at Lake Sumner, and identified a range of actions to acquire water to meet the contract requirements of the Carlsbad Project. An FCP is an allocation of storage in Sumner Lake or Santa Rosa Reservoir, which is designated specifically for the benefit of the shiner by maintaining flows or avoiding intermittency.

Figure 1: Area Map



The Pecos River Basin supports irrigation and critical habitat for the Pecos bluntnose shiner. The proposed project would add supplemental water to the river upstream of the upper reach of critical habitat.

As part of the consultation process under the Endangered Species Act (ESA), the US Fish and Wildlife Service issued a Biological Opinion (2006 – 2016) (BO) on the selected alternative from the EIS (US Fish and Wildlife Service 2006). One of the provisions of the Biological Opinion was for Reclamation to keep the river continuous. Reclamation is committed to work within their discretionary authority to meet these requirements.

Because changes in Carlsbad Project operations to benefit the shiner could result in reduction to the available Carlsbad Project water supply, a variety of options for acquiring water to keep the project whole were considered in the EIS. Likewise, a variety of additional upstream water sources to directly benefit the shiner were identified, including the use of a fish conservation pool in Sumner Lake and/or Santa Rosa Reservoir.

Reclamation is currently identifying additional supplemental water sources. In November 2006 Reclamation conducted public scoping, including meetings in Carlsbad and Ft. Sumner, to collect public comments and to help identify supplemental sources (Reclamation 2006b). Reclamation is continuing to develop a package of supplemental water options, which will be evaluated under a separate EA. During the scoping process, leasing ground water rights from the ISC and expanding the FCP from 500 acre-feet/year to 1000 acre-feet/year were determined to be viable and timely options. The ISC holds ground water rights on about 770 acres of agricultural lands south of Ft. Sumner and is building a pipeline linking the wells to the Pecos River.

For the FCP, Reclamation would exchange surplus ground water rights they currently own at the Seven Rivers Waterfowl Mitigation Farm to augment the FCP. Seven Rivers is located adjacent to Brantley Reservoir (Figure 1). The ISC currently operates a well-field and pipeline that would be used to pump groundwater into Brantley Reservoir in exchange for storing and withdrawing an additional 500 acre-feet of water from Sumner Lake and or Santa Rosa Reservoir.

These options would provide Reclamation flexibility in providing water to the river during this year's and future irrigation seasons. Due to the timing of the lease agreement and desire to implement it by June 30th, Reclamation is preparing this EA specifically on the long-term lease and expanding the FCP.

The EA is prepared pursuant to the National Environmental Policy Act of 1969 (NEPA), as amended; the Council on Environmental Quality's (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500-1508); the Department of the Interior's NEPA Implementing Procedures (516 DM 1-15); and Reclamation's NEPA Handbook. In accordance with CEQ regulations (parts 40 Code of Federal Regulations [CFR] 1500.4(i), 1502.20, 1502.21, and 1508.28), Reclamation guidance, and the Paperwork Reduction Act of 1995, this EA is tiered to Carlsbad Project Water Operations and Water Supply Conservation EIS and incorporates relevant data and findings of the EIS by reference. Tiering is defined by CEQ as a procedure which allows agency to avoid duplication of paperwork

through the incorporation by reference of the general discussions and relevant specific discussions from an EIS of broader scope into a document of lesser scope without duplication of the analysis prepared for the EIS (CEQ NEPA's 40 Most Asked Questions). The EIS is available upon request for review and may be viewed on-line at:

<http://www.usbr.gov/uc/albuq/library/eis/carlsbad/carlsbad.html>

Need for the Action

The need for the 1,000 acre-foot fish conservation pool and long-term lease is to provide Reclamation with the operational flexibility to comply with the 2006-2016 Biological Opinion for the selected alternative of the Carlsbad Project Water Operations and Water Supply Conservation 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. Reclamation is developing long term strategies to provide sufficient supplemental water to keep the Pecos River continuous; however, these strategies are not defined enough for implementation for the 2007 irrigation season. Therefore, there is a need for immediate efforts to assure the water needs of the shiner will be met. Use of a fish conservation pool and the leasing of surface and ground water and releasing it into the river have proven to be timely and viable tools for supplementing flows.

Purpose of the Action

The purpose of the project is to provide adequate water to allow Reclamation the operational flexibility to meet target flows, keep the river continuous, fulfill the contracted irrigation needs of the Carlsbad Project, and avoid hindering New Mexico delivery requirements to Texas. The goal is to begin providing supplemental water to the Pecos River system by June 30, 2007. Therefore, supplemental water sources should readily available, have the capacity to provide "wet" water to the system, and require minimal infrastructure investments.

Relevant Statutes, Regulations, and other Plans

Reclamation's activities on the Pecos River are guided by a number of laws, agreements, and authorizations as detailed in the Carlsbad Project Water Operations and Water Supply Conservation EIS (Reclamation 2006). Examples include the Reclamation Act of June 12, 1902, the Carlsbad Project Authorization, Hope Decree of 1933, Pecos River Compact of 1948, and the 1988 Texas v. New Mexico U.S. Supreme Court Amended Decree.

Chapter 2: Alternatives

Introduction

This EA evaluates two alternatives; (1) the proposed action, and (2) taking no action. Reclamation anticipates releasing a separate EA to evaluate other supplemental water options as they are further defined. As discussed above, action is required prior to the summer of 2007 to ensure there is adequate water available to keep the river continuous during the irrigation season.

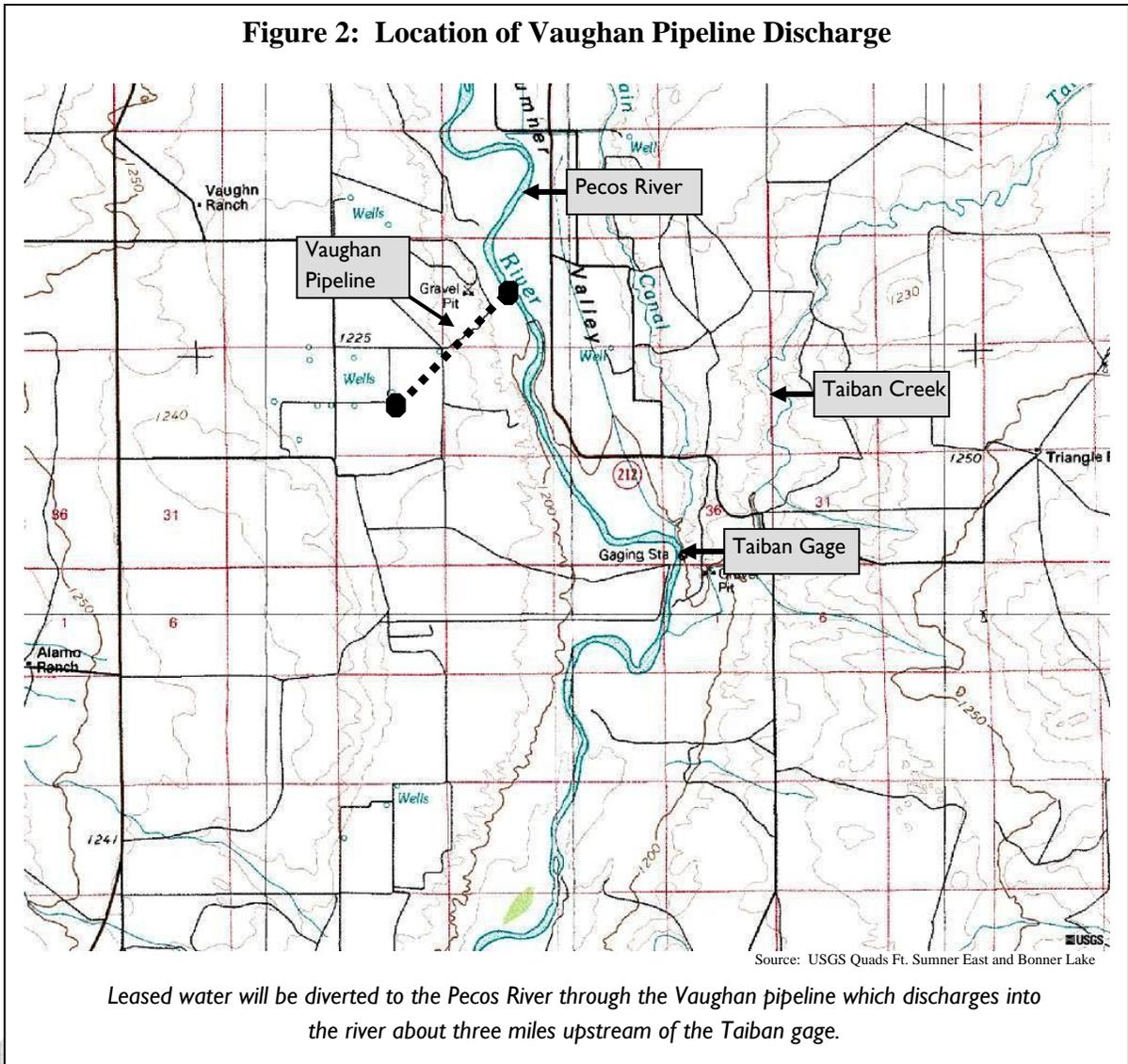
Proposed Action

Reclamation is proposing to enter into a long-term lease from 2007 through 2032 with the ISC for ground water rights associated with about 770 acres of agricultural land located about one mile west of the Pecos River and about seven miles south of the town of Ft. Sumner, De Baca County, New Mexico. The state purchased the land for the water rights as part of the State Water Reserve (SWR) program. The lease may be extended another 25 years if mutually agreeable by ISC and Reclamation. The affected water rights are New Mexico Water Right File Numbers FS-14, FS-21 & FS-22 combined, and FS-32.

The leased water would be pumped from ground water wells and delivered to the Pecos River through a pipeline to supplement streamflow for the benefit of the Pecos bluntnose shiner. Reclamation would annually lease a minimum of 1,100 acre-feet of water, up to a maximum of 1,793.98 acre-feet, as needed, depending on river flow conditions.

The ISC is constructing a two-mile long pipeline (Vaughan pipeline) to transport the water from the well field to the river. The existing wells have a capacity of about 10 cfs, but additional wells could be developed to produce up to 15 cfs, which is the operational capacity of the pipeline. All permits and consultation requirements for the construction and operation of the infrastructure (including discharge of the water into the river) have been obtained by the ISC. The point of discharge into the river is about three miles upstream of the Taiban gage, which is essentially the upstream boundary of the upper reach of critical habitat for the shiner (Figures 1 and 2).

Figure 2: Location of Vaughan Pipeline Discharge



Ownership, operation, and maintenance responsibilities of the infrastructure would remain with the ISC. Reclamation would notify the ISC verbally and by e-mail when Reclamation wants the water delivered to the river or to cease such deliveries. The action would be implemented within 48 hours of the request. Leased water would not be delivered to the river during block releases of irrigation water from Sumner Reservoir for delivery to the Carlsbad Irrigation District. The lease terms require that the agricultural land to which the leased water rights are appurtenant would be fallowed and not irrigated. The ISC would establish native grasses on the lands and control invasive weeds.

Additionally, Reclamation is proposing to formalize the use of a 1,000 acre-foot fish conservation pool (FCP) in Lake Sumner and/or Santa Rosa Reservoir (Figure 1). Under the Carlsbad Project Water Operations and Water Supply Conservation EIS, Reclamation committed to maintain a 500 acre-foot FCP (Reclamation 2006a). Since then, it has been determined that there is a need for a larger FCP to

provide additional flexibility in managing water operations to benefit the shiner. Reclamation would commit up to 750 acre-feet of ground water rights owned by Reclamation at Seven Rivers Waterfowl Mitigation Farm to be pumped into Brantley Reservoir in exchange for being able to store and withdraw up to 1,000 acre-feet of water from Sumner Lake and or Santa Rosa Reservoir.

Reclamation and the US Fish and Wildlife Service have about 1,800 acre-feet of water rights at Seven Rivers Waterfowl Mitigation Farm. Reclamation currently dedicates 375 acre-feet to maintain the existing 500 acre-foot FCP. About 640 acre-feet are currently committed to irrigate 360 acres as part of a mitigation commitment for the construction of Brantley Dam and Reservoir. This use would continue in providing habitat for waterfowl, migratory birds, and wildlife. Therefore, Reclamation is proposing to use an additional 375 acre-feet of the surplus water rights at Seven Rivers to be pumped into Brantley Reservoir in exchange for an additional 500 acre-feet for the FCP. Reclamation is coordinating with the New Mexico Department of Fish and Game (NMDGF) and US Fish and Wildlife Service (Service) to obtain their concurrence in changing this mitigation requirement and change in ground water use.

No Action Alternative

Under the No Action Alternative Reclamation would not expand the fish conservation pool and they would not enter into a long-term lease with ISC for their ground water rights near Ft. Sumner. The ISC would retain the water rights and would use the infrastructure to deliver water to the Pecos River to help manage river flows to meet State-line delivery requirements or other Strategic Water Initiatives. Reclamation would not be able to use the rights to meet the requirements of the Biological Opinion, and therefore, the no action alternative does not meet the purpose and need.

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Chapter 3: Affected Environment and Environmental Consequences

Introduction

Scope of Analysis

This section describes the current condition and trends of resources that may be affected by the proposed action and the environmental consequences of the proposed action and no action alternative. The information in this EA is tiered to and derived primarily from the information in the *Carlsbad Project Water Operations and Water Supply Conservation EIS* (Reclamation 2006a), the *2006-2016 Biological Opinion* (US Fish and Wildlife Service 2006), the *Long-term Miscellaneous Purposes Contract EIS* (Reclamation 2006c), and site specific studies for the Seven Rivers areas and for the Vaughan Pipeline (New Mexico Interstate Stream Commission 2007; Reclamation 2007). Information from these documents is incorporated by reference and will not be repeated here unless needed to clarify discussions, to meet a legal requirement, to provide site-specific detail or to address changes in the resource baseline. Each aspect of the environment that would be affected by the proposed action is discussed to the level of detail commensurate with the potential for environmental impact. The greatest potential for impacts would be to water resources, biology, agricultural soils and land resources, and recreation. Other resources discussed in this chapter include cultural resources, Indian trust assets, and Environmental Justice.

Leasing and delivering water through the ISC infrastructure and the expansion of the FCP would have negligible or no effect on air quality, noise, safety and human health, visual resources, and socioeconomics. The only difference between the proposed action and the no action alternative would be duration of pumping and changes in storage and application of water to the river. Since the water would be leased from the state, effects on the local economy would be negligible and limited to positive inputs for equipment maintenance and servicing. There would be no disproportionate human health, economic and environmental impacts on any group of people, including minority and low-income populations.

Pumping of ground water rights at Seven Rivers into Brantley Reservoir would not change any land uses and would have no impacts on air quality, noise, safety and human health, visual resources, socioeconomics and environmental justice. This land would still be maintained as habitat for waterfowl, migratory birds, and wildlife. Relevant ongoing trends in the Pecos River Basin include actions by the ISC to acquire 18,000 acre-feet of water and transfer the necessary water rights for well field operations to meet obligations under the Pecos River Carlsbad Project Settlement Agreement.

Study Area

The direct impact area would be the point on the Pecos River where the water would be discharged, the two reservoir locations where FCP water would be stored and released, and Brantley Reservoir. Because the proposed action includes changes in river inflows and reservoir storage, there would be potential for effects on water resources, biology and riparian habitat throughout the Pecos River system. Other effects could result in DeBaca County in the immediate vicinity of the well-field location and in nearby communities.

Water Resources

Climatic and Geomorphic Setting

The Pecos River Basin is generally considered to be semi-arid, with average rainfall in the Ft. Sumner area at 14 inches annually. Precipitation exhibits a distinct seasonality. In late fall and winter, lower-intensity precipitation typically associated with frontal storms enter the study area from the west and northwest. Weather patterns in July and August are characterized by scattered high-intensity thunderstorms which occur nearly daily, triggered by convective heating of a moisture-laden atmosphere. The moisture during the summertime “monsoon” season results from the atmospheric circulation from the Gulfs of Mexico and California to the south. Air temperatures vary within the region depending on location, but the basin is characterized by a high rate of evaporation due to wind and low humidity. Springtime is the most consistently windy period.

From Santa Rosa Dam to Sumner Lake, the Pecos River flood plain mostly is mostly incised into bedrock canyons of varying width and up to 300 feet deep. From Sumner Dam to Brantley Reservoir is a broad valley that was a relatively treeless, dry flood plain before the 1900s. Today, the lower valley, from the Near Acme gage to Brantley Reservoir, is covered by farm fields, and the flood plain includes mostly non-native invasive species, although there are ongoing efforts by several agencies to eliminate them.

Operational Priorities

Flood control is the foremost operational priority on the Pecos River; however, floods requiring regulation are relatively infrequent in the Pecos River system. Irrigation deliveries of Carlsbad Project water to Brantley reservoir (and eventually Avalon reservoir) through block releases for use by the Carlsbad Irrigation District (CID) and bypass of Fort Sumner Irrigation District’s (FSID) entitlement through Sumner Dam for diversion at FSID’s diversion dam are next in priority to flood control. Bypasses of Carlsbad Project supplies through Sumner Dam when available (such as during the non-irrigation season) for augmenting river flows for the shiner are next in priority. FCP releases are a last effort in the chain of priority for keeping the river continuous and are used when bypasses cannot be used and scheduling a block release is not permissible with the exception of emptying the FCP at the end of the calendar year in order to utilize any left over FCP storage completely. The water leasing action contemplated in this document would be

used when scheduling a block release is infeasible and when bypass water is not available, but before releases are made from the FCP for the same purpose. If water leasing is insufficient to cover target demands for keeping the river continuous, FCP releases and water leasing may be used in tandem for this purpose. Also, if bypass is available to meet some water demands, water leasing and FCP releases, in that respective priority order, may be used to supplement bypasses. Please refer to the EIS for further statistical information on block releases and FSID diversions (Reclamation 2006a.)

Streamflows

Streamflows in the study area are derived from two primary sources: snowmelt runoff from the headwaters of the Pecos River in the Sangre de Cristo mountain range and monsoon (and other event) rainfall in the study area. To a lesser extent, ground water inflows from mountain front recharge infiltrating into the Roswell and Capitan Reef aquifers, and subsequently discharging into the Pecos River, also contribute to streamflows in the study area. For a synopsis of streamflows in the entire study area, please refer to the Water Resources section in Chapter 3 of the EIS (Reclamation 2006a). For the purpose of this document, examination of streamflows is most important at the Near Acme gage since this area is critical in determining whether flow in the Pecos River is continuous. Figure 3.1 depicts historic flow duration at the Near Acme gage for the entire period of record at the gage (with the exception of provisional data) and Figure 3.2 depicts historic intermittency at the gage for the entire period of record.

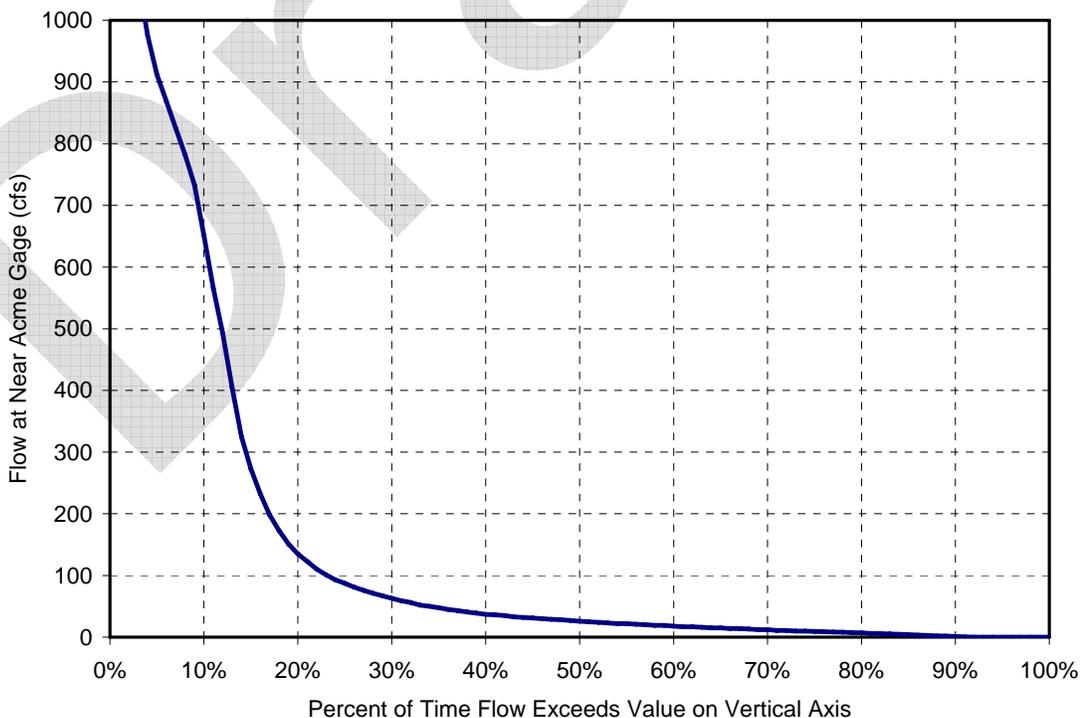


Figure 3. 1 Flow duration at the USGS Near Acme gage for the historic period of record (7/1937 through 12/2006).

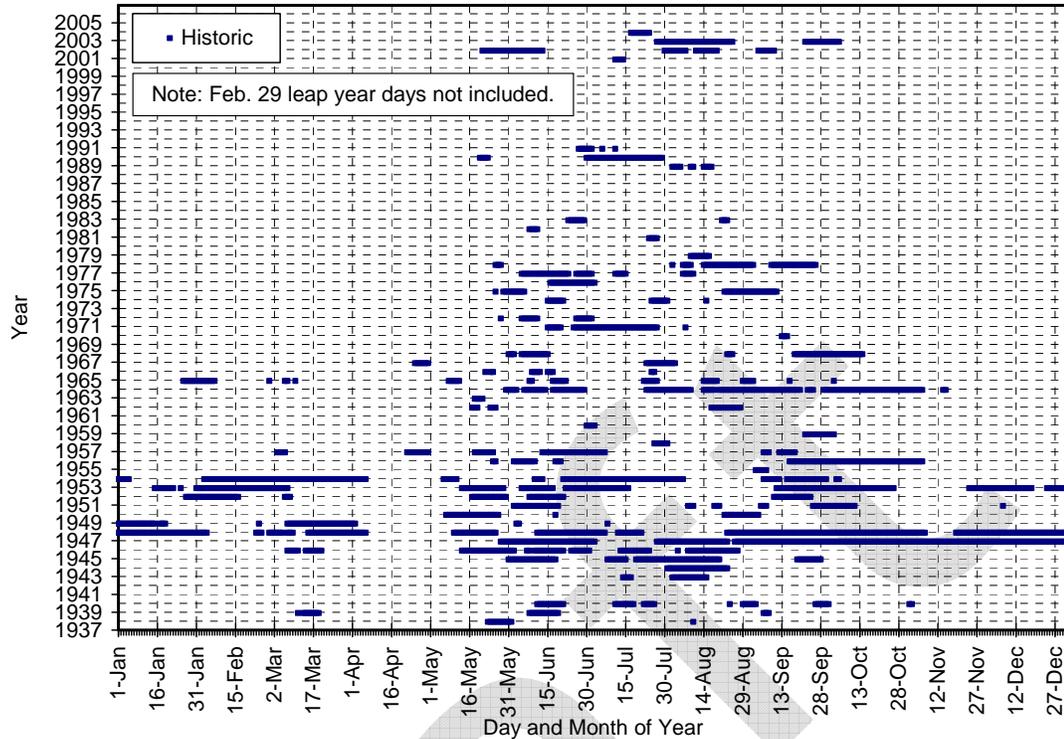


Figure 3. 2 Historic periods when intermittency occurred at the USGS Near Acme gage (7/1937 through 12/2006).

Reservoir Storage

Four reservoirs are located within the study area on the mainstem of the Pecos River; they include: Santa Rosa Reservoir, Sumner Reservoir, Brantley Reservoir, and Avalon Reservoir. With the exception of the 500 acre-foot FCP, all of the reservoir storage is utilized for irrigation within the Carlsbad Project. Including the FCP, the maximum allowable entitlement storage or “conservation storage” for the Carlsbad Project is 176,500 acre-feet. This maximum storage is divided among the four reservoirs depending on sedimentation levels in Sumner and Avalon reservoirs (Reclamation 2006a). Table 3.1 contains pertinent information about the reservoirs including purpose, conservation storage limits, total storage, ownership, year completed, and minimum pool (Reclamation 2006a).

Although Brantley reservoir has a maximum conservation storage of 40,000 acre-feet, it also exhibits additional storage because of its direct connection with the Major Johnson aquifer, which is a large aquifer at the southern boundary of the Roswell Basin Artesian aquifer. This additional storage for reservoirs is often referred to as “bank storage”. The estimated total conservation storage for Brantley reservoir including bank storage is close to 63,000 acre-feet. Since approximately 10,000 acre-feet of water still remains in the banks at the minimum storage of 2,500 acre-feet, roughly 13,000 acre-feet of this extra storage is available to the Carlsbad Project.

Table 3.1 Pecos River Reservoirs

Reservoir	Purpose(s)	Ownership	Year completed	Allowable conservation storage space ¹ (acre-feet)	Total storage capacity ² (acre-feet)	Minimum pool (acre-feet)
Santa Rosa	Flood control and irrigation	Corps	1980	92,236	438,364	0
Sumner	Irrigation and flood control	Reclamation	1937	40,398	93,828	2,500
Brantley	Irrigation and flood control	Reclamation	1988	40,000	414,466	2,000
Avalon	Irrigation	Reclamation	1907	3,866	4,466	600

¹ Excludes minimum pool.

² Top of flood pool; accounts for sedimentation using latest surveys; does not include flood surcharge space.

Reservoir Evaporation

Reservoir evaporation is significant in the study area since all of the reservoirs are located in the arid desert climate of Eastern New Mexico. Pecos River RiverWare modeling indicates average annual evaporation from these four reservoirs is around 45,000 acre-feet/year. Some reservoirs experience lower evaporation rates per unit area because of their physical location in Eastern New Mexico. Typically temperatures increase from upstream to downstream along the Pecos River so it follows that evaporation rates also increase. Santa Rosa has the lowest average unit evaporation rate at 68 inches per year, Sumner averages 84 inches per year, and Avalon and Brantley reservoirs experience an average of 89 inches per year (Reclamation 2006a).

Unit evaporation is not the only parameter affecting total reservoir evaporation. The amount of storage contained in a reservoir compared to the amount of surface area exposed to the atmosphere is also important. Ratios are dependent on the particular geometry (or bank storage effect) in the reservoir at a given storage level. A comparison of ratios at the conservation limit of each reservoir is as follows. For the ratio of exposed surface acres to acre-feet of storage, Santa Rosa is most efficient at 26. Brantley reservoir is second most efficient, which is somewhat attributable to its large bank storage capacity, with a ratio of 19. Sumner is third most efficient, which is mostly due to the many years of sedimentation that has accumulated in the reservoir, with a ratio of 15 acre-feet of storage per acre of water surface exposed to the atmosphere. Although its storage capacity is rather small, Avalon is least efficient with a ratio of 5 acre-feet of storage per acre of exposed water surface.

Reservoir storage is an important concept in understanding depletions from the Pecos River System and it is also a key parameter in net depletions or changes to the Carlsbad Project's water supply due to changes in river operations. Changing river operations can affect storage levels and detention times at reservoirs, which ultimately affects the amount of evaporation that occurs within them.

Groundwater

Groundwater in the study area includes two major confined aquifers and a shallow unconfined aquifer underlying the entire mainstem of the Pecos River within the study area. The two major confined aquifers include the carbonate aquifer in the Roswell Artesian Basin and the Capitan Reef Complex, which is a large arc shaped aquifer underlying most of the Carlsbad area that stretches east into West Texas. Both the shallow and the confined aquifers are linked to the Pecos River. The proposed water lease agreement and FCP expansion both involve changing uses for wells that pump from these aquifers. In the case of the proposed water lease agreement, the aquifer in the Ft. Sumner area is known to have a direct connection to the Pecos River (Chudnoff, et. al. 2005). Aquifer tests indicate that in this area the aquifer may be a confined or a leaky-confined aquifer (Chudnoff, et. al. 2005). For the FCP exchange, ground water withdrawals are made from the artesian (carbonate) confined aquifer at the southern tip of its extents near Seven Rivers, NM. This aquifer is known to affect the discharge of base inflows to the Pecos River between Acme, NM and Artesia, NM.

Water Quality

Impaired waters and salinity are generally the two biggest factors in water quality in the study area. The four reservoirs and five river reaches within the Pecos River study area are listed as impaired waters (Reclamation 2006a). Four of the river reaches are listed as impaired primarily due to nutrient loading not supporting a typical warm water fishery (New Mexico Water Quality Control Commission [NMWQCC] 2004). Reservoirs are listed as impaired and probable causes listed include: mercury found in fish tissue, nutrient/eutrophication biological indicators, and sediment/siltation (NMWQCC 2004).

Salinity is primarily an issue for irrigation since high salinity can stunt crop growth or possibly even result in plant mortality. Salinity is typically measured as Total Dissolved Solids (TDS), but is often approximated using Electrical Conductivity (EC). Waters in the Pecos River study area are governed by TDS standards, but the standards have not been exceeded (Reclamation 2006a). EC (and subsequently TDS) generally increases from upstream to downstream in the study area. Median EC measurements range from less than 1,000 micro-Siemens per centimeter ($\mu\text{S}/\text{cm}$) above Santa Rosa to over 6,000 $\mu\text{S}/\text{cm}$ at Artesia and over 4,000 $\mu\text{S}/\text{cm}$ downstream of Brantley Reservoir (Reclamation 2006a). Generally, irrigation water stored in Santa Rosa and Brantley reservoirs does not exhibit a high enough concentration of TDS to affect crops; however, Brantley reservoir has known water quality problems at times mostly from upstream irrigation return flows that tend to increase TDS. These TDS increases occur as low discharge (~100 cfs or less)

enters the reservoir from the Pecos River. CID sometimes uses block releases, large blocks of water (>1000 cfs) with low TDS, to dilute the concentration of TDS in Brantley reservoir (Reclamation 2006a). Groundwater is also known to generally increase in salinity in the upstream to downstream direction in the Pecos River study area (Reclamation 2006a). In the Seven Rivers area, sampling of artesian and shallow wells was conducted in 2005 with average EC results (ranging from 2,230 to 3,280 $\mu\text{S}/\text{cm}$) being below the median EC amounts in Brantley Reservoir (surface = 3,768 $\mu\text{S}/\text{cm}$ and bottom = 5,179 $\mu\text{S}/\text{cm}$) (Reclamation 2007).

Biological Resources

Wildlife and Habitat

A detailed discussion of the wildlife and habitat along the Pecos River is found in the Carlsbad EIS (Reclamation 2006a). Vegetation in the vicinity of the Vaughan pipeline discharge point includes native and non-native riparian vegetation, surrounded by farms and fallowed farmland. This habitat supports a wide variety of birds, mammals, amphibians, and reptiles.

The Seven Rivers Waterfowl Mitigation Farm was established as mitigation for habitat loss when Brantley Reservoir was created. The farm is operated by the New Mexico Department of Game and Fish (NMDGF) to raise grains crops and provide a secure rest stop for migratory birds. It is surrounded by undeveloped land.

Generally, small-bodied fishes dominate the riverine fish community in the Pecos River; however, other aquatic species, including reptiles and amphibians are also dependent upon Pecos River flows. Below the discharge point, the Pecos River enters a broad alluvial plain where the river is more typical of a Plains stream, with a relatively wide channel and a shifting sand substrate. Shallow runs and braided channels are prevalent, and there are small wetlands along the river and in oxbows. This reach provides the necessary habitat components for the Pecos bluntnose shiner and other aquatic species but has been subject to intermittency when base inflows are low or diverted.

Santa Rosa Reservoir is a popular sport-fishery for catfish, largemouth and smallmouth bass, crappie, and walleye. Sumner Lake provides warmwater fishing, with several varieties of bass, crappie, pike, bluegill, carp, and catfish. Detritivores, including shad, carp, and warmwater suckers, may be important to trophic (food chain level) dynamics in Sumner Lake because they have been found to accumulate large biomasses and influence food availability there. The Sumner Lake stilling basin contains catfish and trout. NMDGF stocks the stilling basin with rainbow trout from November through March.

Brantley Reservoir provides year-round fishing for white bass, catfish, largemouth bass, walleye, and crappie. In the last several years, Brantley Reservoir has been

stocked with crappie, Florida strain largemouth bass, and catfish. Golden algae blooms are possible in Brantley Reservoir.

Threatened, Endangered and Special Status Species

Special status species are those listed as threatened or endangered under provisions of the Federal Endangered Species Act of 1973, as amended (ESA); those proposed or considered as candidates for such listing; and those considered as rare or species of concern by the Service, NMDGF, and New Mexico Energy, Minerals and Natural Resources Department, Forestry Division. The ESA grants listed species protections from harassment, harm, or destruction of habitat.

There are over 65 known sensitive status species known to occur in Guadalupe, DeBaca, Chaves, and Eddy Counties. Of these, the only federally protected species that could be impacted by the proposed action are the Pecos bluntnose shiner (*Notropis simus pecosensis*) and interior least tern (*Sterna antillarum*).

The shiner is a state and federally threatened species. It is a small fish that is native to the Pecos River in New Mexico. The shiner was first collected in 1874 in the Rio Grande of New Mexico (Federal Register 52(34): 5295-5303). The Service designated the shiner as a federally threatened species, with critical habitat, in 1987 under ESA. At the time of listing, the Service identified the “most important factors in the species’ decline as reduced flow in the main channel of the river because of water storage, irrigation, and water diversion” (Federal Register 52(34): 5295- 5303).

There is a lack of scientific consensus concerning the precise habitat and in-stream flow requirements for the shiner but general agreement that maintenance of a dynamic sand bed channel with low-velocity areas and avoidance of intermittency are important components. The ongoing drought, combined with the continued demands on the river for irrigation and compact deliveries to Texas, may be putting additional strain on the genetic diversity of the remaining population and thus the long-term survival of the shiner.

Designated critical habitat for the shiner is divided into two reaches. The boundary of the upper critical habitat is located near the discharge point at the confluence of Taiban Creek and extends downstream to Crockett Draw. The lower critical habitat reach is from Hagerman to Artesia. The upper critical habitat has a wide sandy river channel with only moderately incised banks and provides habitat suitable for all age classes. The lower critical habitat is deeply incised, has a narrow channel, and has a compacted bed. Although the lower critical habitat has permanent flow, the habitat is less suitable for shiners and only smaller size classes are common in this reach. Lack of growth, reduced survival, and reduced recruitment in this reach is attributed to poor habitat conditions and the periodic downstream displacement of eggs, larvae, and small juveniles.

The Interior least tern is a federally listed endangered species. This water bird 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 west shoreline of Brantley Reservoir intermittently from 2003 through 2006. Nesting Season is between late April and August throughout the species’ range.

Agricultural Soil and Land Resources

This section identifies the conditions and trends in agricultural land use and soils that may be affected by the proposed action. No state designated farmlands of statewide importance or federally recognized prime or unique farmlands would be impacted by the proposed action. Farms in the Pecos River Basin support a variety of valuable food and fiber crops, as well as cattle feed for the local livestock industry. Irrigated lands are currently being purchased or leased and retired on the basis of the Settlement Agreement (Reclamation 2006c) and to meet the requirements of the Biological Opinion. Other lands have been retired from irrigation because of a water table buildup or soil salinity increase. Still other lands have been retired because of high costs to pump ground water or other economic factors. Lands in the area of the artesian ground water basin are being retired, and the ground water is being transferred to urban use.

Soil organic matter is rather low. Irrigation tends to maintain or increase organic matter in the surface soil because irrigation usually results in the increased incorporation of crop residues into the soil. Noxious weeds and invasive species are a major problem throughout the basin, although many agencies have very active programs to reduce affected acreage.

Irrigated land in the Seven Rivers area is primarily used as nut orchards, especially pecans, and for grain crops. The Seven Rivers Waterfowl Mitigation Farm produces 360 acres of irrigated grains and forage for wildlife.

Recreation

The affected environment for recreation includes the recreational facilities at the storage reservoirs and the recreational opportunities that exist along the Pecos River. A detailed discussion of the attendance, use and expenditures associated with recreation is found in the Carlsbad EIS (Reclamation 2006a).

Santa Rosa Reservoir, located on the Pecos River about 7 miles north of Santa Rosa, is a recreational use area managed jointly by the US Army Corps of Engineers and the New Mexico State Division of Parks and Recreation. The State leases 551 acres from the Corps for Santa Rosa Reservoir State Park, which has facilities for boating, camping, fishing, hiking, picnicking, sailing, water-skiing,

and wildlife viewing. The Corps encourages fishing, hiking, and hunting on these lands. Backcountry access is by foot only. Fishing can be poor to excellent, depending on the water level; low water levels result in poor fishing success. Approximately 680 acres of land are managed by the Corps as wildlife habitat. Hunting is allowed on project lands, except within 300-yard “no shooting” zones around camping, recreational, and operational areas.

Sumner Lake, located on the Pecos River about 16 miles northwest of Ft. Sumner, encompasses approximately 4,500 acres of water surface and 60 miles of shoreline. The New Mexico State Division of Parks and Recreation provides facilities for, and manages recreation at, Sumner Lake State Park. Although Sumner Lake is primarily used for irrigation, recreation is also a beneficial use. Facilities are provided to support boating, camping, fishing, picnicking, sailing, water-skiing, and wildlife viewing. Visitor use during the summer is affected by extreme water levels above or below the conservation pool.

Small watercraft and other flotation devices can be used on the upper reaches of the Pecos River in the spring if flows are sufficient. Fishing, however, appears to be the primary activity on the river. Fishing and other recreational activities depend on the availability of water, as well as public access. Public access below Sumner Dam is provided by the State park. Other public access is available at State and county highway bridges and across public land managed by the Bureau of Land Management (BLM). BLM does not have any developed recreation sites or river access sites along the Pecos River. The area of the river in which the greatest amount of recreational use takes place is likely directly downstream from Sumner Dam. The presence of the State park, with its camping and picnicking facilities, restrooms, and easy access, makes this a popular river recreation area.

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. 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 2006a).

The Seven Rivers Waterfowl Mitigation Farm is used for wildlife and bird-watching and limited hunting.

Cultural Resources

This section identifies cultural resources that may be affected by the proposed action. The affected environment for cultural resources includes the existing water channels or active flood zones of the Pecos River corridor and the various reservoir storage pools.

Cultural resources include past and present expressions of human culture and history in the physical environment, such as prehistoric and historic archaeological sites, buildings, structures, objects, districts, natural features, and biota, which are considered important to a culture, subculture, or community. Cultural resources also include aspects of the physical environment that are a part of traditional lifeways and practices, and are associated with community values and institutions. Historic properties are a subset of cultural resources that meet specific eligibility criteria found at 36 CFR 60.4 for listing on the National Register of Historic Places (NRHP).

Cultural resources have been organized into prehistoric resources, historic resources, and traditional cultural properties. These types are not exclusive, and a single cultural resource may have multiple components. Prehistoric cultural resources refer to any material remains, structures, and items used or modified by people before Europeans established a presence in New Mexico in the early 17th century. Historic cultural resources include material remains and the landscape alterations that have occurred since the arrival of Europeans in the region. Traditional cultural properties are places associated with the cultural practices or beliefs of a living community. These sites are rooted in the community's history and are important in maintaining cultural identity. Examples of traditional cultural properties for Native American and Hispanic communities include natural landscape features, places used for ceremonies and worship, places where plants are gathered to be used in traditional medicines and ceremonies, places where artisan materials are found, and places and features of traditional subsistence systems, such as community-maintained irrigation systems and traditionally used fields, grazing areas, and firewood-gathering sites..

A detailed cultural setting and site record search for the Pecos River basin is included in the cultural resource technical report (Tetra Tech, Inc., 2004), prepared in support of the Carlsbad Project Water Operations and Water Supply Conservation EIS (Reclamation 2006a). The affected environment for cultural resources is identified as the area of potential effects (APE), as described in 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. Because the proposed action only involves the lease, delivery and storage of water, the APE for cultural resources for the proposed changes in water operations includes existing water channels or active flood zones. No additional construction, ground disturbance, changes in water storage, control and delivery infrastructure, or new land

abandonment is proposed. Cultural resources, primarily archaeological sites, bridges, and water storage, control and delivery infrastructure are located in the existing water channels and active flood zones. No traditional cultural properties have been identified in the Pecos River Basin during tribal consultations conducted for the Carlsbad EIS (Reclamation 2006a). Letters describing the range of supplemental water proposals were sent to representatives of twelve tribes and Native American pueblos on January 22, 2007 (See Chapter 6). No traditional cultural concerns have been identified to date.

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.

No issues involving Indian Trust or specific ITAs were identified in the Pecos River Basin during the preparation of the Carlsbad EIS (Reclamation 2006a). Letters regarding the range of supplemental water proposals were sent to representatives of twelve tribes and Native American pueblos on January 22, 2007 (See Chapter 6). No ITA issues have been identified to date.

Environmental Justice

An evaluation of environmental justice impacts is mandated by Executive Order 12898 on Environmental Justice (February 11, 1994). Environmental justice addresses the fair treatment of people of all races and incomes with respect to Federal actions that affect the environment. Fair treatment implies that no group of people should bear a disproportionate share of high and adverse human health and environmental impacts from a Federal action.

The impacts of an action can be considered disproportionately distributed if the impacts imposed on a specific group are greater than the percentage of the total

population represented by that group. A group is typically defined by race, ethnicity, income class, or community identity. Evaluating potential environmental justice concerns requires an understanding of where the project impacts are likely to occur and where potentially affected groups are located. The analysis relies on demographic data from sources such as the U.S. Census Bureau, individual counties and municipalities, and local school districts to determine the location of different groups of people. Census demographic data and state economic development figures are typically the most complete and comparable information available for individuals and households.

Demographic data compiled from the Census Bureau sources for the EIS are repeated here in Table 3.2. .

Table 3.2 Population of study area by race and Hispanic ethnicity

Race and Hispanic origin	Chaves County		De Baca County		Eddy County		Guadalupe County		Four-county Region	
	Total	Percent of total	Total	Percent of total	Total	Percent of total	Total	Percent of total	Total	Percent of total
White	44,167	72.0	1,882	84.0	39,438	76.3	2,530	54.1	88,017	73.4
Black or African American	1,209	2.0	1	0.0	805	1.6	62	1.3	2,077	1.7
American Indian and Alaskan native	694	1.1	21	0.9	646	1.3	53	1.1	1,414	1.2
Asian	323	0.5	5	0.2	231	0.4	25	0.5	584	0.5
Native Hawaiian and other Pacific races	34	0.1	0	0.0	47	0.1	2	0.0	83	0.1
Other race	13,042	21.2	281	12.5	9,129	17.7	1,828	39.1	24,280	20.2
Two or more races	1,913	3.1	50	2.2	1,362	2.6	180	3.8	3,505	2.9
Hispanic or Latino (can be of any race)	26,904	43.8	790	35.3	20,023	38.8	3,801	81.2	51,518	42.9

The annual per capita income for the State of New Mexico in 2005 was \$27,889. The 2005 per capita personal income by county is as follows: Chaves County: 24,880, DeBaca County: \$ 22,565, Eddy County: \$29,983, and Guadalupe County: \$16,455 (Reclamation 2006a).

These data indicate that the distribution of population by race and ethnicity is similar for each of the study area counties, except for Guadalupe County, which has a very large percentage of residents who identify themselves as of “other race” and ethnically Hispanic. Race is considered by the U.S. Census Bureau a separate concept from Hispanic origin (ethnicity). People who identify their origin as Spanish, Hispanic, or Latino may be of any race. The per capita income of Guadalupe County is much lower than the rest of the counties in the study area and the state as a whole.

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Chapter 4: Environmental Consequences

Water Resources

The following indicators were used to evaluate water resources for the alternatives. A detailed definition of these indicators is provided in Appendix A.

- Flow duration or frequency at the Near Acme gage, or the amount of time that a certain flow has occurred at the Near Acme gage; and intermittency, which is the amount of time that zero flow has occurred at the Near Acme gage
- Additional water need (AWN), or the amount of additional water required to satisfy the target demand of 35 cfs at the Taiban gage or a continuous river, which is defined as 2 cfs at the Acme gage in summer months
- Carlsbad Project water supply, which is measured as the shortfall amount to the project due to the proposed action, sometimes referred to as the net depletion to the Carlsbad Project water supply
- Pecos River flows at the New Mexico-Texas State Line, which is measured as the change in the amount of flow at the State line
- Changes to Pecos River Compact (Compact) delivery obligation due to alternative operations affecting Sumner Reservoir outflows
- Groundwater withdrawals, increases or decreases in ground water withdrawals due to water leasing actions
- Water quality impacts, qualitative impacts to the Pecos River and reservoirs considering water leasing agreements and changes in operations

Hydrological modeling was conducted to evaluate these indicators. Appendix A provides an overview of the modeling methods. In summary, the model assessed a prior to 1991 (pre-91) baseline condition, no action condition, and the proposed action. For the proposed action, three operational scenarios were developed to assess how the river might respond to different applications of the fish conservation pool and rate of pumping ground water.

No Action

Modeling results for the No Action alternative are presented in this section. Flow duration and intermittency are presented along with remaining additional water needs (AWN), Carlsbad Project water supply, State-line flows, compact obligations, ground water withdrawals, and water quality.

No Action Flow Duration and Intermittency

Flow duration modeling results for flows at the Near Acme gage are presented in Figure 4.1. Intermittency results (occurrence of zero flow) are presented in Figure 4.2

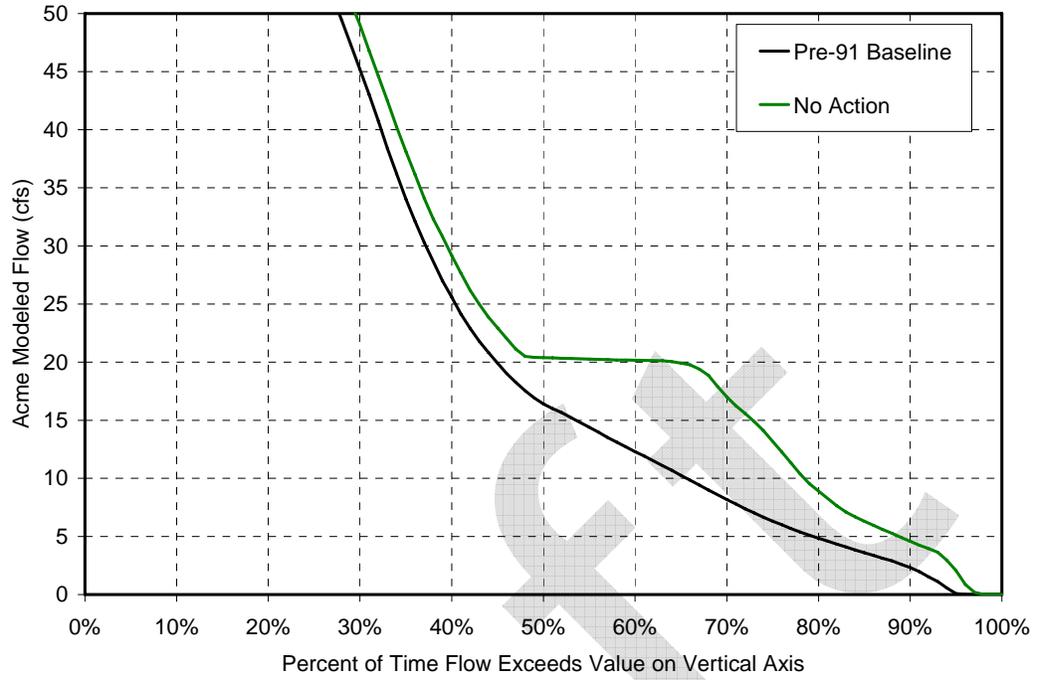


Figure 4. 1 Modeled flow duration at the Near Acme Gage showing pre-91 baseline and No Action results.

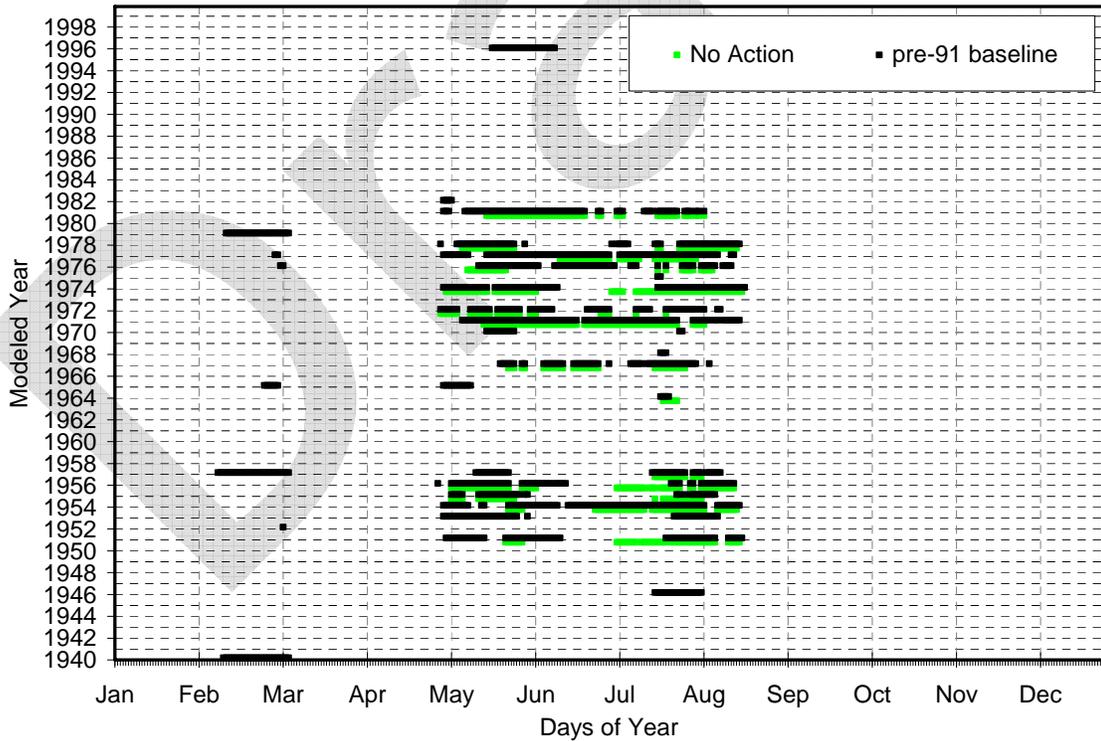


Figure 4. 2 Modeled intermittency at the Near Acme Gage showing pre-91 baseline and No Action results (bars denote times when intermittency occurred).

From Figure 4.1, it is apparent that winter bypassing for a constant target of 35 cfs at the Taiban gage makes a large benefit at the Near Acme gage (note plateau at 20 cfs). Also note from the plot, that the 500 acre-foot per year FCP in conjunction with bypassing makes a difference in the amount of intermittency, an improvement from 7% to 5%. The days of modeled intermittency depicted in Figure 4.2 indicate that winter bypassing eliminated all of the intermittency occurring in the non-irrigation season and the FCP reduced some intermittency during the summer months.

No Action Remaining Additional Water Needs (AWN)

Table 4.1 indicates the original and remaining AWN for meeting the constant target of 35 cfs at Taiban. These AWN values also include the amount of water to keep the Pecos River flow continuous at a discharge of 2 cfs at the Near Acme gage in the summer months. AWN is the amount of water that is needed to meet all of the target flow demands after available bypass amounts are consumed. Total water needed is the sum of available bypass and AWN.

Table 4.1 No Action (remaining) Additional Water Needs

Alternative	60-year annual averages			Maximum and minimum additional water needed			
	Total water needed (acre-feet per year)	Available water bypassed (acre-feet per year)	AWN (acre-feet per year)	Maximum AWN (acre-feet)	Maximum occurs in modeled year	Minimum AWN (acre-feet)	Minimum occurs in modeled year(s)
Bypass Only	4300	2500	1800	6900	'56	0	'42
No Action	4000	2300	1200	5900	'56	0	'41, '42, '49, '58, '86, '87, '91, '93, '95, '97, '99

From the table it is apparent that the FCP helps to reduce the additional water need required after bypassing is applied to river operations. For example, the average AWN was reduced from 1,800 acre-feet per year to 1,200 acre-feet per year. In the modeled year for 1956, the maximum annual AWN was reduced from 6,900 acre-feet to 5,900 acre-feet.

No Action Water Supplies

Water supplies for the No Action alternative are measured in comparison to the pre-91 baseline. Carlsbad Project total net depletions, changes to flows at the New Mexico-Texas Stateline, and changes in Compact delivery obligation are water supply resource indicators. Table 4.2 summarizes impacts to these indicators.

Table 4.2 Average (60-year) Changes in Water Supply Indicators for the No Action Alternative

Alternative	Total Net Depletion to Carlsbad Project Water Supply (acre-feet per year)	Increased CID Diversions (acre-feet per year)	Project water lost to additional conservation spills (acre-feet per year)	Estimated increase in flows at the Stateline (acre-feet per year)	Additional Compact Obligation (acre-feet per year)
No Action	-600	500	1000	1250	-3100

In reading the table, the first column represents the total net depletion to diversions and project storage to the Carlsbad Project water supply for the No Action alternative. In other words, compared to the pre-91 baseline, an average of 600 acre-feet per year more water was made available to the Carlsbad Project for the No Action alternative. The second column represents increases in CID diversions from project water supplies, an average of 500 acre-feet per year. The third column shows how much water spilled from the Project due to the action, 1,000 acre-feet per year. The fourth column estimates the additional State-line flow as a result of water spilled from the project and additional CID diversions, which assumes a 50% return flow component for CID diversions (EIS modeling indicated Carlsbad area ground water gains at 75% of CID diversions, but 50% is used here to be conservative in the absence of modeling these ground water gains). The fifth column shows the estimated relative change in Compact obligation due to increases (or decreases) in Sumner outflow.

No Action Groundwater Withdrawals

Groundwater withdrawals for the No Action model simulation only includes exchange of 375 acre-feet per year of Seven Rivers ground water rights pumped into Brantley reservoir (Carlsbad Project storage) for the 500 acre-feet per year FCP stored in Sumner or Santa Rosa reservoirs. Well records indicate historic withdrawals in 2002 and 2003 of 790 and 870 acre-feet per year, respectively, for these water rights before FCP exchanges started. The full diversion amount for these rights is 1,800 acre-feet per year and the consumptive irrigation requirement associated with the water right is 1,260 AF/year. Pumping 375 acre-feet per year for the exchange is less than the historic diversion for 2002 and 2003, but the water rights are essentially only being used partially. If Reclamation continues pumping at the 2002-2003 level for previous uses under the No Action alternative in addition to pumping 375 acre-feet per year for the FCP exchange, ground water withdrawals will be approximately 1,200 AF/year in this location.

No Action Water Quality

The Carlsbad Project Environmental Impact Statement (EIS) shows slight modeled impacts to electrical conductivity (EC) at Artesia and Below Brantley Dam as a result of bypassing (Reclamation 2006a). EC is an indirect measurement of total dissolved solids (TDS), sometimes referred to as salinity. Stratification of high salinity water is historically a problem in Brantley reservoir and is managed by using block releases to “turn over” the stratified layer and mix the reservoirs contents, subsequently

diluting the stratified high-EC layer with fresh water from a block release. Bypassing actions included in the No Action alternative will not impact water quality of flows at Artesia or Below Brantley anymore than was already identified in the EIS.

Newly developed wells in the Seven Rivers area show lower EC values than the seasonal EC values in Brantley reservoir so exchange pumping in the Seven Rivers area will likely serve to dilute some of the salinity in Brantley reservoir (Reclamation 2007).

Proposed Action

Alternative impacts for the three simulated scenarios of the proposed action are presented in this section. Operational Scenario A is an expansion of the FCP from 500 acre-feet per year to 1000 acre-feet per year with a subsequent increase of exchange pumping at Brantley from 375 acre-feet per year to 750 acre-feet per year. Operational Scenario B also expands the FCP and exchange by the same amount and in addition includes a lease of roughly 1100 acre-feet per year of ground water rights in the Ft. Sumner area to augment Pecos River flows. Operational Scenario C also expands the FCP and exchange by the same amounts and in addition includes a lease of roughly 1600 acre-feet per year of ground water rights in the Ft. Sumner area to augment Pecos River flows. Operational Scenario B would pump these Ft. Sumner area ground water rights to the river at a maximum rate of 10 cfs and Operational Scenario C would pump at a maximum rate of 15 cfs (refer to Table A.1 in Appendix A).

The following table (Table 4.3) shows qualitative measurements of the water resources indicators used in this chapter for all three of the Proposed Action operational scenarios. In sum, operational scenarios B and C show the most relative improvement. Expansion of the FCP only, Operational Scenario A, showed the least improvement from the No Action alternative. Quantification of these resource indicators is discussed below.

Table 4.3 Qualitative Summary of Resource Indicators

Alternative	Relative change from No Action Alternative				
	Flow frequency and intermittency Near Acme	Additional Water Needs	Project Water Supply, State-line Flow, and Compact	Groundwater withdrawals	Water Quality
Scenario A	slight improvement	slight reduction	no improvement to slight improvement	slight increase at Seven Rivers	No change to slight reduction at Brantley
Scenario B	large improvement	large reduction	no improvement to slight improvement	slight increase at Seven Rivers; large decrease near Ft. Sumner	No change to slight reduction at Brantley and Pecos River near Taiban Creek
Scenario C	large improvement	large reduction	no improvement to slight improvement	slight increase at Seven Rivers; large decrease near Ft. Sumner	No change to slight reduction at Brantley and Pecos River near Taiban Creek

Proposed Action Flow Duration and Intermittency

Modeled flow durations at the Near Acme gage for the action alternative operational scenarios A, B, and C are shown in Figures 4.3, 4.4, and 4.5, respectively. Depictions of intermittency from the modeled results for flow at the Near Acme gage for operational scenarios A, B and C are shown in Figures 4.6, 4.7, and 4.8, respectively. All of the operational scenarios in the Figures are compared to the No Action alternative.

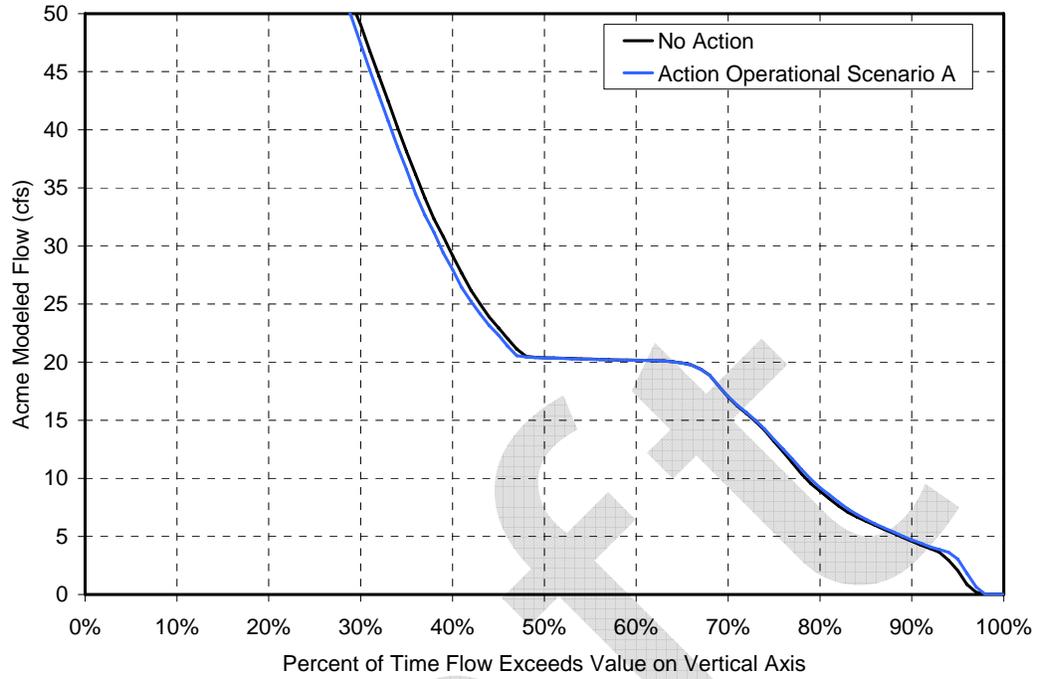


Figure 4.3 Modeled flow duration at the Near Acme gage for Operational Scenario A as compared to No Action.

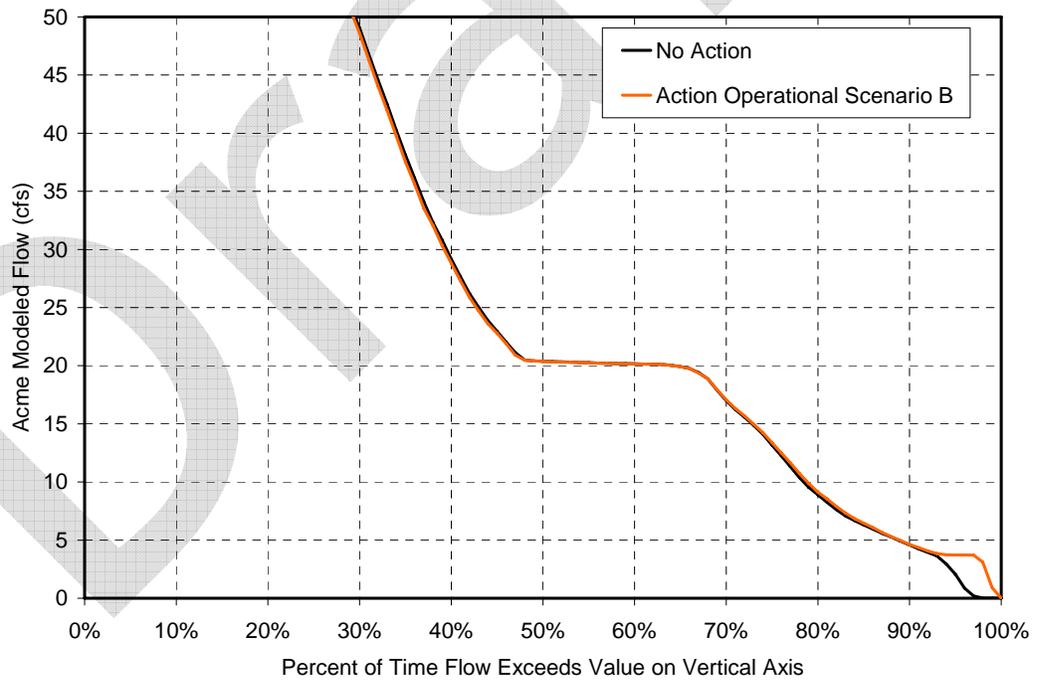


Figure 4. 4 Modeled flow duration at the Near Acme gage for Operational Scenario B as compared to No Action.

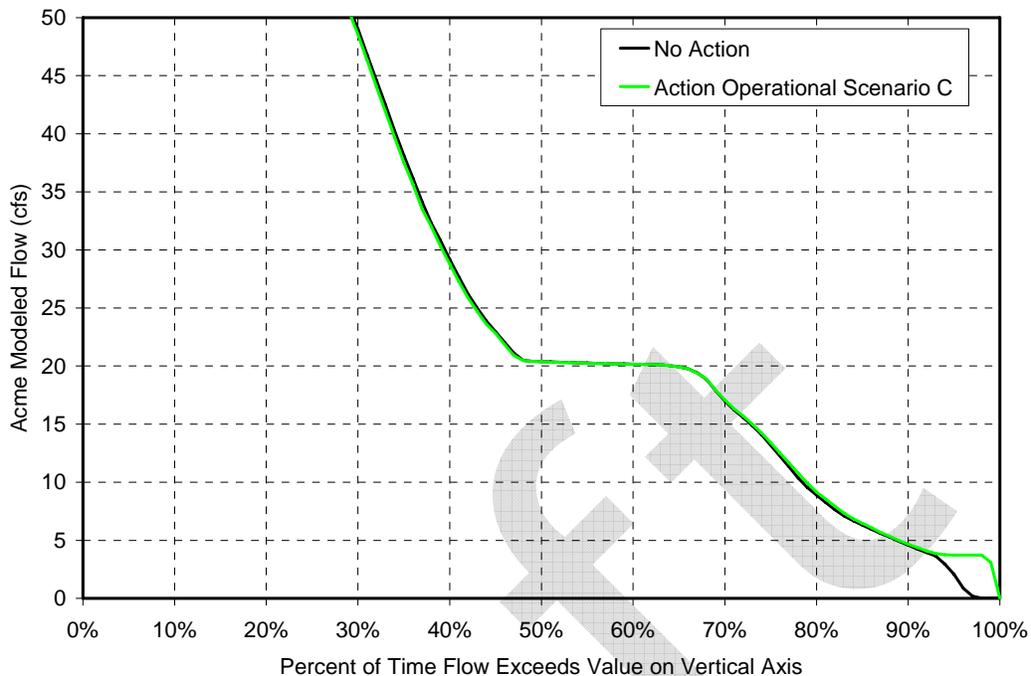


Figure 4. 5 Modeled flow duration at the Near Acme gage for Operational Scenario C as compared to No Action.

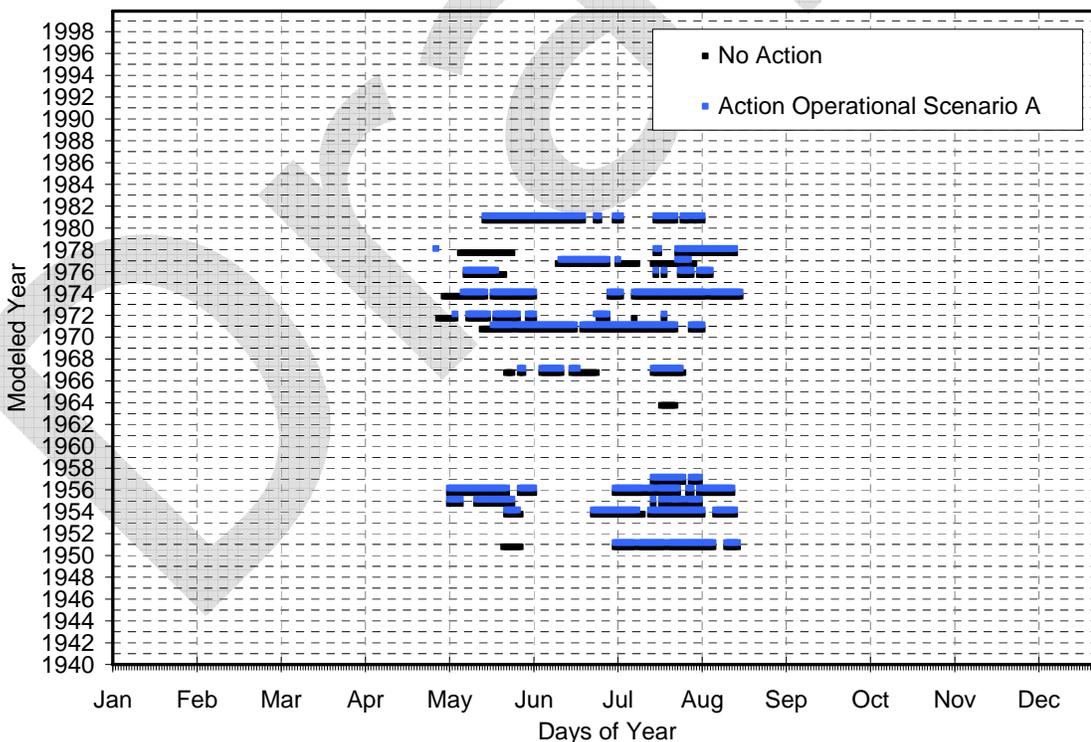


Figure 4. 6 Modeled intermittency at the Near Acme gage for Operational Scenario A as compared to No Action.

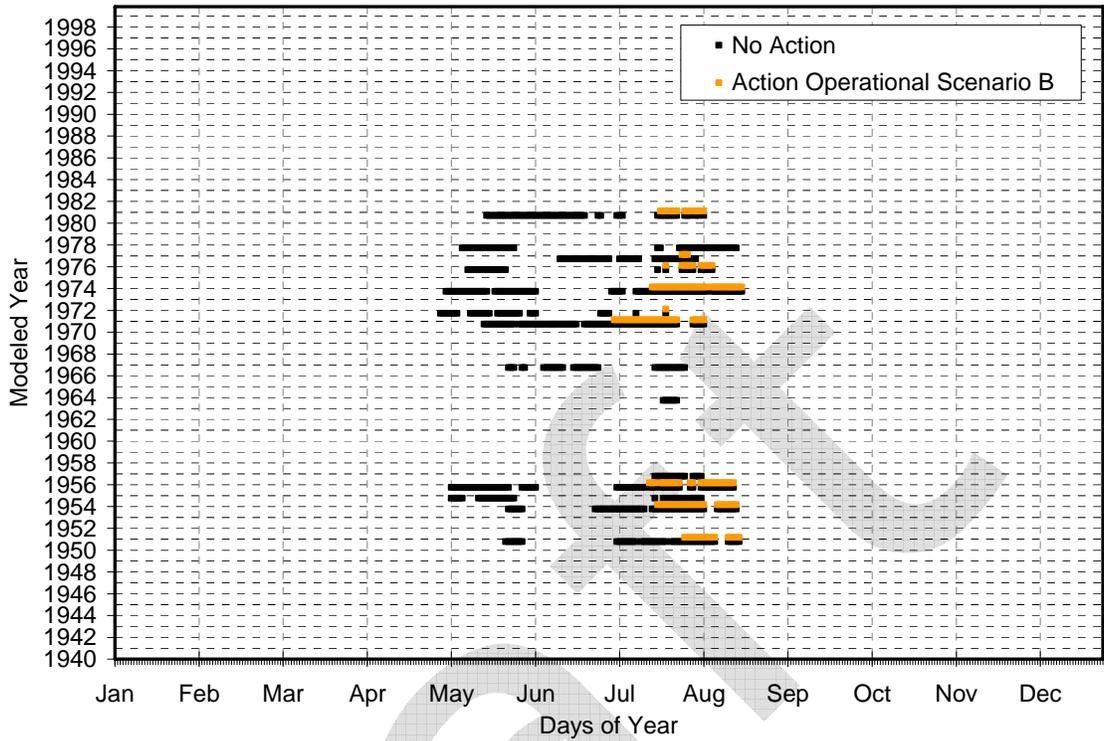


Figure 4. 7 Modeled intermittency at the Near Acme gage for Operational Scenario B as compared to No Action.

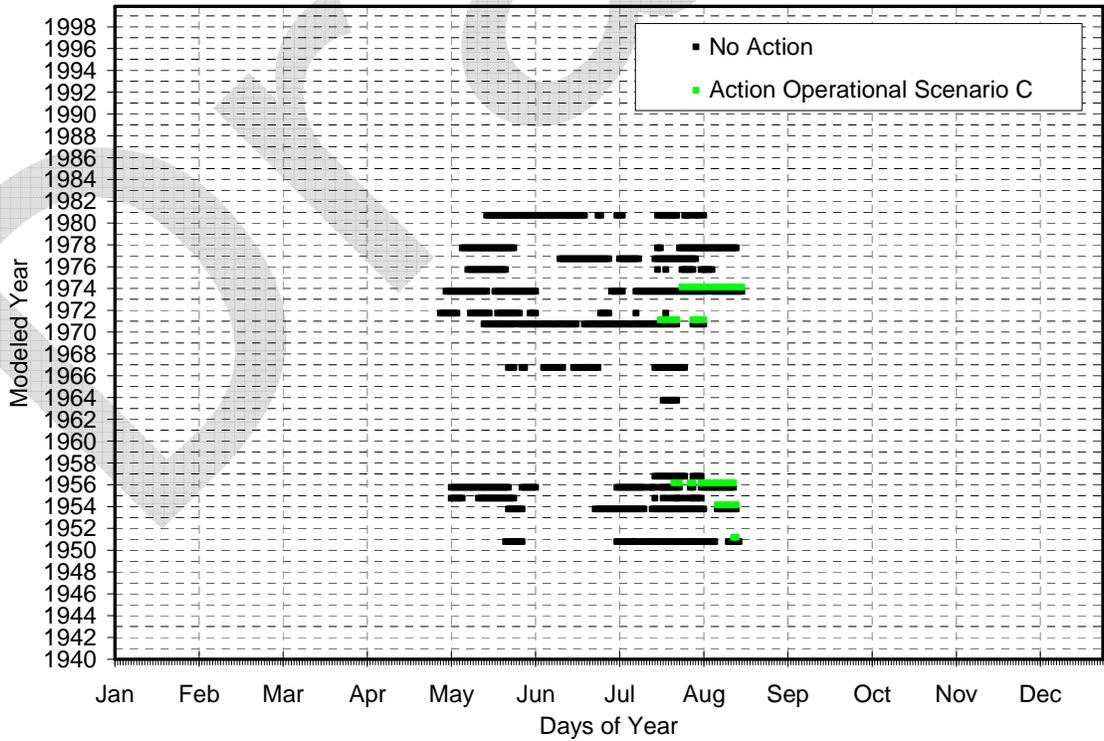


Figure 4. 8 Modeled intermittency at the Near Acme gage for Scenario C as compared to No Action.

The flow duration plots vary from a slight improvement in the 0-5 cfs range of the plot (Operational Scenario A) to a large improvement in the 0-5 cfs range of the plot (Operational Scenario C). Note that the plateau in these graphs begins to extend around 4 cfs, which is due to the 2 cfs target for keeping the river wet plus the additional constant 2.5 cfs from ground water leasing upstream of the Near Acme gage. It is interesting to note that the proposed ground water leasing in the Ft. Sumner area helps to augment the effectiveness of the current leasing upstream of the Near Acme gage.

The intermittency plots demonstrate that the proposed expansion of the FCP from 500 acre-feet per year to 1000 acre-feet per year makes a slight difference in intermittency at the Near Acme gage (as shown in Figure 4.6). Pumping of ground water rights of approximately 1100 acre-feet per year (at a maximum delivery rate of 10 cfs per day) in the Ft. Sumner area makes a much larger contribution to eliminating intermittency (as shown in Figure 4.7) in combination with the FCP expansion. Figure 4.8 demonstrates that an even larger lease of ground water rights in the Ft. Sumner area of approximately 1600 acre-feet per year (at a maximum delivery rate of 15 cfs per day) in combination with the expanded FCP reduces intermittency to roughly 10% of the modeled intermittency for the No Action alternative. Table 4.4 tabulates intermittency statistics for the pre-91 baseline, No Action alternative, and the three Action alternative operational scenarios.

Table 4.4 Modeled Intermittency Statistics at the Near Acme gage

Alternative / Baseline	Total intermittency		Number of occurrences over 60 years - for single or consecutive days of intermittency					
	Percent of time	Number of days (out of 60 years)	1 day	2 to 5 days	6 to 10 days	11 to 20 days	21 to 30 days	Greater than 30 days
pre-91 baseline	4.9%	1064	13	32	20	18	13	5
No Action	2.8%	606	9	20	15	16	4	3
Operational Scenario A	2.4%	521	11	22	11	12	4	2
Operational Scenario B	0.7%	159	3	9	3	4	2	0
Operational Scenario C	0.3%	62	0	4	3	2	0	0

Proposed Action Remaining Additional Water Needs

The remaining amounts of AWN for the three operational scenarios are shown in Table 4.5. Also shown in the table are the original (bypass only) AWN amounts and the No Action AWN amounts. As stated previously, AWN is a sum of all the target demand to achieve 35 cfs at Taiban (or 2 cfs at Acme in the summer months) remaining after bypassing available supplies.

Table 4.5 Action and No Action (remaining) Additional Water Needs

Alternative	60-year annual averages			Maximum and minimum additional water needed			
	Total water needed (acre-feet per year)	Available water bypassed (acre-feet per year)	AWN (acre-feet per year)	Maximum AWN (acre-feet)	Maximum occurs in modeled year	Minimum AWN (acre-feet)	Minimum(s) occur(s) in modeled year(s)
Bypass Only	4200	2500	1800	6900	'56	0	'42
No Action	4000	2300	1200	5900	'56	0	'41, '42, '49, '58, '86, '87, '91, '93, '95, '97, '99
Operational Scenario A	4000	2300	900	5200	'56	0	'41, '42, '49, '58, '86, '91, '95, '97, '99
Operational Scenario B	3600	2200	400	3900	'56	0	'41, '42, '49, '58, '86, '91, '93, '95, '97, '99
Operational Scenario C	3500	2200	200	2600	'56	0	'41, '42, '49, '58, '86, '91, '93, '95, '97, '99

It is apparent from the table that AWN decreases considerably as a result of the Action alternative scenarios. AWN follows the same trend as intermittency in that reductions due to an expanded FCP (Operational Scenario A) are fairly minor, but reductions due to an expanded FCP in conjunction with ground water leasing in the Ft. Sumner area are fairly significant (Operational Scenarios B and C). Total water need decreases somewhat from only using bypass supplies due to timing of block releases, an average reduction of 200 acre-feet per year. Leasing of ground water in the Ft. Sumner area reduces total water need by another 400 to 500 acre-feet per year on the average because the water is added to the system downstream of Sumner Dam, closer to the Near Acme gage location; subsequently, some of the loss incurred as Sumner Dam release is eliminated by applying the water that is needed closer to the source. It is also apparent from the table that the worst year for AWN is the modeled year 1956; however, reductions in this maximum are fairly significant for those operational scenarios that utilize the ground water rights in the Ft. Sumner area (Operational Scenarios B and C).

Proposed Action Water Supplies

Action water supplies are measured against the pre-91 baseline to determine the amounts of net depletion incurred as a result of augmenting flows for the shiner. Table 4.6 summarizes impacts to the three water supply indicators including net depletions to Carlsbad Project supplies, changes to flows at the New Mexico-Texas Stateline, and changes in Compact delivery obligation.

Table 4.6 Average (60-Year) Changes in Water Supply Indicators for the Operational Scenarios Compared to the No Action Alternative

Alternative	Total Net Depletion to Carlsbad Project Water Supply (acre-feet per year)	Increased CID diversions (acre-feet per year)	Project water lost to additional conservation spills (acre-feet per year)	Estimated increase in flows at the Stateline (acre-feet per year)	Estimated Additional Compact Obligation (acre-feet per year)
No Action	-600	500	1000	1250	-3100
Operational Scenario A	-900	700	900	1250	-2900
Operational Scenario B	-800	700	1100	1450	-2900
Operational Scenario C	-800	700	1100	1450	-3000

The table illustrates that additional water acquisition (AWA) shows little benefit to Carlsbad Project water supplies or flows at the New Mexico-Texas Stateline. Since most of the water added to the system for the operational scenarios is closer to Sumner Reservoir than Brantley Reservoir (with the exception of the augmented Brantley exchange pumping), most of the water leasing or FCP release is consumed before it reaches Brantley and is mostly ineffective at augmenting Carlsbad Project water supplies. Note for all the alternatives shown in the table 4215 acre-feet per year of river pumper retirement was modeled as Carlsbad Project Water Acquisition to eliminate the net depletions caused by bypassing. It is this retirement that makes the most difference in keeping the Carlsbad Project whole in lieu of all the river flow augmentation activities (bypassing and water leasing for augmenting river flows).

Proposed Action Groundwater Withdrawals

Under the all of the operational scenarios, ground water pumping for exchange in the Seven Rivers area would be doubled from 375 acre-feet per year to 750 acre-feet per year. If Reclamation continues other historical (pre-FCP exchange) uses for the 1,800 acre-feet per year right in addition to pumping 750 acre-feet per year for FCP exchange, Action ground water withdrawals will be closer to the full diversion right at approximately 1,600 acre-feet per year.

Modeled ground water withdrawals for the operational scenarios entail pumping ground water leases in the Ft. Sumner area to the Pecos River (Operational Scenarios

B and C) are shown in Figure 4.9. Estimates from energy usage by the ISC indicate that for the years 1976-1983 and 1996-2005 irrigation well pumping for the same wells being considered under the lease agreement averaged 2,450 acre-feet per year, with a more recent average of 4,000 acre-feet per year for the latter period of record (1996-2005) (2006). Average modeled pumping rates for Operational Scenarios B and C were 300 and 400 acre-feet per year, respectively. The chart shows that in many years the full amount of the lease will be needed to augment Pecos River flows, but in many years the pumping is unnecessary.

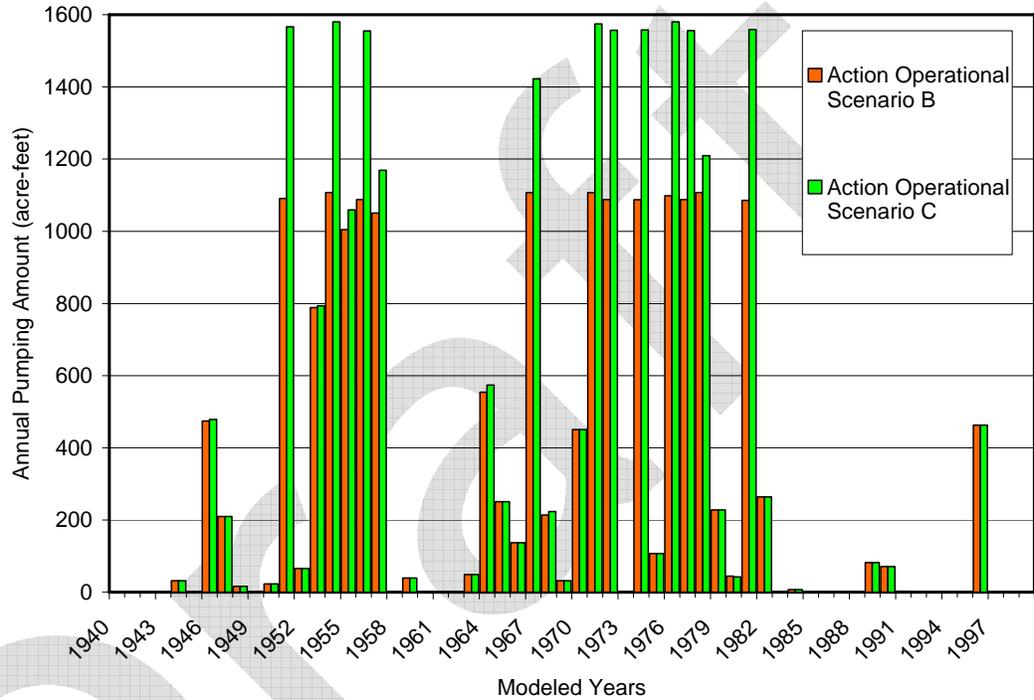


Figure 4. 9 Modeled pumping of ground water lease to augment Pecos River flows for Operational Scenarios B and C.

Proposed Action Water Quality

The Action alternative operational scenarios will not impact water quality in the study area any more than the No Action alternative. Even though an additional 375 acre-feet per year will be pumped into Brantley for the Proposed Action, water quality measurements in the Seven Rivers area indicate a lower EC than the background levels in Brantley reservoir (Reclamation 2007).

In addition, the lease of ground water rights and subsequent pumping of those rights to the Pecos River in the Ft. Sumner area will serve to improve water quality in this reach of the river since a large portion of farm acreage will no longer be irrigated with the leased water. Irrigation of lands, and subsequent return flows, serves to increase salinity in rivers from leaching salts from the irrigated lands. This leaching process increases the TDS in the water, where as just pumping the water into the Pecos River will not cause an increase in TDS from the source well water quality.

Biological Resources

The following indicators were selected to evaluate potential impacts on biological resources:

- Increased potential for overbank flows or inundation of habitats used by nesting shorebirds, terrestrial wildlife species, and wetland aquatic species.
- Changes in frequency, extent, duration of intermittency or extreme low flows that would cause direct mortality of aquatic organisms and loss of aquatic habitat.
- Change in frequency, magnitude, or duration of managed or natural peak flows that could impact aquatic habitat or spawning activities.
- Changes in availability of sport fish spawning habitat and adult habitat in response to reservoir elevation changes.
- Changes in availability of habitat for waterfowl based from the loss irrigated grain crops.

No Action Alternative

Under the No Action Alternative, there would be no change from current trends or conditions. Reclamation would not enter into a long-term agreement with ISC to lease and deliver water at this location or to use the larger permitted FCP for the benefit of the shiner. In order to avoid jeopardy, Reclamation would still be obligated to meet the conditions of the BO and would continue to acquire other supplemental sources of water or pursue other measures to meet the flow target and keep the river continuous.

The no action alternative would have no effect on the potential for overbank flows, inundation of habitat, potential for intermittency, extreme low or peak flows or the availability of habitat for waterfowl or reservoir sport fish.

Proposed Action

If the proposed action is implemented, Reclamation would have additional tools available beginning in the 2007 irrigation season to meet the flow target and keep the river continuous which would benefit the threatened shiner. The discharge point for the Vaughan pipeline is located near the top of the upper critical habitat and three miles north of the Taiban gage where flows are monitored. Reclamation would be able to quickly and efficiently add water to the river if base flows drop. The expanded FCP would allow Reclamation additional flexibility to store and release water upstream for the benefit of the shiner. The availability of water upstream on a more continuous basis during summer months should have a positive effect on terrestrial, riverine and floodplain habitats and the species that use them.

Because the flow rate of water pumped to the river is small and the amount of water that would be available for release from the FCP is not large, the proposed action is not expected to have much effect on the potential for overbank flows or inundation of habitats. Most overbank flows and habitat inundations are the result of much larger

natural events. The use of pumped water and smaller block releases may reduce the need for larger block releases that can be beneficial to spawning and channel formation, but can also sweep eggs and larvae into the reservoirs.

Reservoir fish habitat in Santa Rosa Reservoir and Sumner Lake should improve if more water is stored in these facilities for a longer period each year. Likewise, there may be some benefits to species within Brantley Reservoir from improved water quality from the pumped ground water. There would be no impact to least terns at Brantley Reservoir because flows into Brantley from ground water pumping at Seven Rivers would not be sufficient enough to alter the reservoir elevation and Reclamation would continue to manage Brantley Reservoir water levels in accordance with the *2006-2016 Biological Opinion* (US Fish and Wildlife Service 2006).

Agricultural Soil and Land Resources

The following indicators were selected to evaluate potential impacts on Agricultural Soil and Land Resources:

- Potential for the action to cause or increase soil erosion.
- Potential for the action to cause a decrease in soil quality.
- Potential acreage loss of prime farmland or farmland of statewide importance.
- Potential acreage of land infested with noxious weeds or other undesired species.

No Action Alternative

Under the No Action Alternative, there would be no change from current conditions and trends. The Seven Rivers Waterfowl Mitigation Farm would continue to be irrigated and grains would be grown to benefit waterfowl. The no action alternative would have no effect on ongoing soil erosion, soil quality, loss of farmland or acres infested with undesirable plant species.

Proposed Action

If the proposed action is implemented, up to 375 acre-feet of water rights at the Seven Rivers Waterfowl Mitigation Farm would be pumped into Brantley Reservoir. These water rights could have been used for irrigation in the past, but are not part of the rights that currently irrigate the 640 acres dedicated to crop production for waterfowl and migratory birds. Therefore, the proposed action would not convert any agricultural land to a nonagricultural use and current land uses would be maintained.

Recreation

The following indicators were selected to evaluate potential impacts on recreation:

- Water levels and their effects on recreational opportunities, visitation and

- associated expenditures at reservoir facilities.
- Water levels and their effects on recreation along the Pecos River.

No Action Alternative

Under the No Action Alternative, there would be no change from current recreational conditions or trends at the reservoirs and at recreational sites along the Pecos River. Reservoir recreation is highly dependent upon the amount of water held in storage, the surface area available, and elevation of the reservoirs. Recent drought conditions and low water levels at Sumner Lake and Brantley Reservoir resulted in large declines in visitor use in 2002 and 2003. The availability of recreational opportunities along the Pecos would also continue fluctuate widely based on flows and location. The no action alternative would have no effect on instream and reservoir water levels and therefore no effect on recreation. Recreational opportunities at the Seven Rivers Waterfowl Mitigation Farm would be unchanged.

Proposed Action

If the proposed action is implemented, Reclamation would have the flexibility to store and release an additional 500 acre-feet of water in upstream reservoirs and to pump ground water into the river. The proposed action is expected to have negligible to minor positive impacts on recreation. More water flowing in the Pecos River and stored in the reservoirs during the summer could mean greater opportunities for water-oriented outdoor recreation, but fluctuations in weather, timing, supply, location and irrigation demand would be far more influential in determining recreational opportunity and use than the proposed action.

Recreational opportunities at the Seven Rivers Waterfowl Mitigation Farm for bird-watching and wildlife viewing would be unchanged.

Cultural Resources

The following indicators are used to evaluate changes to cultural resources:

- The known presence or potential for cultural resources that may be eligible for listing on the National Register of Historic Places (NRHP) or locations that are important to Native American or other traditional communities in areas affected by the action.
- River flow and reservoir storage levels and fluctuation resulting from the action where there is a potential for directly disturbing resources, increasing access to resources, or exposing submerged resources.

Impact analysis for cultural resources incorporates the National Historic Preservation Act, Section 106 process. In the Section 106 process, the Federal lead agency determines an Area of Potential Effect (APE) for each undertaking or project. The APE is the physical area where the action may affect cultural resources and specifically those that are listed or meet the criteria for listing (36 CFR 60.4) on the National Register of Historic Places (NRHP). The APE for cultural resources

includes the existing water channels or active flood zones of the Pecos River corridor, the various reservoir storage pools, and the Seven Rivers Waterfowl Mitigation Farm.

Impacts on cultural resources are assessed by applying the criteria of adverse effect as defined in 36 CFR 800.5a. “An adverse effect is found when an action may alter the characteristics of a historic property that qualify it for inclusion in the NRHP in a manner that would diminish the integrity of the property’s location, design, setting, workmanship, feeling, or association. Adverse effects may include reasonably foreseeable effects caused by the action that may occur later in time, be farther removed in distance, or be cumulative.” The criteria of adverse effect provide a general framework for identifying and determining the context and intensity of potential impacts on other categories of cultural resources, as well, if these are present. Assessment of effects involving Native American or other traditional community, cultural or religious practices, or resources also requires focused consultation with the affected group.

No Action Alternative

The No Action Alternative is unlikely to affect cultural resources. Potential impacts would be limited geographically to known and unknown cultural resources in the existing water channels and active flood zones of the Pecos River corridor, the various reservoir storage pools and the Seven Rivers Waterfowl Mitigation Farm.

Ongoing impacts on cultural resources resulting from river and reservoir operations include the potential for direct disturbance of the integrity of archaeological sites through erosion, wave action, and cycles of inundation and drawdown, and the potential for vandalism of formerly submerged archaeological resources. The potential for these kinds of impacts, including impacts on resources that may be eligible for listing on the NRHP or may be of traditional importance, is greater from natural drought cycles and flood events. The condition of known cultural resources at the various reservoirs has been monitored on multiple occasions. No new impacts would be anticipated at the Seven Rivers Waterfowl Mitigation Farm and current disturbance of any cultural resources that may be present would be limited to the plow zone. Future actions to acquire and develop additional water or to conserve the shiner would be expected to continue and may require further consideration of the effects on cultural resources.

Proposed Action

The Proposed Action is unlikely to affect cultural resources. No additional construction, ground disturbance, changes in water, control, storage and delivery infrastructure, or new land abandonment is proposed. The action of leasing water and releasing it into the river at a slow rate at this location would be a negligible change from current operations and similar in nature to other existing actions. An expanded FCP would result in more upstream reservoir storage, but would not increase the overall reservoir pool. Sites in the immediate vicinity of the river or in flood zones have been subject to past disturbances, reducing the likelihood of their intact preservation. Proposed flow levels, flow fluctuations, and changes in reservoir

storage would be within the range of normal river and reservoir operations and would not be expected to exacerbate erosion of archaeological resources or exposure of submerged resources. No new impacts would be anticipated at the Seven Rivers Waterfowl Mitigation Farm and current disturbance of any cultural resources that may be present would be limited to the plow zone. Future actions to acquire and develop additional water and to conserve the shiner would be expected to continue and may require further consideration of the effects on cultural resources.

Indian Trust Assets

The following resource indicator is used to evaluate impacts on Indian trust assets:

- The potential for the action to affect Indian real property, physical assets, or intangible property rights. Actions which would adversely affect the value, use, or enjoyment of an ITA would be considered an impact.

As part of the preparation of the Carlsbad EIS (Reclamation 2006a) Reclamation contacted representatives of tribal groups with historic ties to the Pecos River basin or tribal groups who had expressed interest in Reclamation activities to identify any tribal trust interests. In addition, Reclamation contacted various representatives and offices of BIA, informing them of the consultation and requesting any feedback that the agency might have including the potential of Reclamation's actions to affect ITAs. Letters describing the range of supplemental water proposals were sent to representatives of twelve tribes and Native American pueblos on January 22, 2007 (See Chapter 6). No ITAs or ITA issues have been identified to date. If present, impacts on ITAs include any actions that affect Indian real property, physical assets, or intangible property rights. In some cases, the measure of impact significance on ITAs may be estimated based on the monetary value of the assets to the Indian tribe, but ITAs may also have social and cultural values that will need to be considered in addition to their economic value.

No Action Alternative and Proposed Action

No ITAs have been identified in the Pecos River Basin in consultation with tribes and the Bureau of Indian Affairs (BIA). There are no reservations or ceded lands present. Because resources are not believed to be present, no impacts are anticipated to result from the No Action Alternative or the Proposed Action.

Environmental Justice

The following resource indicator is used to evaluate environmental justice:

- The potential for the action to cause a disproportionate share of high and adverse human health and/or environmental impacts on low income and/or minority communities.

As discussed in chapter 3, U.S. Census Bureau data indicate that the distribution of population by race and Hispanic origin is similar for each of the four study area counties, with the exception of Guadalupe County. The percentage of total population that is Hispanic in Guadalupe County is nearly double the percentage for the entire area. Income data indicate that the per capita income for all four study area counties is lower than the average for all of New Mexico. Data also show Guadalupe County has much lower per capita income than the rest of the study area.

No Action Alternative

Under the No Action Alternative, there would be no change from current conditions and trends. The no action alternative would have no effect on ongoing socioeconomic and environmental trends affecting minority and low income populations. Other actions would be required to acquire and develop additional water sources. These actions may result in potential environmental justice issues if they involve minority and low income populations.

Proposed Action

The action of leasing and delivering water through the ISC infrastructure and the expansion of the FCP would have no effect on environmental justice. Negligible or no environmental impacts are anticipated for other resources. Since the water required would be leased from the state or is already owned by Reclamation, effects on the local economy would be negligible and limited to positive inputs for equipment maintenance and servicing. There would be no disproportionate human health, economic and environmental impacts on any group of people, including minority and low-income populations.

Irretrievable Commitment of Resources

The implementation of the proposed action would result in the commitment of resources such as power to run pumps and labor. Use of ground water sources may represent an irretrievable impact if pumping exceeds recharge rates. Federal funds will be expended on a long-term basis to lease and deliver water.

Cumulative Impacts

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.

There are ongoing efforts, primarily by the ISC, to acquire land with water rights in the Pecos River Basin to ensure compliance with the Pecos River Compact and meet obligations under the Settlement Agreement. Reclamation has executed a long-term contract with the Carlsbad Irrigation District (CID) to allow ISC to use water up to 50,000 acre-feet for purposes other than irrigation. The result of these actions is that land is being taken out of agricultural production, land ownership is being shifted from private to public ownership, prices for land with water rights has increased, there is additional economic incentive to sell, there is additional short-term economic input into the region, and a long-term loss to agriculturally-related segments of the regional economy. The ISC and Reclamation recently completed the Seven Rivers Pipeline Environmental Assessment which analyzed the construction and operation of the water delivery pipeline from the Seven Rivers Augmentation Well field to Brantley Reservoir for use as Carlsbad Project water as partial fulfillment of the Settlement Agreement and to help maintain Compact compliance. No significant impacts were found.

On a more limited scale, Reclamation is continuing its efforts through leases to acquire and transfer water with the 2006-2016 Biological Opinion. The Pecos Supplemental Water and Exchange EA is being prepared concurrently with this EA but on a longer time frame. The Bureau of Reclamation would like to obtain supplemental water to provide the operational ability to release approximately 2,500 acre-feet of water out of Santa Rosa Reservoir and 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 are being considered to meet these goals. Scoping for this project was completed November 2006, and a draft EA will be available later this year.

Additional efforts by federal state and local agencies in the Pecos River Basin are focused on salt cedar removal and river habitat restoration. Many thousands of acres have been treated to reduce the adverse effects of invasive plant species. Reclamation is currently partnering with the US Fish and Wildlife Service (Service) in an Environmental Assessment on Pecos River restoration at Bitter Lake National Wildlife Refuge (NWR). 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. The 2006-2016 Biological Opinion requires Reclamation to restore two reaches totaling 3 miles of the river and to cooperate with other agencies in restoration efforts. Reclamation is assisting the Service with NEPA compliance and plans to restore flows into one oxbow. The proposed restoration actions at Bitter Lake NWR would correct or improve degraded ecological conditions caused by excavating straight channels and encroaching nonnative vegetation, and would restore parts of the river to more natural flow conditions within the context of the modern hydrological regime, including reconnecting the river to the floodplain.

Under the 2006-2016 Biological Opinion 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 throughout this period of time.

Reclamation has determined that the proposed action would not have a significant adverse cumulative effect on any resources. The water proposed for leasing by Reclamation in the vicinity of the Taiban gage would not result in any additional loss or fallowing of agricultural land. This land was previously purchased and fallowed by the ISC who are also constructing the delivery infrastructure to meet their independent needs. The actions at the Seven Rivers Waterfowl Mitigation Farm would involve the transfer of water rights already owned by Reclamation and delivery to Brantley Reservoir through ISC infrastructure. The contribution of the proposed action to cumulative effects would likely be beneficial for most resources.

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Chapter 5: Environmental Commitments

The following environmental commitments would be implemented as part of the proposed action:

- Monitor the river flow to adequately manage the timing of releases from the fish conservation pool and/or the pumping of ground water.
- Avoid conducting ground water pumping during block releases.
- Reclamation will consult with the US Fish and Wildlife Service under Section 7 of the Endangered Species Act.

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Chapter 6: Consultation and Coordination

The following lists the individuals and organizations that were consulted in preparing this environmental assessment and in developing the proposed action.

Districts and Agencies

Carlsbad Irrigation District
Mr. William Ahrens

Ft. Sumner Irrigation District
Mr. Leslie Armstrong

Pecos Valley Artesian Conservancy District
Mr. Fred Hennighausen

New Mexico Department of Game and Fish
Ms. Janell Ward
Ms. Lisa Kirkpatrick
Mr. Luke Shelby
Mr. Richard Artrip
Mr. Shawn Denny

New Mexico Interstate Stream Commission
Mr. Emile Sawyer
Ms. Sara Rhoton

Army Corp of Engineers
Lt Col Bruce Estock

U.S. Fish and Wildlife Service
New Mexico Ecological Services Field
Office
Ms. Marilyn Meyers
Mr. Wally Murphy

Pueblo and Tribal Governments

Pueblo of Jemez

Kiowa Tribe of Oklahoma

Fort Sill Apache Tribe of Oklahoma

Apache Tribe of Oklahoma

Hopi Tribe

Navajo Nation

Jicarilla Apache Nation

Comanche Indian Tribe

Pueblo of Ysleta del Sur

Pueblo of Isleta

Mescalero Apache Tribe

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Chapter 7: List of Preparers

NAME	EDUCATION / EXPERIENCE	RESPONSIBILITIES
US Bureau of Reclamation		
Marsha Carra	B.S., Anthropology/Geography Eastern New Mexico University 10 Years	Project Manager; NEPA Specialist; Interagency and Tribal Coordination
Gary Dean	B.S. Fisheries Biology Colorado State University 22 Years	Biological Resources and Section 7 Consultation
Nancy Purdy		Realty and Water Rights
Garret Ross	New Mexico Institute of Mining and Technology 15 Years	Water Resources
EMPS, Inc.		
David Batts	M.S., Natural Resource Management, Michigan State University 15 Years	Project Management; Chapters 1 and 2; Public Involvement; Document Production
Leslie Bandy	B.S., Conservation and Resource Studies, University of California, Berkeley 6 Years	Recreation; Agricultural and Land Resources; Biological Resources;
John King	M.S., Environmental Engineering, Northwestern University MPH, Environmental Health, University of California Berkeley 25 Years	QA/QC; Tech editing
Stockton Engineering		
Tomas Stockton	M.S. Civil (Geotechnical) Engineering, University of New Mexico 8 years	Water Resources; Hydrological Modeling
Tetra Tech, Inc.		
Kevin Doyle	B.A., Sociology, University of California, Santa Barbara 22 Years	Project Management; Cultural Resources; ITA; QA/QC; Document Production

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Appendices:

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APPENDIX A: Water Resources Modeling Methods and Definitions

Introduction

This appendix provides definitions for the resource indicators and overall methods used in the hydrological modeling and water resource impact analysis.

Resource Indicators

1. Flow Frequency at the Near Acme Gage

Evaluation of the effectiveness of the water leasing action to augment river flows in the critical habitat for the Pecos Bluntnose shiner (shiner) is best accomplished by examining impacts to the duration of flows at the Near Acme gage and the occurrence of zero flow (or intermittency) at the Near Acme gage. The duration of flows and occurrence of intermittency are presented in flow duration curves and intermittency charts. The flow duration curves denote the percentage of time that a certain flow occurs over a given time period, and intermittency charts depict the exact days that zero flow occurred during a given time period. The Near Acme gage was used as a location on the river because it is located just downstream of the critical habitat in a location that often undergoes river drying (Reclamation 2006a).

2. Additional Water Needed to Meet Target Flows

Due to seasonal distributions of inflows to Sumner and Santa Rosa reservoirs, bypassing Carlsbad Project inflows through the reservoirs to meet target demands is insufficient during much of the irrigation season. Additional water needed (AWN) refers to the amount of water, measured as Sumner Reservoir outflow, that needs to be acquired to achieve downstream flow at the target location all of the time. AWN can apply to evaluation of an alternative that only considers bypassing as an option such as the alternatives presented in the EIS or AWN can apply to the remaining water need after additional water acquisition (AWA), such as the leasing agreement considered in this document, has been implemented.

3. Carlsbad Project Water Supply

Along with the goal of augmenting Pecos River flows for the shiner, it is also desirable to not impact the water supply of the Carlsbad Project. Impacts to Carlsbad Project water supplies are measured in net depletions, or relative shortfalls to the project before ESA operations were established. These relative shortfalls are measured against the before 1991 (pre-91) baseline, which refers to Pecos River operations before ESA, when river operations were tailored to be most efficient for irrigation operations. These relative shortfalls occur due to bypassing flows through Sumner Dam that under the baseline operations would

have been stored and released in a block release. These “net depletions” are primarily caused by increases in evaporation from the river surface, seepage into the local ground water system, and losses to transpiration from riparian corridor vegetation due to bypassing (or releasing in the case of an FCP) small amounts of water as opposed to releasing large chunks of water all at once. Net depletions to the Project water supply can also occur due to changes in block release configurations (duration, magnitude, and frequency), reservoir storage configurations, or differences in conservation spills from the study area of the Pecos River system.

4. Pecos River Flows at the New Mexico-Texas State Line

The Pecos River Compact (Compact) mandates that New Mexico must share a portion of Pecos River water with the State of Texas. The delivery of water under this compact is measured at the New Mexico-Texas State Line, specifically at the USGS’s Red Bluff gage. Because flow reduction in the Pecos River at this location is undesirable, the impact of the alternatives on this resource indicator is important. Flows at the New Mexico-Texas State Line are affected by changes in three primary sources: flood inflows downstream of Avalon Dam, diversions (and subsequent return flows) by the Carlsbad Irrigation District (CID), and conservation spills from Avalon Dam. Shortages in CID allotments (net depletions to the Project water supply) may cause changes in supplemental well pumping in the CID; however, it is not anticipated that the project action will affect the pumping patterns of these irrigators as long as the Project water supply is not impacted. Although river flows at this location were not modeled specifically for this document, the relative impacts to this resource indicator can be inferred from impacts to Carlsbad Project water supply and changes to conservation spills from the Project water supply at Avalon Dam.

5. Changes to Pecos River Compact Obligation

Because the Pecos River Compact obligation is dependent on outflows from Sumner Reservoir in addition to flood inflows below Sumner Dam, changes to the Compact obligation are also in important resource indicator. The Compact obligation can vary because outflow from Sumner Dam can vary due to changes in water operations. Flood inflows below Sumner Dam are fixed and are not affected by changes in water operations; therefore, changes to the Sumner outflows can be evaluated in the context of Compact calculations and a relative change in Compact obligation can be estimated. This resource indicator is important to consider in addition to flows at the New Mexico-Texas State Line since even though flows may increase (or decrease) due to an alternative, the obligation may also increase (or decrease) due to an alternative.

6. Changes to Groundwater Withdrawals in the Study Area

Since the action contemplated in this document includes the leasing of ground water rights in the study area, it is appropriate to quantify those withdrawals and measure their relative change from historic withdrawals for the same water rights. It is anticipated that ground water withdrawals will change from the

action in Ft. Sumner area where water rights are being acquired for the long-term lease and also in the Seven Rivers area where water rights are undergoing a change of use from providing water for wildlife habitat to supplementing irrigation in the CID (FCP exchange water).

7. Changes to Pecos River Water Quality in the Study Area

Changes to water quality in the Pecos River is also an important resource indicator since the purposes of uses for the long-term ground water lease and the FCP exchange water will change from their historic uses (irrigation and habitat enhancement). Water quality impacts will be handled qualitatively in this document.

Modeling of Alternatives

Modeling alternatives was accomplished using the latest version of the Pecos River RiverWare Model (Boroughs and Stockton, 2006; Boroughs and Stockton, 2005). The model runs 60-years (1940-1999) of hydrology inputs with policy and reservoir configurations as they are in the present. Four alternatives and one baseline were simulated with the model. The baseline is used to represent conditions in the Pecos River before any changes were made to operations for the Endangered Species Act (ESA); this baseline was called the pre-91 baseline. The No Action alternative represents Reclamation's current operations on the Pecos River. The Action alternative was subdivided into three operational scenarios to study in detail the various components of the proposed action.

Pre-91 Baseline

The modeled pre-91 baseline includes an operational policy that focuses solely on providing irrigation for agriculture. The pre-91 baseline is used to compare the impacts of the Action and No Action alternatives to operating conditions before changes were made for the shiner. Comparisons with the pre-91 baseline are made to determine impacts to Carlsbad Project water supplies, State-line flows, and changes to Compact obligations. Since the pre-91 baseline represents a historical mode of operation with the current system elements (e.g. reservoirs presently operating along the Pecos River), it will not match historical Pecos River hydrology in the regulated system. To contrast with the alternatives, the pre-91 baseline: does not bypass or release water to maintain river flows; does not have any stipulations on when block releases can be made; does not have any retirement of historical diversions; and does not have any supplemental water actions for augmenting river flows such as ground water pumping or releases from an FCP.

No Action Alternative

The No Action alternative represents current actions being conducted on the Pecos River by Reclamation. These actions include: bypass of inflows when available to keep 35 cfs at the Taiban gage or prevent intermittency,

administration of a 500 acre-foot per year fish conservation pool (FCP) to prevent intermittency, exchange of 375 acre-feet per year of Roswell Artesian Basin well water pumped into Brantley to pay for depletions caused by the FCP, 4,215 acre-feet per year retirement of the historical diversions by river pumpers in the study area, pumping of 900 acre-feet per year (2.5 cfs pumped for approximately 180 days) of ground water rights upstream of the USGS's Near Acme gage to the Pecos River, and constraints on block releases. The constraints put on block releases for the alternatives amount to a maximum duration of 15 days, at least 14 days in between releases, a maximum of 65 days of block release per year, and a no-release period for 6 weeks centered on August 1 of every year. The No Action RiverWare model of this alternative contains all of these elements.

Proposed Action

The Proposed Action was split into three operational scenarios for modeling with the Pecos River RiverWare model. These include operational scenarios A, B, and C. Operational Scenario A is essentially identical to the No Action alternative, but expands the FCP to 1,000 acre-feet per year with an exchange of 750 acre-feet per year at Brantley Reservoir. Operational Scenario B includes leasing of approximately 1,100 acre-feet per year of ground water rights in the Ft. Sumner area and pumping those rights to the Pecos River at a rate of 10 cfs per day (or less) when needed in addition to the FCP expansion of Operational Scenario A. Operational Scenario C includes a lease of approximately 1,600 acre-feet per year of ground water rights in the Ft. Sumner area and pumping those rights to the Pecos River at a maximum rate of 15 cfs per day in addition to the FCP expansion of Operational Scenario A. Table A.1 summarizes the modeling elements included for the pre-91 baseline, No Action, and the Proposed Action operational scenarios. The table includes the target flow used for each model simulation, block releases constraints, annual maximum release volume for an FCP, annual maximum ground water lease amounts in the Ft. Sumner area, current ground water lease amounts, Carlsbad Project Water Acquisition for eliminating depletions from bypassing (retirement of river pumpers), and exchange at Brantley from FCP depletions. The target flows for the alternatives consist of a 35 cfs target at Taiban and a 2 cfs target at the Near Acme location in the model to simulate a target for keeping the Pecos River continuous. It is also important to note that the ground water lease in the Ft. Sumner area will not divert any additional amount from the local aquifer in this area than the original consumptive irrigation requirement (CIR) associated with the water right as it was used for agriculture. For Operational Scenario B, this amount is precisely 1,107.6 acre-feet per year or enough to pump 10 cfs per day to the Pecos River for 55.8 days; and for Operational Scenario C, this amount is precisely 1,580 acre-feet per year or enough to pump 15 cfs per day to the Pecos River for 53.1 days.

Table A.1 Summary of Modeled Hydrologic Operations for Alternatives and the Pre-91 Baseline

Model	Target Flow ¹	Block Release Constraints ²	FCP (acre-feet per year)	Ft. Sumner Area Groundwater Lease (acre-feet per year) ³	Near Acme Groundwater Lease (acre-feet per year)	River Pumpers CPWA (acre-feet per year)	Seven Rivers Exchange (acre-feet per year)
pre-91 baseline	N/A	N/A	N/A	N/A	N/A	4215 Diverted	N/A
No Action	35 cfs at Taiban	Typical	500	N/A	900 (2.5 cfs for 181.5 days)	No Diversion	375
Action (Operational Scenario A)	35 cfs at Taiban	Typical	1000	N/A	900 (2.5 cfs for 181.5 days)	No Diversion	750
Action (Operational Scenario B)	35 cfs at Taiban	Typical	1000	1107.6 CIR (10 cfs for 55.8 days)	900 (2.5 cfs for 181.5 days)	No Diversion	750
Action (Operational Scenario C)	35 cfs at Taiban	Typical	1000	1580 CIR (15 cfs for 53.1 days)	900 (2.5 cfs for 181.5 days)	No Diversion	750

¹A 35 cfs target at Taiban also includes a 2 cfs target at the Near Acme gage during summer months.

²Typical block release constraints include a 15-day maximum duration, 14-day no-release period between block releases, a maximum of 65 block release days per year, and a no-release period for 6-weeks centered on August 1 of every year.

³Consumptive Irrigation Requirement (CIR) associated with ground water lease amounts.

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