

Chapter 4. Cumulative Effects

4.1 REASONABLY FORESEEABLE ACTIONS

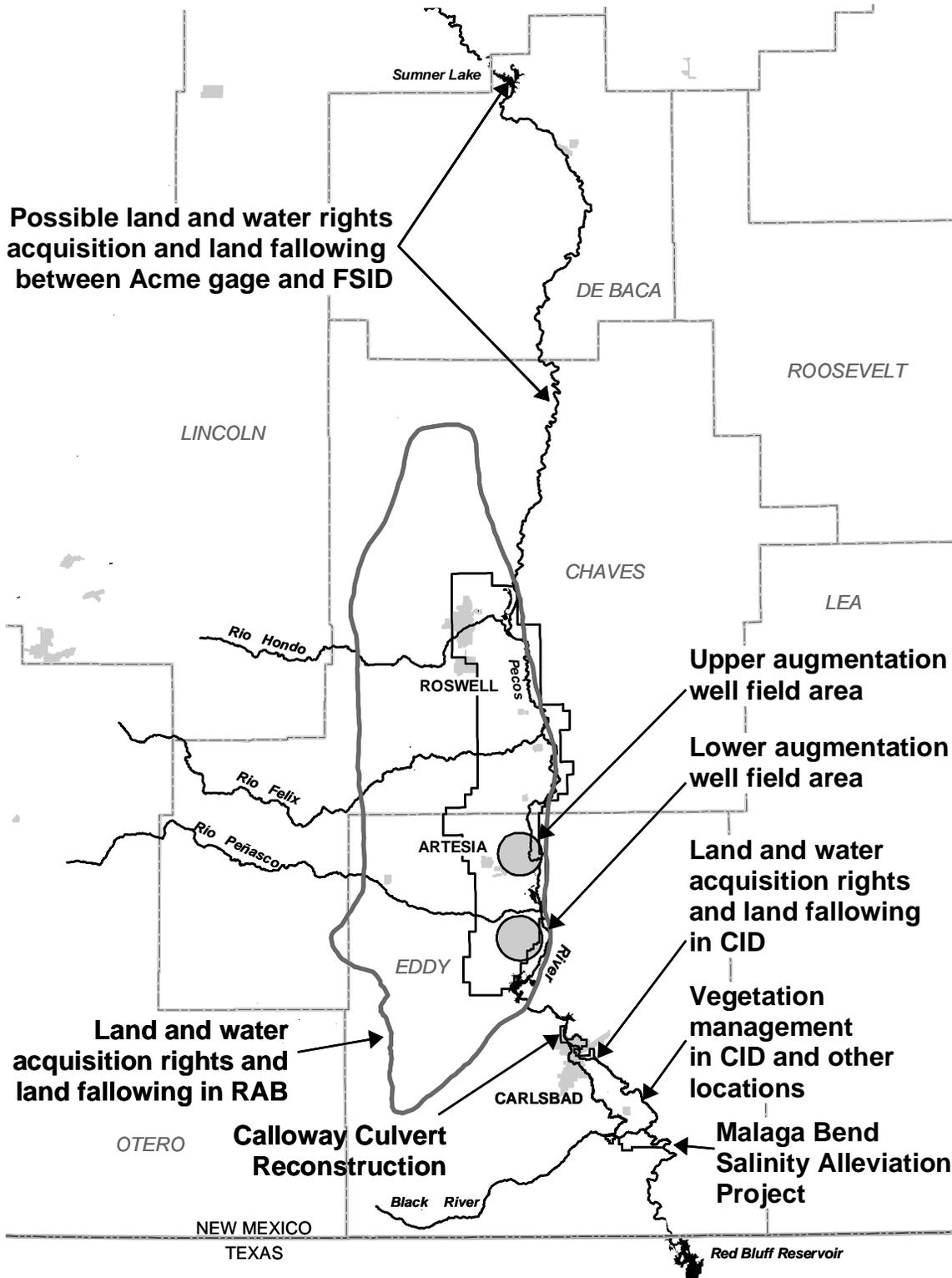
Reasonably foreseeable actions analyzed in this FEIS are those future actions and activities independent of the Proposed Action that could result in cumulative effects when combined with the effects of the Proposed Action. These activities are anticipated to occur regardless of which alternative is selected. The cumulative effects of these reasonably foreseeable actions in combination with the Proposed Action are described for each resource in this chapter. Cumulative effects are applicable only to agency action alternatives, not to the No Action Alternative (EPA 1999; Reclamation 2000).

The reasonably foreseeable actions evaluated in this FEIS are: the Pecos River Settlement Agreement, NMOSE's Active Water Resource Management, actions analyzed in the Carlsbad Project Water Operations and Water Supply Conservation EIS, Vegetation Management Projects, Brantley and Avalon Reservoirs Resource Management Plan, the Malaga Bend Salinity Alleviation Project, NMISC's Water Resources

Conservation Project, and the Calloway Culvert Reconstruction. The general location of some of these actions is shown in Figure 14.

4.1.1 Analysis Area and Geographic Area

The area potentially affected by the Proposed Action varies by resource; therefore, the area in which cumulative effects may occur also varies by resource. To be considered for cumulative effects, resources must first be potentially affected by the Proposed Action. The Reclamation Handbook states "other actions should be included in analysis when their impact zones overlap areas occupied by the resources affected by the proposed action" (Reclamation 2000). For example, hydrology direct/indirect impacts may occur south of Avalon Dam, the release point for water under the miscellaneous purposes contract. Any cumulative effects would occur in that same geographic area, even though the actions that cause those effects are outside of the direct/indirect impact analysis area. With socioeconomic impacts, the geographic area for direct/indirect impacts is



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Figure 14
 Reasonably Foreseeable
 Actions

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 Date: July 11, 2005

1 Inch = 25 Miles



broader. For example, businesses in both Eddy and Chaves Counties may be affected by the Proposed Action, and the geographic area considered for cumulative effects is both counties.

4.1.2 Pecos River Settlement Agreement

The Settlement Agreement describes actions to be taken by the NMISC and others that will resolve litigation, implement a plan to ensure delivery of water to the CID and New Mexico-Texas state line, and settle many water management issues on the Pecos River. The Settlement Agreement also describes certain conditions (conditions precedent) that must be met, postponed, or waived by agreement of the parties before the Settlement Agreement is implemented. The conditions precedent established by the Settlement Agreement are:

- Entry of a Partial Final Decree
- Implementation of a Consensus Plan
- Completion of Federal contracts and environmental compliance

4.1.2.1 Entry of a Partial Final Decree

The Partial Final Decree judicially establishes the maximum allowable annual diversion and storage rights of the United States and the CID, and the CID's right to deliver water for CID members. The entry of a Partial Final Decree is a legal matter being addressed by the District Court and is not discussed further in this document.

4.1.2.2 Implementation of Consensus Plan

In 2002, the Pecos River Basin *ad hoc* committee developed a Consensus Plan, designed to achieve long-term Compact compliance. The condition precedent of the Settlement Agreement for the Consensus Plan requires compliance with NMSA

§72-1-2.4, and at a minimum: 1) the acquisition of at least 4,500 acres of assessed lands in the CID, and at least 7,500 acres of land with appurtenant water rights in the RAB, and 2) the construction, lease, or purchase of wells sufficient to undertake augmentation pumping of at least 15,750 acre-feet of water per year.

The *ad hoc* committee determined the water rights required to establish long-term compliance with the Compact to be 6,000 acres of irrigated farmland within the CID, 11,000 acres water rights in the RAB, and 1,000 acres of water rights upstream of the Pecos River near Acme gauge including the FSID. The *ad hoc* committee's Consensus Plan did not originally contemplate land purchase, only water rights. NMSA §72-1-2.4 requires the NMISC purchase the land in addition to the appurtenant water rights for the amounts identified in the Consensus Plan. In addition, the Settlement Agreement requires the construction, lease, or purchase of wells sufficient to undertake augmentation pumping of no more than 100,000 acre-feet of water during each 5-year water accounting period and no more than 35,000 acre-feet of water in any one year. The activities described in the Consensus Plan are State actions and therefore are not subject to NEPA analysis except as to how they may be connected, inter-related or interdependent to the Proposed Action of this EIS.

4.1.2.3 Federal Contracts and Environmental Compliance

The completion of Federal contracts and environmental compliance for the Settlement Agreement requires the execution of a long-term miscellaneous purposes contract between Reclamation, CID and NMISC and completion of required environmental compliance (the Proposed Action of this EIS), and completion of the Carlsbad

Project Water Operations and Water Supply Conservation EIS (Operations EIS). The Operations EIS is being prepared to address Reclamation’s proposed changes in Carlsbad Project water operations and a water acquisition program.

Project water is authorized for irrigation use only, and a miscellaneous purposes contract is required for the NMISC to use Project water for purposes other than irrigation (in this case, state line delivery). Execution of a long-term miscellaneous purposes contract and review of any related third-party contracts are Federal actions requiring analysis under NEPA. Implementation of the Consensus Plan as described in the Settlement Agreement will proceed with or without the contracts.

The Settlement Agreement can be thought to contain two major types of components: physical and operational. The physical components of land acquisition and development of an augmentation well field, and associated operational components, are independent of the execution of a miscellaneous purpose contract and review of any related contracts, and are not connected to the execution of those contracts. The New Mexico Legislature has provided authorization and partial funding for land acquisition and development of the augmentation well field. These State actions need no Federal approval or authorization to proceed, and are not interdependent or interrelated to the contracts. For these reasons, the components of the Consensus Plan as described in the Settlement Agreement are reasonably foreseeable State actions. These actions are summarized in Table 25.

During scoping, management of NMISC’s fallowed lands was identified as a significant issue of concern. For the past several years, the NMISC, in cooperation with a subcommittee of the Lower

Table 25. Summary of key physical and operational components of the Settlement Agreement.

Component	Action
<i>Physical Components</i>	
NMISC land acquisition in CID	Up to 6,000 acres
NMISC land acquisition in RAB	Up to 11,000 acres
NMISC land acquisition above Pecos River near Acme Gage	Up to 1,000 acres
Development of augmentation well field	Yes
<i>Operational Components</i>	
Supplemental pumping within CID	Up to 3.697 acre-feet/acre
Reallocation of NMISC allotment	Yes
Target volumes supplied to CID	Yes
Augmentation well field pumping	Up to 100,000 acre-feet in a 5-year period, or 35,000 acre-feet in any given year
Sell/Lease back	May occur following accumulation of 115,000 acre-feet state line credit
Pecos River Compact Shortfall Condition	Voluntary measures to increase flow

Pecos River Basin Committee (formerly known as the *ad hoc* committee), evaluated methods to effectively manage fallowed lands. The NMISC has developed a preliminary plan for fallowed land management. The plan will be implemented as NMISC acquires irrigated lands and fallows them.

The primary issues associated with fallowed lands are weeds and wind erosion. Individual land maintenance plans will be developed for all NMISC parcels acquired under the Settlement Agreement. The NMISC is contemplating several options including mowing, long-term grazing leases, and seeding to establish native grasses.

Implementation of any of these options is dependent on funding. Over time, the NMISC anticipates native vegetation will become established, minimizing soil erosion. The NMISC will consider other management techniques on its fallowed land as necessary to minimize soil erosion and spread of noxious weeds.

4.1.3 Active Water Resource Management

In December 2004, the New Mexico State Engineer adopted statewide Active Water Resource Management (AWRM) regulations. The regulations are designed to promote implementation of the Settlement Agreement, to establish a framework for priority administration, allowing the NMOSE to supervise the physical distribution of the available water supply by priority date or alternative administration, as agreed upon by water right owners and the State Engineer, and to limit over-diversions and eliminate illegal diversions with penalties established for such activities. The State Engineer will create water master districts throughout the state and appoint water masters (NMSA §72-3-1). A water master will have the responsibility for diversions and water distribution within a water master district. Under the general regulations, administration of water rights under AWRM may require the curtailment of water use by those with junior water rights.

Currently, regulations specific to the Lower Pecos River basin Water Master District are being developed. CID supplemental well regulations have been drafted and are being promulgated. Several sub-districts have been established for the Lower Pecos River Basin Water Master District, and water masters have been appointed. Lower Pecos River Basin Water Master District-Specific regulations will provide the NMOSE the regulatory

framework for the administration of a priority call, where water rights that are junior are curtailed based on the priority date of the water right. Under these regulations, a priority call may be made 1) if the CID does not receive the water allotment that they are entitled to as established by the terms of the Settlement Agreement, 2) as part of a River Master approved plan to remedy a net shortfall condition at the state line, or 3) in response to a valid priority call for a senior water right owner on a stream tributary to the Pecos River.

4.1.4 Actions Analyzed in the Carlsbad Project Operations EIS

Reclamation is proposing to change water operations in one or more Carlsbad Project reservoirs, and to implement various water acquisition activities to either offset depletions to Project water supply or supplement river flows to meet specific flow targets. Reclamation and the NMISC currently are preparing the Carlsbad Project Water Operations and Water Supply Conservation EIS on these actions (Reclamation and NMISC 2005). The purposes of the actions are to conserve the Pecos bluntnose shiner and to conserve the Carlsbad Project water supply. The need for the action is Reclamation's compliance with the ESA and conservation of the Carlsbad Project water supply for authorized purposes (67 Fed. Reg. 62262, October 4, 2002). The water acquisition program is designed to conserve the Project water supply by offsetting depletions caused by the change in operations. The change in operations is also designed to provide additional water to help conserve the Pecos bluntnose shiner. The alternatives being considered in the Operations EIS provide a range of flows at various key locations for Pecos bluntnose shiner habitat below Sumner Dam, options for means to deliver Carlsbad Project

water, and acquisition of water sources to offset depletions, among other elements.

4.1.5 Vegetation Management Projects

Three major vegetation management and research projects are ongoing in the analysis area. The New Mexico Salt Cedar Control Project, the Pecos River Basin Water Salvage Project, and the Carlsbad Project Vegetation Management Program are summarized below.

In 2004, the New Mexico Legislature appropriated \$2.4 million to control salt cedar along the Canadian, Pecos and Rio Grande Rivers. Salt cedar control is one of several activities being considered to improve the water supply for New Mexico and Texas water users. The New Mexico State University is managing the project in cooperation with other state agencies. The Carlsbad Soil and Water Conservation District is identifying priority areas and developing budgets for the costs associated with land clearing and channel maintenance.

The Pecos River Water Salvage Project is jointly funded by Reclamation and the State of New Mexico, and is designed to control salt cedar growth from the Sumner Dam area to the New Mexico-Texas state line. Clearing activities conducted by Reclamation began in 1967 and continued until 1971, during which about 54,000 acres at various locations were cleared. The clearing program was reinitiated in 1995, and about 30,000 acres are currently maintained.

Reclamation plans to implement the Carlsbad Project Vegetation Management Program (Program), including vegetation treatment and research components, in partnership with the CID, Carlsbad Soil and Water Conservation District, and the New Mexico Department of Game and Fish. A

Final Environmental Assessment and Finding of No Significant Impact for this project were issued in 2004. The locations currently under consideration for the Program are Carlsbad Project lands around Brantley and Avalon Reservoirs, north of the City of Carlsbad. Within the 7,829 acres of Carlsbad Project lands that are in the Vegetation Management Program, about 6,200 acres are vegetated by salt cedar. Other target weeds include kochia, Malta Star thistle, and African rue. Select areas will be treated (chemical, mechanical treatments) and researched (biological, mechanical, and herbicide treatment studies). The purpose and need for the project is to use information from studies to increase the efficiency and effectiveness of salt cedar treatment. The Program is not expected to result in measurable water salvage, nor will water salvage be monitored.

4.1.6 Brantley and Avalon Reservoirs Resource Management Plan

In 2003, Reclamation developed a Resource Management Plan for Brantley and Avalon Reservoirs that provides a conceptual framework for the management of resources at these reservoirs. The plan focuses on land resources, and also recommends how different reservoir management might benefit a variety of resources including fisheries, recreation and cultural activities. Reclamation proposes to expand and improve existing recreation areas, and to develop four new recreation areas. Reclamation expects that annual visitation to Brantley and Avalon Reservoirs will increase by 5 percent annually as a result of these activities (Reclamation 2003a).

4.1.7 Malaga Bend Salinity Alleviation Project

Malaga Bend is in the southern portion of the Pecos River basin in New Mexico. The surface waters of the Pecos River at Malaga Bend are hydrologically connected to a saline aquifer unit immediately underlying the river and contained in the Rustler formation. This connection allows discharge of highly saline water into the surface water flows of the Pecos River resulting in deteriorating surface water quality.

Between 1963 and 1976, the USGS, in cooperation with the Pecos River Compact Commission, operated the Malaga Bend Salinity Alleviation Project. The purpose of the salinity alleviation project was to improve the quality of water that the state of New Mexico delivers to Texas. This operation involved pumping ground water from the saline aquifer and discharging it into several surrounding playa lakes, allowing the lake water to evaporate, and harvesting the remaining salt. These activities resulted in the temporary decrease in saline water discharge to the river. Unfortunately, the lakes leaked and salty water entered the aquifer, and ultimately made it back to the river. The project was terminated due to its failures.

The project was reinitiated in 2001 after several years of negotiations between the states of New Mexico and Texas. In the project's current form, the Red Bluff Irrigation District of Texas pumps water from a ground water well, which is permitted to pump 645 acre-feet of water per year. The water is discharged to one of several man-made ponds owned by a private salt mining company. The ponds evaporate and the salt is harvested. In order for New Mexico to get credit for water that would have otherwise been delivered to Texas, the Pecos River Master's Manual was modified to allow for

the delivery credit of up to 645 acre-feet by New Mexico. It was discovered in 2003 that these ponds also leaked. Salt operations and ground water pumping were ceased until the ponds could be lined. Operations resumed in early 2004. The USGS monitors the quality of water upstream and downstream of Malaga Bend to determine if any improvements are made to the surface water quality. To date, there have been numerous technical difficulties in making this determination. The current deadline for demonstrating improvements to the water quality and thus continuing the project is 2007.

4.1.8 NMISC Water Resources Conservation Project

In 1991, the New Mexico Legislature found that a potential water shortage crisis existed in the Pecos River basin. The legislature authorized the NMISC to "...purchase, and retire and place in a state water conservation program...adequate water rights over a period of years to increase the flow of water in the Pecos River...and therefore meet the State's future obligations under the Pecos River Compact and the United States Supreme Court's amended decree..." (NMSA §72-1-2.2). Water rights eligible for this program include Carlsbad Project water as well as other lower Pecos River basin water. Under this statutory authority, the NMISC purchased and retired water rights in the Lower Pecos River basin, from both the RAB and within the CID. The retired water rights may no longer be exercised, but the land may still be used, at the owner's discretion, for other purposes, such as grazing. Prior to 2003, NMISC did not lease water (and subsequently fallow land) from the RAB because an agreement was not in place to bypass that water through Project facilities for delivery to the state line. Since 2003, an agreement for the bypass of non-Project leased water through

Carlsbad Project facilities was developed between the CID and the NMISC making the lease of RAB water beneficial for Compact compliance purposes.

4.1.9 Calloway Culvert Reconstruction

The Calloway Culvert is a culvert in the City of Carlsbad that is proposed for reconstruction. Releases from Avalon Dam into the Pecos River are restricted by the capacity of this culvert, which currently can accommodate a maximum discharge of 600 cfs. The Calloway Culvert is being redesigned with a capacity of 1,200 cfs, and reconstruction is expected to be complete in 2007 (Tully 2005).

4.2 HYDROLOGY

Reasonably foreseeable actions that would result in cumulative impacts to hydrological resources when considered with the Proposed Action include the Settlement Agreement, NMOSE's Active Water Resource Management Program, actions analyzed in the Carlsbad Project Operations EIS, the Calloway Culvert Reconstruction, and various Vegetation Management Projects. Direct and indirect effects of the Proposed Action were summarized in Table 5.

4.2.1 Cumulative Effects of the Settlement Agreement

The reasonably foreseeable action that would have the greatest cumulative impact on hydrological resources when considered in conjunction with the Proposed Action is implementation of the Settlement Agreement. Under the Settlement Agreement, the NMISC will acquire land and appurtenant water rights in the lower Pecos River basin including:

- Up to 6,000 acres of land in the CID entitled to delivery of Project water

- Up to 11,000 acres of irrigation water rights in the RAB, of which about 3,000 acres will be water rights that are currently pumped from the shallow alluvial aquifer and about 8,000 acres of water rights that are currently pumped from the artesian aquifer
- Up to 1,000 acres of irrigation water rights between the Pecos River near Acme gauge to and including the FSID.

Waters appurtenant to the retired lands would then be transferred to the augmentation well field and pumped to meet certain Project water supply targets to CID and to meet New Mexico's delivery obligations under the Pecos River Compact. The proposed long-term miscellaneous purposes contract would assist in meeting Compact obligations. Under the terms of the Settlement Agreement, the NMISC will request releases each year to the state line depending on the CID allotment and the State's cumulative departure credit with Texas. In a full allotment year under the Settlement Agreement, NMISC could release as much as 26,800 acre-feet of water to the state line (based on 6,164 NMISC-owned CID acres, 3.697 acre-feet per acre at full allotment, and 1.176 multiplier for unrealized transmission losses in the Main Canal; $6,164 \times 3.697 \times 1.176 = 26,799$ acre-feet). This amount is about 9,000 acre-feet more than the average under the current leasing program, and about half of the total 50,000 acre-feet allowable under the proposed long-term miscellaneous purposes contract.

Following implementation of the Settlement Agreement, CID may choose to modify operations to improve system efficiency and water quality. Under the existing short-term miscellaneous purposes contract, CID has typically released NMISC lease water in mid-summer and again in the fall. When the Settlement Agreement becomes

fully implemented, CID may release NMISC water in February instead of mid-summer. This shift in timing of releases may be possible because of a more reliable water supply under the terms of the Settlement Agreement.

Such a change in operation will probably benefit CID as well. Water stored in Brantley Reservoir through the winter usually has higher salinity than water held in the upstream reservoirs. Using this water for state line deliveries will allow less saline water from Sumner and Santa Rosa Reservoirs to be used earlier in the irrigation season. Because this water will be released directly to the state line and not applied to CID lands, it should ultimately reduce total salt load at the state line as well. Additionally, vacating a portion of NMISC's share of Project water early in the irrigation season will make additional storage space available in the reservoir system to capture summer flood inflows.

Releasing water to the state line in February may make it necessary to increase the size of spring block releases from Sumner Dam to meet Project demands, as there would be less water in Brantley Reservoir than operations with no February state line releases. Any changes to timing of block releases will be an indirect effect of the Settlement Agreement, in order to meet Project needs, but not a cumulative effect of the Settlement and the Proposed Action (there are no direct or indirect effects of the Proposed Action upstream of Avalon Reservoir). Any modifications to block release operations would need to occur within the operational policy constraints defined by existing or future Biological Opinions, the Carlsbad Project Operations EIS (see Section 4.2.3), or other operational constraints. Additionally, augmentation pumping under the Settlement Agreement may reduce the need for a spring block release from Sumner Dam. Much of the augmentation pumping will occur during winter.

Brantley Reservoir will tend to be fuller prior to the irrigation season once augmentation pumping begins, and thus the need for spring block releases from Sumner will be reduced. The use of Project water for state line deliveries instead of irrigation may actually increase the flexibility that CID has in the timing and magnitude of block releases from Sumner Dam, due to the less rigid delivery schedule associated with releasing water to the state line. Evaporative losses in Carlsbad Project reservoirs may also be reduced, because late winter/early spring deliveries to the state line will reduce the residence time of Project water in storage.

4.2.1.1 Cumulative Effects on Resource Indicators

The Settlement Agreement implementation will affect the hydrologic resource indicators identified previously in Chapter 3. Flows in the Pecos River below Avalon Dam will likely increase slightly in the near-term, compared to flows estimated for the Proposed Action, because water from the augmentation wells will increase the per-acre CID allotment, enabling the NMISC to deliver more water to Texas. Under the terms of the Settlement Agreement, once certain Pecos Compact credit goals are met, releases to the state line will be reduced in favor of re-distributing water to CID irrigators to increase the economic benefit to the region. Over the long-term (10 or more years), implementation of the Settlement Agreement probably will not affect flows below Avalon Dam.

Implementation of the Settlement Agreement will affect base inflows below Avalon Dam as well. Reduction of total irrigated acres (retirement of 6,000 acres compared to the Proposed Action's 3,416 acres) as a result of the NMISC land purchase will decrease return flows, and hence base inflows, in the near term.

The Settlement Agreement contains provisions that guarantee certain minimum water supply conditions for CID. These minimum water supply targets will be met through a combination of augmentation pumping and redistribution of NMISC's portion of its CID allotment to other members when supplies are low. These provisions cumulatively tend to increase the CID allotment over time (Carron 2004). In the near-term, in some years, the increased water supply will likely more than offset the impact of the reduction of base inflows from retirement of acreage. Model results (Carron 2004) have shown that while near-term changes to base inflows are difficult to quantify when compared to the No Action Alternative, over the long-term the Settlement Agreement will likely cause a net increase in base inflows.

One objective of the Settlement Agreement is to accumulate and sustain a cumulative Compact credit of at least 50,000 acre-feet and ultimately 115,000 acre-feet. Releases of NMISC's allotment of Project water to the state line through Avalon Dam will vary as a function of the credit when the cumulative Compact credit at the state line ranges between 50,000 and 115,000 acre-feet. If the cumulative credit exceeds 115,000 acre-feet and the NMISC has determined that there is sufficient Project water in storage so as to negate the need for pumping from the State's augmentation well field for the next succeeding year, then the NMISC will consider implementing an annual lease-back program whereby the water will be leased back to the region from which it was purchased. Under this lease-back program, the delivery of additional surface water to farms will have a tendency to increase return flows and base inflows to the river. This will result in increased state line flows even when releases are not made explicitly for state line delivery. Over the 40-year period of the Proposed Action, flows to the state line will increase on

average relative to No Action Alternative as well as compared to current conditions. Because of the increase in long-term average water supply and the redistribution clauses of the Settlement Agreement, CID delivery volumes and Project water delivery efficiencies would likely increase with the Settlement Agreement and the Proposed Action.

At the state line, the cumulative effects of the Settlement Agreement implementation and the Proposed Action would be increased flows at the Red Bluff gauge. Unlike the Proposed Action (and current conditions), which would likely just maintain a minimal level of Compact credit, when added to the Settlement Agreement implementation, the combined effect would lead to an accumulation of Compact credit (i.e., more flows at the Red Bluff gauge). Once the Settlement Agreement's cumulative credit targets are met, water can be leased back or sold back to maximize potential water use by irrigators in CID.

Another cumulative effect of the Settlement Agreement implementation and the Proposed Action would be a reduced risk of a priority call to satisfy the requirements of the Pecos River Compact. Under priority administration, water right owners would likely have their water usage involuntarily curtailed until Compact delivery requirements are met, starting with the most junior to the most senior water right owner. Curtailed uses would be restored in reverse order of priority.

4.2.2 Cumulative Effects of NMOSE Active Water Resource Management

4.2.2.1 CID Supplemental Wells Rules and Regulations

Rules and regulations for Active Water Resource Management (AWRM) in the Lower Pecos River Basin will include provisions for regulating

supplemental well pumping in the CID. Under the CID Supplemental Well Regulations, supplemental wells will be limited to a total annual volume of 3.697 acre-feet per acre, minus the CID surface water allotment. This rule is consistent with the terms of the Settlement Agreement. Implementation of the Settlement Agreement should result in a more reliable surface water supply, thus decreasing the need for supplemental well pumping. If the Settlement Agreement is fully implemented, the CID Supplemental Well Regulations should have no additional cumulative effects beyond the effects identified above with the Settlement Agreement (Section 4.2.1).

4.2.2.2 Lower Pecos River Basin Water Master District-Specific Rules and Regulations

Rules and regulations are being promulgated for the Lower Pecos River Basin for Active Water Resource Management. These regulations promote the implementation of the Settlement Agreement by providing additional detail regarding how water rights will be administered in accordance with the terms of the Settlement Agreement. Implementation of the Settlement Agreement should result in a more reliable surface water supply providing for long-term compliance with the Pecos River Compact, which protects against a priority call for the Compact or a priority call for CID surface water supplies. Under these regulations, illegal diversions and over-diversions will be eliminated. By eliminating over-diversions or diversions that are not permitted (illegal), more water will be available in the Lower Pecos River Basin. These regulations establish procedures and requirements for implementing priority administration, which will assist the State in implementing a priority call, if that is necessary. These regulations also provide for expedited

transfers of water rights, enabling water right owners whose rights may be curtailed during a priority call to continue using water under a lease agreement with an in-priority water right, thus helping to avoid the economic harm that can result from a priority call. Under these regulations, a system of alternative administration is possible, which enables water right owners to agree to a system of water distribution other than by priority of the water right. Alternative administration provides for shortage sharing during times of drought, and adaptability to local needs, so long as this type of administration is not harmful to other water right holders or interstate compact deliveries. In sum, these regulations provide for improved administration of water rights in an active manner, adaptability to local needs, and procedures for implementing a priority call if needed, all of which will result in better management and use of the State's water resources.

4.2.3 Cumulative Effects of the Carlsbad Project Operations EIS

The outcome of the Carlsbad Project Operations EIS will likely include changes to water operations in one or more Carlsbad Project reservoirs, plus various water acquisition activities to either offset depletions to the Project water supply or to supplement river flows to meet specific flow targets, or both. As long as CID water supplies are kept "whole" (that is, the water supply is the same in any given year with the modified operations as it would have been without), then there would be no cumulative impact to the hydrologic resource indicators from implementation of the actions analyzed in the Operations EIS.

4.2.4 Cumulative Effects of the Vegetation Management Programs

The State of New Mexico and Federal agencies have ongoing vegetation management programs in the Pecos River basin. To the extent that these programs may reduce evapo-transpiration from the river channel, any additional water that might be realized from these programs would accrue to either the Carlsbad Project (if above Avalon Dam), or to the state line (if below Avalon Dam). However, these programs are not expected to result in measurable volumes of water salvage, nor will water salvage be monitored.

4.2.5 Cumulative Effects of the Calloway Culvert Reconstruction

Under the Proposed Action, releases from Avalon Dam would be limited to 600 cfs or less because of a low-flow culvert near the City of Carlsbad. The new culvert is scheduled to be completed by 2007, and is expected to have a capacity of 1,200 cfs. Releasing NMISC's leased water at 1,200 cfs instead of 600 cfs would reduce by half the number of days each year that these releases occur.

4.3 WATER QUALITY

4.3.1 Cumulative Effects of the Settlement Agreement

To estimate the cumulative water quality effects with the Proposed Action, it is assumed that the typical July release from Avalon Dam will occur, in the future, in February. This will be CID's preferred operational scheme and will help decrease the salinity of water stored in Brantley Reservoir (located upstream of Avalon Reservoir) before the irrigation season. This change in timing of releases to the state line will likely occur only if

the Settlement Agreement is implemented. Another likely effect of implementing the Settlement Agreement is an increase in base inflows to the Pecos River from the Carlsbad Basin (Carron 2004). These base inflows are naturally occurring, but are affected by CID return flows, supplemental well pumping, and total acreage irrigated. Given the various components of the Settlement Agreement, and the manner in which they interact to affect base inflows, it is difficult to predict whether the Settlement Agreement would result in any change in the water quality of these base inflows. Regardless, the effect of the Settlement Agreement on base inflow water quality probably will be significantly less than the increase in salinity that currently occurs at Malaga Bend downstream.

Cumulatively, the Proposed Action and the Settlement Agreement would change salinity concentrations in February and July. In February, salinity would be higher than existing conditions at the below Dark Canyon gauge. Water released in February from Brantley Reservoir would have higher winter salinity levels and would result in higher salinity levels at the below Dark Canyon gauge. However, salinity would be lower than existing conditions at the other three gauges (near Malaga, Pierce Canyon Crossing, and Red Bluff) because there would be more flow from the upstream release, which would dilute the highly saline ground water inflows to the Pecos River between below Dark Canyon and near Malaga.

For the month of July, salinity would be lower than existing conditions at the below Dark Canyon gauge because the higher salinity release from Brantley Reservoir would not be occurring. Salinity would be higher than the existing conditions at the other three gauges (near Malaga, Pierce Canyon Crossing, and Red Bluff). Over the long-term, the average salinity of the river at the

state line should decrease with the Settlement Agreement implemented.

The analysis above assumes that changing the release patterns out of Brantley Reservoir would not result in a change in the release water quality. It is possible that changing Brantley Reservoir operations would change the distribution of salts in the reservoir and thus change the salinity of released water. Salinity at the bottom of Brantley Reservoir is higher than current release concentrations and an increased flow through the reservoir in February could result in higher release concentrations.

In addition, the specific conductance of water flowing into the analysis area generally is increasing (Hydrosphere Resource Consultants 2005b). The reason for this trend has not been determined, although it does not appear to be to the result of flow variations. The water quality analysis for the FEIS is based on average historical concentrations flowing into the analysis area, and does not account for the recently-observed upward trend in salinity.

4.3.2 Cumulative Effects of the Malaga Bend Salinity Alleviation Project

Saline inflows in the Malaga Bend reach double or triple river salinity values compared to observations at the near Malaga gauge just upstream. Because the performance of the Malaga Bend Salinity Alleviation Project is unclear, it is difficult to quantify its impact on downstream water quality and is not included in this analysis. The project, however, is likely to decrease salinity at downstream locations.

4.4 GEOMORPHOLOGY

4.4.1 Cumulative Effects of the Calloway Culvert Reconstruction

The only reasonably foreseeable action that would have cumulative geomorphologic effects is the increase in flow capacity below Avalon Dam from 600 cfs to 1,200 cfs due to the Calloway Culvert Reconstruction. The cumulative effect of the increase in release rate from 600 to 1,200 cfs would be to transport 76 percent more sediment than the Proposed Action at the below Avalon gauge, and about 26 percent more sediment than the Proposed Action at the Red Bluff gauge. Increased sediment transport could result in some reshaping of the river channel just downstream of Avalon Dam, although flood control releases may be an order of magnitude larger than either the Proposed Action or cumulative effects release rates, and are more likely to affect channel morphology. More details on this cumulative effect are discussed in Geomorphology Technical Report (Hydrosphere Resource Consultants 2005c).

4.5 WETLANDS AND RIPARIAN AREAS

Along with the Proposed Action, the implementation of the Settlement Agreement would provide larger water delivery volumes along the Pecos River corridor. These increased deliveries would provide more base flow within the Pecos River for a longer duration and have minimal short-term benefits around the time of releases. This in turn may further promote the development of wetland areas along the Pecos River.

Improvements to the existing 600 cfs Calloway culvert that would double the conveyance and half the transmission time may provide a more

substantial base flow and possibly saturate bank areas not currently saturated during 600 cfs releases. This may have beneficial effects for wetland areas along the Pecos River; however, these effects would be limited by the decrease in saturation time due to the increased flow rate.

4.6 VEGETATION

Under the Proposed Action, in conjunction with implementation of the Settlement Agreement and the low-flow culvert improvement, it is foreseeable that a larger volume of water would be released on behalf of NMISC at a higher rate of flow. These more efficient releases may provide a greater bank inundation along the Pecos River downstream from Avalon Dam, the release point. This increased volume over a larger area within the Pecos River would provide more water for vegetation within the Pecos River floodplain than under the current conditions. To a limited extent, this may promote the growth and spread of riparian vegetation along the Pecos River. However, this depends on the consistency of annual releases (which are highly variable) and on snow melt and stormwater within the Pecos River basin.

4.7 WILDLIFE

Under the Proposed Action, in conjunction with implementation of the Settlement Agreement and the low-flow culvert improvement, it is foreseeable for a larger volume of water to be released on behalf of NMISC at a higher rate of flow. These more efficient releases may provide a greater bank inundation along the Pecos River downstream from Avalon Dam, the release point. This increased volume over a larger area within the Pecos River would provide more water for wildlife and their habitat within the Pecos River floodplain than under the current conditions.

4.8 THREATENED AND ENDANGERED SPECIES

Independent of the Proposed Action, Reclamation and NMISC are preparing the Operations EIS. The purpose of that proposed federal action is to conserve the Pecos bluntnose shiner and to conserve the Carlsbad Project water supply. In conjunction with the actions analyzed in the Carlsbad Project Operations EIS, Reclamation and NMISC have prepared a Biological Assessment, which assessed the potential impacts to threatened and endangered species (Reclamation 2005). The Operations EIS and the associated Biological Assessment will be updated throughout the final Operations EIS process for a separate and independent action.

When the Proposed Action of this EIS is analyzed in conjunction with implementation of the Settlement Agreement and the low-flow culvert improvement, it is foreseeable for a larger volume of water to be released on behalf of NMISC at a higher rate of flow. These more efficient releases could possibly provide a greater bank inundation along the Pecos River downstream from Avalon Dam, the release point. This increased volume over a larger area within the Pecos River may provide more water for listed species and their habitat within the Pecos River floodplain than under the current conditions. No cumulative impacts to threatened or endangered species are anticipated under the Proposed Action.

4.9 SOILS

Three of the reasonably foreseeable actions considered in this FEIS—the Pecos River Settlement Agreement, Vegetation Management Projects, and actions analyzed in the Operations EIS would potentially result in cumulative impacts to soil resources in the Pecos River basin. The

other reasonably foreseeable actions—Active Water Resource Management, the Brantley and Avalon Reservoirs Resource Management Plan, and the Malaga Bend desalination activities—are not anticipated to result in cumulative impacts to soil resources.

Under the Settlement Agreement, up to 6,000 irrigated acres in the CID and up to 12,000 acres north of the CID will be purchased and fallowed. After a state line credit greater than 115,000 acre-feet has accumulated, some agricultural lands may be sold or leased back to resume agricultural production. Potential actions considered in the Operations EIS may also result in cumulative effects to prime farmland in the Pecos River basin. Reclamation is considering options to retire farmland in the Operations EIS (up to 1,900 acres in the CID). Because most designated prime farmland in the Pecos River basin is prime only if irrigated, the amount of prime farmland will be reduced as a result of implementing the Settlement Agreement and actions considered in the Operations EIS. Because the NMISC is developing a land management program to control erosion and weeds, these problems are expected to decrease from levels that currently exist under the leasing program. Pecos River floodplain soils may be affected by slightly higher flows in the river downstream of Avalon Dam.

Vegetation management projects would likely result in a net benefit to floodplain soils due to salt cedar removal; however, removing salt cedar may result in bank destabilization prior to establishment of replacement vegetation.

4.10 LAND USE

As discussed previously, the current status of fallowed and cropped land is expected to remain static under the Proposed Action. The proposed

long-term miscellaneous purposes contract allows a total of 50,000 acre-feet per year of Project water to be released to the state line, which is similar to the maximum amount of water the NMISC has released under the existing short-term miscellaneous purposes contract. Ownership of agricultural lands is expected to change as 6,000 acres of land within the CID may be purchased by the NMISC as part of the Settlement Agreement. The NMISC plans to purchase and fallow up to 12,000 acres of irrigated land north of the CID within the Pecos River basin per the Settlement Agreement. NMISC land purchase and fallowing per the Settlement Agreement is discussed in more detail in the *Socioeconomics* section (Section 3.12.2).

The Proposed Action, in conjunction with the Settlement Agreement, would result in an increase to the current volume of water in the Pecos River channel. An improvement in water quality in the river is also expected. Increased water quantity and improved quality would benefit recreation. Recreation impacts are discussed in greater detail in the *Recreation* section (Section 4.11).

As noted in the *Hydrology* section (Section 4.2), the Proposed Action, in conjunction with the Settlement Agreement, is expected to increase water volume and water quality in the Pecos River. In addition, the vegetation management projects underway within the cumulative effects analysis area are expected to result in a decrease in non-native plant species along the river. These changes would likely be beneficial to wildlife dependent on the riparian and riverine habitats.

4.11 RECREATION

There are no anticipated cumulative effects to recreation. None of the reasonably foreseeable

actions in the analysis area would cumulatively affect recreation.

4.12 SOCIOECONOMICS

Two of the reasonably foreseeable actions—the Settlement Agreement and actions analyzed in the Carlsbad Project Water Operations and Water Supply Conservation EIS may result in cumulative impacts when combined with the effects of the Proposed Action. Overall, socioeconomic effects from reasonably foreseeable actions are likely to be positive, especially during the first few years of implementation of the Settlement Agreement. Losses in agricultural production would be more than offset by increases in employment, income, tax revenue, and value added from investments in water management actions. Moreover, implementation of the Settlement Agreement would reduce the likelihood of a priority call, which would reduce the risk of job losses, large economic impacts, and adverse social effects.

4.12.1 Analysis Methods

Analysis methods for evaluating cumulative socioeconomic effects parallel those described in Section 3.12.2.1, and include both quantitative and qualitative methods. Socioeconomic effects are considered quantitatively where sufficient data exist and qualitatively where insufficient information is available to quantify the impact. Like in Section 3.12.2, effects are discussed in relation to crop production, regional economic impacts, social effects, and the likelihood of a priority call.

4.12.2 Cumulative Effects of the Settlement Agreement

Implementation of the Settlement Agreement will be the reasonably foreseeable action with the largest economic impacts. Thus, the regional

economic effects of the Settlement Agreement are analyzed quantitatively with the same methods, including IMPLAN modeling, used for evaluation of direct and indirect effects described in Section 3.12.2. The analysis assumes that the loss of existing water lease revenue is offset by income from the sales of those lands. Also, it is assumed that only forage crops, cereals, and cotton crops would be reduced in CID and RAB as a result of NMISC's land fallowing under the Settlement Agreement. Lands used for these crops are more likely to be sold to NMISC and removed from production because these are the least profitable crops grown in CID and RAB (Hawkes and Libbin 1999; ERO 2005a). Also, if lands in more profitable crops are sold to the NMISC, other lands remaining in production, which are currently used for less profitable crops, are likely to be converted to more profitable crops (ERO 2005a).

4.12.3 Cumulative Effects of the Operations EIS

Quantitative analyses are provided for the range of alternatives considered in the Operations EIS and qualitative analyses are provided for the other water management actions. The analysis of these projects and programs is based on available information. Potential cumulative effects associated with a priority call are evaluated qualitatively for the Settlement Agreement but not for the other reasonably foreseeable actions.

4.12.4 Direct Effects of Reasonably Foreseeable Actions

Direct socioeconomic effects of the reasonably foreseeable actions are described in this Section. As discussed in Section 3.12.2.3, there would be no significant socioeconomic effects from the Proposed Action. Thus, the cumulative socioeconomic effects associated with the

Proposed Action would be the effects of the reasonably foreseeable actions described below.

4.12.4.1 Settlement Agreement

Under the Settlement Agreement, NMISC will acquire and fallow up to 6,000 acres of land and appurtenant water rights in CID and up to 11,000 acres in RAB. The NMISC also may acquire and fallow up to 1,000 acres of land and appurtenant water rights north of the Acme gauge to and including FSID in De Baca County. However, the likelihood of land acquisition north of the Acme gauge is less certain than acquisition of land in CID and RAB. Therefore, the cumulative effects in the area north of the Acme gauge are addressed qualitatively.

Land and water right acquisitions by NMISC are anticipated to cost about \$60 million distributed evenly over 5 years beginning in 2005, with 40 percent of the purchase price spent by the sellers in the analysis area economy. Initial costs for erosion control (field preparation and seeding) are estimated to average \$43 per acre. After acquisition, annual land management costs (e.g., mowing) are estimated to average \$23 per acre for the first 10 years of NMISC ownership (ERO 2005a).

Under the Settlement Agreement, once an accumulated Pecos River Compact credit reaches 115,000 acre-feet, NMISC may lease or sell back water rights for irrigation use. Accumulating a credit of this amount will require an uncertain number of years. Consequently, NMISC leases or sales of water rights are analyzed qualitatively.

Fallowed land water leases of Project water are not expected to be necessary if the Settlement Agreement is implemented. However, in the first few years following implementation of the Settlement Agreement, NMISC may seek to enter into fallowed land water leases for Compact

compliance purposes to protect against shortfalls. Such leases will be limited to the total amount of water authorized for miscellaneous use under the long-term miscellaneous purposes contract. Because leasing water through fallowed land water leases is uncertain and not likely to be frequent, the potential economic impacts of such leases are evaluated qualitatively.

Another component of the Settlement Agreement will be development of an augmentation well field. For purposes of the cumulative economic effects analysis, capital costs are estimated to be \$12.8 million for augmentation pumping facilities, which will be distributed evenly over the first 2 years of implementation. Annual operation and maintenance costs for augmentation pumping are estimated to be \$630,000 per year (ERO 2005a), although these costs, which will result in beneficial regional economic effects, may be less if the augmentation pumping does not occur every year. Hydrologic modeling indicates augmentation well pumping will likely occur more frequently in initial years of the Settlement Agreement implementation.

4.12.4.2 Carlsbad Operations EIS

The range of alternatives analyzed in the Operations EIS involves changes in irrigation water use within the analysis area as the result of land retirement, water right acquisition, or cropping pattern changes (Reclamation and NMISC 2005). Thus, economic impacts will be of the same type as described for land fallowing as part of the Settlement Agreement.

The other reasonably foreseeable water management actions are not expected to have significant economic effects because relatively small expenditures are related to these programs and activities.

4.12.5 Cumulative Effects on Crop Production

4.12.5.1 Settlement Agreement

Production of less profitable crops (forage crops, grains, and cotton) would cease on lands purchased by NMISC as part of the Settlement Agreement. These acreage reductions would be up to 2,584 acres in CID and up to 11,000 acres in the RAB (Table 26). Crop production would decline more if up to 1,000 acres are purchased above the Acme gauge. Temporary fallowed land water leases, although unlikely, would result in additional decreases in crop production. However, NMISC may lease or sell land (“lease back” options under the Settlement Agreement) for irrigation in the future if sufficient Compact credits are accumulated, which would restore some crop production.

4.12.5.2 Carlsbad Operations EIS

The range of alternatives analyzed in the Operations EIS includes land fallowing in the analysis area. Crop production will be modified or eliminated on 200 to 4,800 acres depending on the alternative selected, location of land fallowed, and whether the land is retired, fallowed, or the cropping pattern is changed (Reclamation and NMISC 2005). The other water management actions are not expected to have any effect on crop production.

4.12.6 Cumulative Regional Economic Impacts

4.12.6.1 Employment

Implementation of the Settlement Agreement and the Proposed Action would result in about 103 new jobs in the initial 2 years during construction of the augmentation well field and other implementation efforts and about 34 new jobs in years 3 through 5 as the result of land purchases and other implementation activities. Most of the new employment would be employment generated by construction of the augmentation well field and indirectly from the use of \$60 million received for land acquisition in the regional economy (ERO 2005a). Long term, land acquisition would reduce agricultural employment in the region by 16 to 17 jobs. The loss in agricultural production jobs would be partially offset by employment to operate and maintain the augmentation well field and maintain the fallowed lands.

Changes in employment are also expected with the actions analyzed in the Operations EIS, ranging from a one-time gain of up to 52 jobs to a long-term change of +7 to -41 jobs. Likewise, small increases in employment are likely to occur during implementation of the other water management actions. The Settlement Agreement, a change in Carlsbad Project operations, or any other reasonably foreseeable action would not have a significant effect on the area’s employment, which

Table 26. Cumulative effects of the Settlement Agreement and Proposed Action on crop production.

	CID				RAB			
	Forage Crops	Grains	Cotton	Total	Forage Crops	Grains	Cotton	Total
Existing Conditions	13,874	881	4,216	18,971	79,659	6,834	12,129	98,622
Cumulative Effects	-1,890	-120	-574	-2,584	-8,885	-762	-1,353	-11,000
Net Acreage	11,984	761	3,642	16,387	70,774	6,072	10,776	87,622

Source: ERO 2005a.

totaled more than 46,000 jobs in 2003 (New Mexico Department of Labor 2004).

4.12.6.2 Income

During initial implementation of the Settlement Agreement, net income in the analysis area (including labor income and other property income) would be expected to increase by about \$8.0 million per year in years 1 and 2, and about \$5.9 million per year in years 3 through 5. In years 6 through 20, net income would decline by about \$0.6 million per year due to the loss of agricultural production, which would be partially offset by maintenance activities on fallowed land (ERO 2005a). Total income in 2001 in Eddy and Chaves counties was \$2.3 billion.

The range of alternatives analyzed in the Operations EIS result in an initial positive impact of up to \$1.2 million if land is retired and fallowed, with a longer-term change of income ranging from an annual increase of about \$200,000 to an annual loss of \$1.3 million (Reclamation and NMISC 2005). A small increase in net income would be likely from implementation of the other water management actions.

4.12.6.3 Indirect Business Taxes

Under implementation of the Settlement Agreement and Proposed Action, NMISC would not pay property taxes on the land it acquires, resulting in a maximum loss of property tax revenue of about \$17,000 per year in Eddy County and \$34,000 per year in Chaves County (ERO 2005a). However, other tax revenues would increase, including excise taxes, fees, licenses, and sales taxes paid by businesses and households (Snyder and Crook 2005). The result would be a net increase of indirect business taxes totaling about \$260,000 per year in years 1 and 2, about \$130,000 per year in years 3 through 5, and about

\$9,000 per year in year 6 and thereafter (Snyder and Crook 2005). Total business taxes in 2001 in Eddy and Chaves counties were about \$223 million.

Similarly, small net tax revenue increases are expected from the actions analyzed in the Operations EIS. The other water management actions are also likely to slightly increase tax revenues.

4.12.6.4 Value Added and Gross Output

As a result of the Settlement Agreement and Proposed Action, the average net increase in value added to the regional economy would total about \$8.3 million per year in years 1 and 2, and \$6.0 million per year in years 3 through 5. After the initial implementation, total value added would be a loss of \$620,000 per year in year 6 rising to a loss of \$650,000 per year in year 11 and descending slightly after that time. The estimated net present value of total value added over a 20-year period from 2005 ranges from about \$23.8 million at a 10% discount rate to \$25.0 million at a 6% discount rate (Snyder and Crook 2005). Total value added in 2001 in Eddy and Chaves counties was about \$2.5 billion.

The range of alternatives analyzed in the Operations EIS is likely to have a similar effect on value added as the Settlement Agreement, with an initial positive effect and then a smaller long-term annual loss; however, as discussed above for income, the magnitude of the effect would be smaller. Small increases in total value added are likely to result from the other water management actions.

Gross output in the regional economy would increase about \$18.8 million in years 1 and 2, and about \$13.4 million in years 3 through 5 as a result of implementing the Settlement Agreement and

Proposed Action. Net gross output would decline by about \$1.0 million/year in years 6 through 20. The net present value of gross output over a 20-year period from 2005 would range from an increase of about \$58.7 million at a 6 percent discount rate) to about \$55.2 million at a 10 percent discount rate (Snyder and Crook 2005).

The range of alternatives analyzed in the Operations EIS will have varying effects on gross output depending on the alternative, with positive one-time and annual similar effects for some alternatives, and adverse one-time and annual effects for other alternatives.

4.12.6.5 Priority Call

The likelihood of a priority call would be significantly lower as a result of the Settlement Agreement and Proposed Action (ERO 2005b; Carron 2003). Thus, there would be a reduced risk that the regional economy would be subject to job losses and millions of dollars of impacts resulting from a priority call.

The probability of a priority call is not likely to change as the result of implementing any of the alternatives analyzed in the Operations EIS. Similarly, the other water management actions are unlikely to affect the likelihood of a priority call.

4.12.6.6 Social Effects

The reduction in agricultural production in the analysis area from implementation of the Settlement Agreement and Proposed Action is likely to have some social effects. The population size and ethnic or racial diversity is not likely to change. Slight changes in institutional structures and agricultural community resources may occur due to the large amount of land fallowing. However, these adverse effects would be offset by the reduced likelihood of a priority call, thus avoiding the loss of agricultural and other jobs, and avoiding significant impacts to the regional economy. The range of alternatives analyzed in the Operations EIS and other water management alternatives are not likely to have social effects because the scope of these actions will be relatively small.

4.13 CULTURAL RESOURCES

Under the Settlement Agreement, the NMISC will purchase and fallow up to 6,000 acres in the CID. Currently, the NMISC leases water and fallows about 3,416 acres of land in the CID; it also owns and fallows 164 acres. The fallowing of an additional 2,420 acres of irrigated land in the CID would not result in an adverse effect to any elements contributing to or recommended as contributing to the CID National Historic Landmark.