RECLAMATION

Managing Water in the West

San Xavier Cooperative Farm Rehabilitation

Final Environmental Assessment

U.S. Department of the Interior
Bureau of Reclamation
Lower Colorado Region
Phoenix Area Office
Phoenix, Arizona

July 2005

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CHAPTER 1 - PURPOSE AND NEED

1.1 Introduction

The Bureau of Reclamation (Reclamation) has prepared this Environmental Assessment (EA) to analyze potential effects to physical, biological, and cultural resources that may result from rehabilitation of farmland in the San Xavier District (District) of the Tohono O'odham Nation (Nation). The EA was prepared in accordance with the National Environmental Policy Act (NEPA), Council on Environmental Quality Regulations (40 CFR 1500-1508), and Reclamation NEPA Handbook. Reclamation is the lead Federal agency pursuant to NEPA. The District is a co-lead agency for the preparation of this document.

This document is organized into six chapters:

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

1.2 Background

Central Arizona Project (CAP). Congress passed the Colorado River Basin Project Act (CRBPA) on September 30, 1968. The CRBPA authorized the Secretary of the Interior (Secretary), acting through Reclamation, to construct the CAP, to deliver Colorado River water for agricultural, industrial, and municipal uses in central and southern Arizona. The CAP, which was declared "substantially complete" in 1993, conveys Colorado River water through a 336-mile-long system of pumping plants, aqueducts, dams, and reservoirs. CAP water is apportioned through a system of contracts negotiated between the Secretary and Indian Tribes, and subcontracts issued by the Central Arizona Water Conservation District to non-Indian agricultural districts and municipal and industrial (M&I) entities. In years of CAP water shortages, the CRBPA assigns the highest priority for delivery of contracted CAP water to Indian Tribes and M&I entities, with the lowest priority assigned to non-Indian agriculture.

In accordance with the CRBPA, the Secretary made allocations to ten tribes, which were identified to receive a total of 309,828 acre feet (af) of CAP water annually. Nine of the ten tribes, including the Nation (formerly called the Papago Tribe), signed CAP water service contracts in December 1980. The contract negotiated with the Nation allocated 27,000 af of CAP water to the District annually. A lawsuit filed by the State of Arizona and others in December 1980 attempted to prevent implementation of the allocations due to inadequate NEPA compliance. This lawsuit was dismissed by the U.S. District Court when the Secretary agreed to prepare an Environmental Impact Statement on CAP water allocations. The 1983 Record of Decision and revised allocations issued by the Secretary did not affect the District's CAP water entitlement.

Southern Arizona Water Rights Settlement Act of 1982 (SAWRSA). In 1975, the United States filed suit on behalf of the Nation against major water users in the southern Santa Cruz and Avra-Alter Valleys (Franzoy Corey 1988). The suit alleged infringement of Tohono O'odham water rights by defendants, who included the City of Tucson and many eastern Pima County mining and farming interests. Subsequently, the Nation filed a second suit over water rights infringements not covered in the first suit. These lawsuits were consolidated in 1980, and the complaint was amended to name nearly 1,700 defendants, all users of surface water and groundwater within the upper Santa Cruz River Basin. The major issue in the lawsuits related to groundwater depletion under Tohono O'odham land caused by overdraft within the groundwater basin.

The SAWRSA was enacted by Congress in 1982 to settle the water claims of the San Xavier and Schuk Toak Districts of the Nation. Rights granted under SAWRSA were intended "to fully satisfy any and all claims of water rights or injuries to water rights (including water rights in both groundwater and surface water)" within these two districts. SAWRSA also modified the contract negotiated in 1980 between the Nation and the United States for delivery of CAP water.[1] The settlement provided for free delivery of CAP water to the reservation boundary and waived the Nation's responsibility to pay their proportional share of costs for construction of the CAP. SAWRSA directed the Secretary, acting through Reclamation, to acquire and deliver annually to the San Xavier and Schuk Toak Districts 37,800 af of CAP water and 28,200 af of additional water suitable for agricultural use.[2] Allocations to the District consisted of 27,000 af of CAP water and 23,000 af of additional water. The remaining 16,000 af of CAP and additional water was to be delivered to the Schuk Toak District. As a condition of receiving the 66,000 af of imported water, the Nation agreed to limit groundwater withdrawal from beneath the District.[3]

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[1] Obligations that were legislated in SAWRSA were contractually restated in the *Contract between the United States and the Papago Tribe of Arizona to Provide Water and Settle Claims to Water*, dated October 11, 1983.
[2] The City of Tucson contributed 28,200 annually of effluent to be used by the Secretary to facilitate deliveries of other water suitable for agriculture to the districts (through exchange or sale).
[3] Groundwater pumping within District is restricted to 10,000 af annually. New wells with capacities less than 35 gallons per minute (gpm) are exempt from the restriction if the groundwater is used for domestic or livestock needs.

The Arizona Water Settlements Act of 2004 amended SAWRSA and converted the 28,200 af of additional water to CAP water with non-Indian agricultural priority. In amending SAWRSA, Congress directed Reclamation to deliver annually from the CAP additional water in the amount of 5,200 af and 23,000 af to Schuk Toak and San Xavier Districts, respectively. Any portion of this additional water determined to be excess to the needs of the districts will be delivered to the Nation. CAP water supplies confirmed or granted by the Arizona Water Settlements Act to the Nation may be applied to agricultural, municipal, domestic, industrial, commercial, mining, underground storage, in-stream flow, riparian habitat maintenance, recreational, and other uses. This spectrum of potential uses applies to the entire 50,000 af of CAP water assigned to the San Xavier District.

SAWRSA authorizes Federal funds to: (1) complete the CAP water delivery and distribution system in the District, (2) rehabilitate the existing San Xavier cooperative farm, (3) extend the irrigation system to serve new farmland in the District,[4] and (4) design and construct irrigation works to distribute Schuk Toak's CAP water allocation. SAWRSA established a Cooperative Fund for the Secretary to meet the financial obligations necessary for rehabilitation of farmland and construction of water delivery facilities. The Cooperative Fund is administered by the Bureau of Indian Affairs (BIA), and funds are transferred to Reclamation to pay operational costs related to delivery.

In May 1998, the Tohono O'odham Legislative Council formally requested that Reclamation initiate action to assist the District with rehabilitation of the existing San Xavier cooperative farm and expedite completion of a CAP pipeline link to deliver the District's water allocation in accordance with SAWRSA. Construction of the 5.6-mile-long CAP Link Pipeline between Reach 6 of the CAP and the farm's existing water distribution system was completed in 2000.

1.3 Purpose of and Need for Action

The purpose of the San Xavier cooperative farm rehabilitation project is to develop new infrastructure for the efficient conveyance of irrigation water to existing agricultural fields and promote on-farm water conservation. Currently, water losses attributable to evaporation, spillage, and ponding within the distribution system and farm fields limit the productive use of available water supplies. On-farm improvements and efficient conveyance of water is needed to minimize water loss and maximize productivity of the land for agriculture. Rehabilitation of water conveyance and field irrigation systems would increase the acreage of land under active cultivation and improve the economic viability of commercial Indian agriculture in the District.

Agriculture has contributed significantly to the social and economic well-being of District members for more than a century. Despite its importance, farming has had an erratic history. In the last 50 years, the amount of tilled land fluctuated from a high of 1,954 acres in 1969 to approximately 250 acres in 2003.[5] The decline in number of acres under active cultivation is

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[4] The term "irrigation system" refers to canals, laterals, ditches, sprinklers, and other irrigation works used to distribute water and includes activities, procedures, and works for rehabilitation of fields and remediation of sinkholes within the farm.
[5] Approximately 1,685 acres of agricultural land were under lease to non-Indian farmers in 1969. San Xavier allottees cultivated an additional 269 acres that year.

primarily attributable to severe groundwater depletion (and reduced well production within the District) that has resulted from historic withdrawals by major water development interests within the District and surrounding areas. Groundwater withdrawals by municipal and agricultural entities[6] in the Tucson Active Management Area (AMA)[7] are now regulated by the Arizona Department of Water Resources (ADWR) under the Arizona Groundwater Management Code. This code provides for mandatory conservation of municipal and agricultural water use within the Tucson AMA and promotes the use of CAP water and reclaimed effluent. Although these measures have reduced the extent of overdraft in portions of the Tucson AMA, no improvement in groundwater conditions has occurred within the District.

Now that CAP water is available, the most limiting constraint is the poor condition of the on-farm water distribution system. The existing distribution system is antiquated and wholly inadequate to meet levels of farm production desired by the San Xavier Cooperative Association. Portions of the system have been seriously compromised by failing structural components (e.g., cracked or broken concrete-lined ditches, inoperable control boxes and gates, and broken underground pipe) hindering efficient conveyance of water. In recent years, these deficiencies have precluded the distribution of water to most fields in the northern half of the farm.

1.4 Project Area

The project area is located within the northern portion of the District, in Pima County, Arizona (Figure 1). The District is geographically separate from the main reservation, but participates within the Nation's governing structure as 1 of 11 political districts. Rehabilitation activities would be limited to the existing 1,100-acre farm and outlying areas along portions of the farm boundary. Main features bordering the project area include the Santa Cruz River (SCR) and Interstate 19 to the east, nonreservation housing to the northeast and northwest, and the West Branch of the Santa Cruz River (WBSCR) to the southwest. The boundaries of the farm are shown in Figure 2.

The farm boundary encompasses approximately 985 acres of farmland (including actively cultivated, fallow, and abandoned fields) and 115 acres of farm roads, private residential inholdings, field borders, flood channels and dikes, and the farm headquarters complex. Rehabilitation would directly affect approximately 1,025 acres within the farm. In addition, less than 1 acre of undeveloped land south of the farm would be affected by a 500-foot extension of an existing Arizona Department of Transportation (ADOT) flood control dike. Approximately 75 acres consisting of miscellaneous field borders, residential properties, portions of the headquarters complex, and two abandoned fields (Fields 1 and 34) would not be affected by rehabilitation activities.

Following rehabilitation, net irrigated acreage would increase to approximately 949 acres, all of which has been farmed in recent years and is leased to the San Xavier Cooperative Association by allottee landowners. Project development would include leveling fields, widening farm roads,

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[6] Municipal and agricultural use accounts for almost 79 percent of groundwater demand in the Tucson AMA.
[7] The Tucson AMA includes portions of Pima, Pinal, and Santa Cruz Counties; the cities and towns of Tucson, Oro Valley, Marana, and Sahuarita; the Pasqua Yaqui tribal lands, part of the Schuk Toak District, and the entire District.

installing impermeable irrigation conveyance infrastructure, and constructing flood control structures and a new farm administration building.

1.5 Public Involvement

The Council on Environmental Quality defines scoping as "…an early and open process for determining the scope of issues to be addressed and for identifying significant issues related to a proposed action" (40 CFR 1501.7). Scoping is an important underpinning of the NEPA process that aids in the identification of the affected public and agency concerns and focuses the environmental impact analysis on relevant issues.

In December 2003, scoping information was mailed to Federal, state, and local agencies; organizations; and interested individuals. Public scoping meetings were held at the San Xavier District Center on January 31 and February 21, 2004. The scoping meetings included a formal presentation, informational displays, and an opportunity for attendees to discuss the project individually with Reclamation, District, and farm personnel. A total of 42 people participated in the scoping meetings.

Several issues were identified from discussions among the NEPA interdisciplinary team[8] and comments from the public during scoping. These issues defined the range of actions and impacts that are addressed in this document and served as the basis for refining the project and developing mitigation.

The interdisciplinary team considered issues raised during scoping and categorized each according to possible significance or lack thereof. Key issues are defined as those that form the basis for alternative development and met the following criteria: (1) were within the scope of the project (i.e., satisfy the purpose and need); (2) were not already decided/required by law, regulation, or other previous decisions; (3) were relevant to the decision being made; and (4) were amenable to scientific analysis rather than conjecture.

No written scoping comments were received by Reclamation. Comments expressed by the public during the scoping meetings were generally supportive of the project; however, a few attendees were concerned that changes in flood patterns could restrict future land-use options on allotted land in the upper panhandle of the farm and on the west side of the WBSCR. These issues did not require the development of new alternatives.

The draft EA was distributed for 30-day public review on June 17, 2005. Those receiving the EA included public agencies, tribal governments, and interested individuals. Only one letter of comment was received by Reclamation. A copy of the letter and Reclamation's responses are included in Appendix J of this document.

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[8] The NEPA interdisciplinary team consisted of biologists, archaeologists, and engineers from Reclamation and water rights staff from the District.

1.6 Decision to be Made

Reclamation must decide whether to implement the proposed action or no action. If the project is implemented, Reclamation would fund construction of the irrigation conveyance system, field irrigation improvements, flood control structures, farm roads, and new farm administration building.

Reclamation is also the lead Federal agency under NEPA responsible for determining whether the proposed project will have a significant effect on the human environment. If project effects are determined to be insignificant, Reclamation will prepare a Finding of No Significant Impact (FONSI). The FONSI will allow Reclamation to fund project development without the preparation of an Environmental Impact Statement.

FIGURE 1

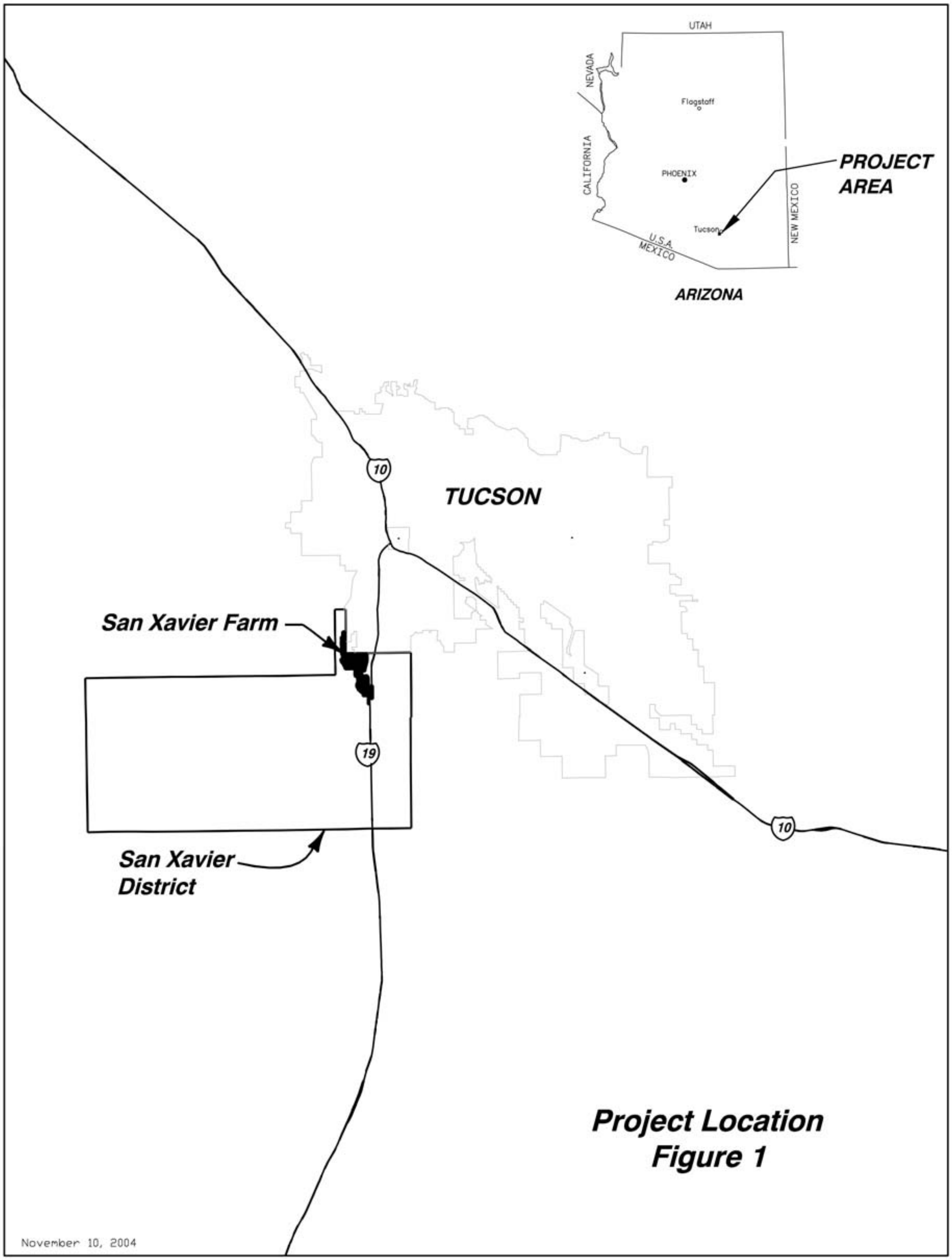
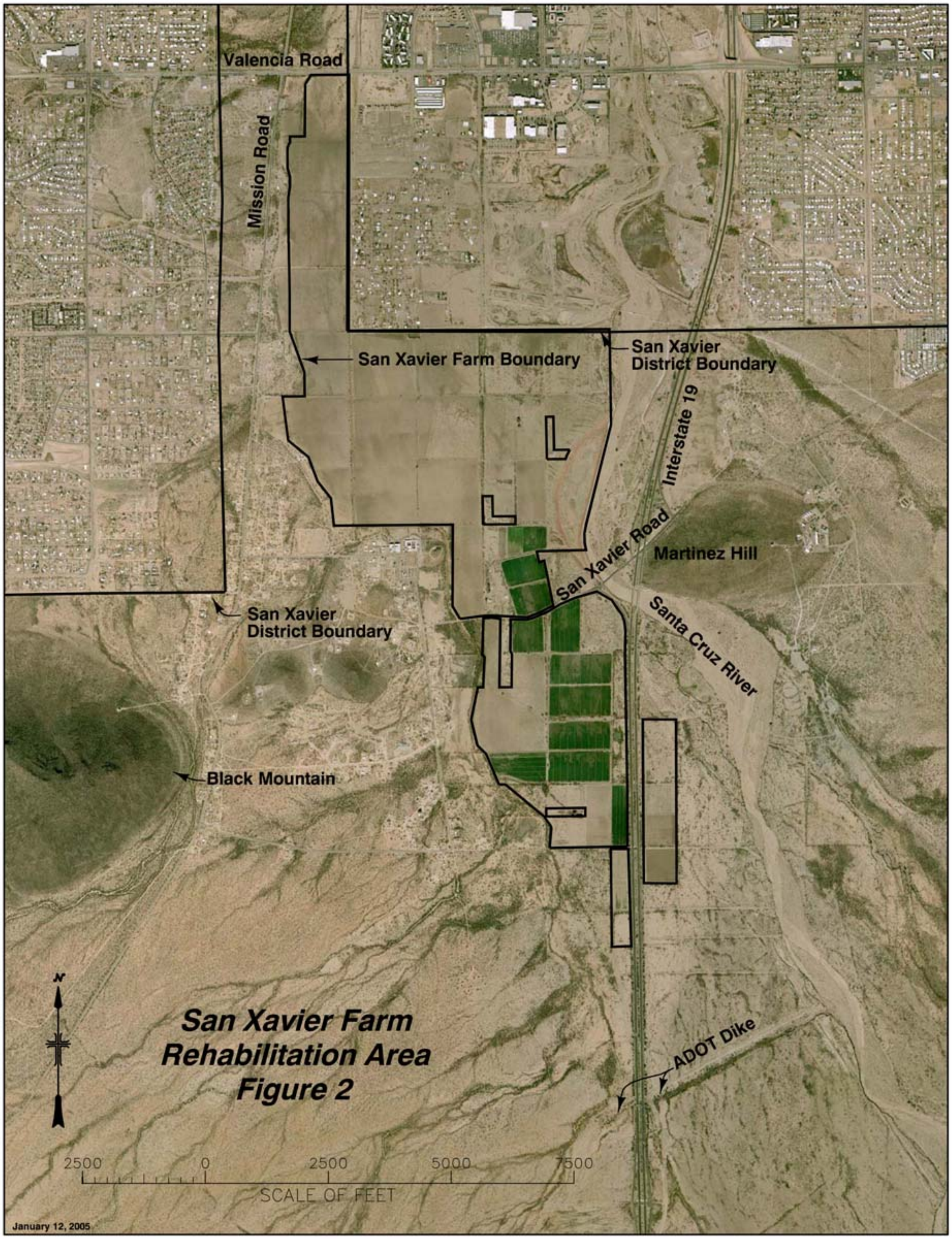

UTAH
NEVADA
Flagstaff
CALIFORNIA
PHOENIX
PROJECT AREA
NEW MEXICO
Tucson
U.S.A.
MEXICO
ARIZONA
10
TUCSON
San Xavier Farm
19
10
San Xavier District
Project Location
Figure 1
November 10, 2004

FIGURE 2



Valencia Road
Mission Road
San Xavier Farm Boundary
San Xavier
District Boundary
Interstate 19
San Xavier Road
Martinez Hill
San Xavier
District Boundary
Santa Cruz River
Black Mountain
N
San Xavier Farm
Rehabilitation Area
Figure 2
ADOT Dike
2500
0
2500
5000
7500
SCALE OF FEET
January 12, 2005

CHAPTER 2 - DESCRIPTION OF ALTERNATIVES

This chapter describes the alternatives being considered to meet the purpose and need for the farm rehabilitation project. It includes the proposed action and no action.

2.1 Proposed Action

The Planning Group for the farm rehabilitation project consisted of the District, San Xavier Cooperative Association Board, San Xavier Cooperative Association, Reclamation, and a consultant. During the early stages of planning, the Planning Group evaluated the farm's potential agricultural production based on improvements to on-farm distribution and irrigation systems and constraints on water supply. Decisions about operation and maintenance costs, water use, desired crop mixes, and the scope of flood protection guided the planning process. Consideration was also given to design details that would protect significant cultural resources and riparian habitat. After considerable study and review coupled with input from community members, the Cooperative Association board passed a resolution to select the preferred conceptual design for rehabilitation of the farm. This design has been refined through additional engineering studies and input from the Farm Manager and is presented in this EA as the proposed action. The proposed action utilizes the best management practices of high-efficiency, piped water conveyance and level-basin flood irrigation.

During the planning phase, the following key elements were identified for rehabilitation within the existing farm:

- On-farm water distribution system
- Field irrigation systems
- Flood protection structures
- Farm roads
- Farm administration building

2.1.1 Water Distribution System

Rehabilitation of the water distribution infrastructure would increase irrigated commercial agricultural acreage to approximately 908 acres. An additional 41 irrigated acres would be planted with mesquite and fruit-/nut-producing trees. During project development, existing concrete-lined irrigation ditches and laterals would be removed.

Under the proposed action, water from the CAP Link Pipeline would be conveyed throughout the farm by a main pipeline and series of field laterals (Figures 3 and 4). The main pipeline would be connected to existing distribution infrastructure at the southwest corner of Field 48S and installed in a northerly direction through the farm. Installation generally would follow field borders and farm roads to the northern margin of Field 1 in the panhandle.

FIGURE 3

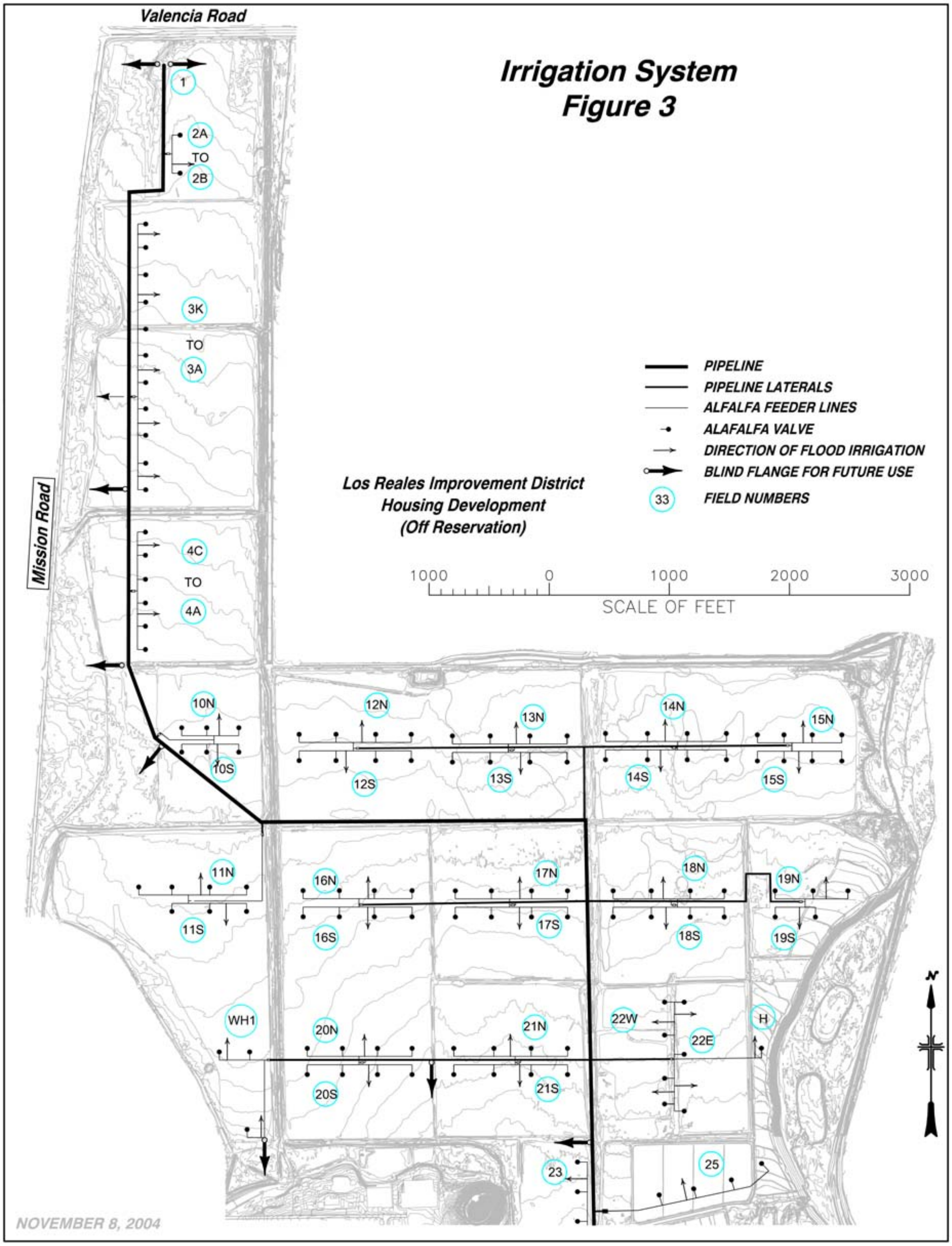
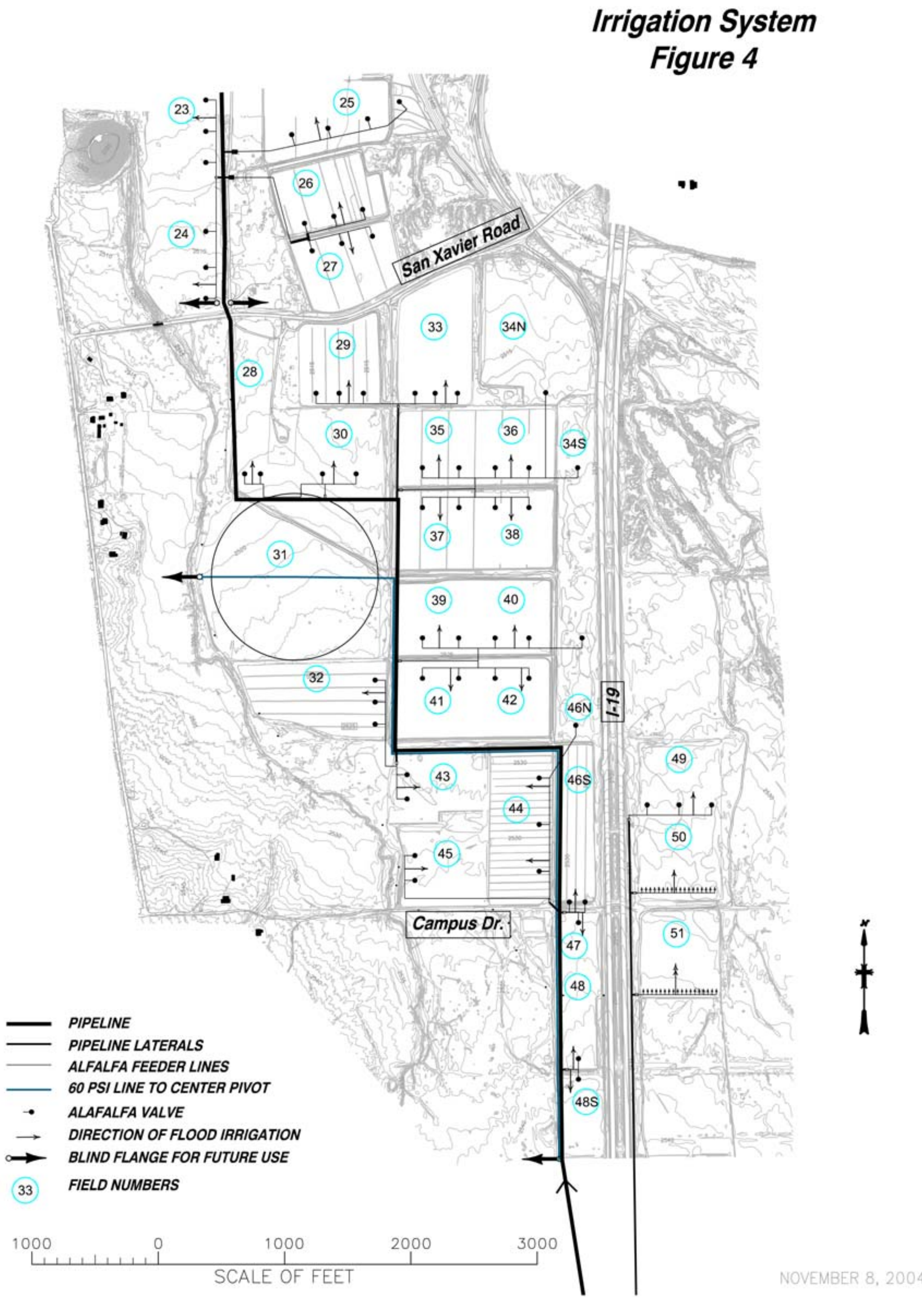

Valencia Road
Irrigation System
Figure 3
Mission Road
PIPELINE
PIPELINE LATERALS
ALFALFA FEEDER LINES
ALAFALFA VALVE
DIRECTION OF FLOOD IRRIGATION
BLIND FLANGE FOR FUTURE USE
33
FIELD NUMBERS
Los Reales Improvement District
Housing Development
(Off Reservation)
1000 0 1000 2000 3000
SCALE OF FEET
1
2A
TO
2B
3K
TO
3A
4C
TO
4A
10N
10S
11N
11S
12N
12S
13N
13S
14N
14S
15N
15S
16N
16S
17N
17S
18N
18S
19N
19S
WH1
20N
20S
21N
21S
22W
22E
H
23
25
N
NOVEMBER 8, 2004

FIGURE 4


Irrigation System
Figure 4
San Xavier Road
Campus Dr.
I-19
PIPELINE
PIPELINE LATERALS
ALFALFA FEEDER LINES
60 PSI LINE TO CENTER PIVOT
ALAFALFA VALVE
DIRECTION OF FLOOD IRRIGATION
BLIND FLANGE FOR FUTURE USE
FIELD NUMBERS
1000 0 1000 2000 3000
SCALE OF FEET
NOVEMBER 8, 2004

The main pipeline would consist of a 30-inch diameter polyvinyl chloride (PVC) pipe with a maximum capacity of 23 cubic per second (cfs). Flood-irrigated fields would be supplied by 18-inch diameter PVC laterals connected to alfalfa risers. A separate 6- to 8-inch-diameter, high-pressure line would be installed to operate the center-pivot sprinkler located in Field 31. Both pipelines would be installed in the same trench that runs from Field 31 to Field 48S.

The active construction corridor includes the main pipeline/lateral alignments and any areas needed for material and equipment staging. For this assessment, the construction corridor consists of a temporary 100-foot-wide right of way approximately 5.5-miles long (combined lineal extent of the main distribution pipeline and laterals) encompassing 66.6 acres.

The depth of excavation needed for pipeline installation would vary depending on the size of pipe used, although the top of the main pipeline would always lay a minimum of 5 feet below the land surface. Lateral pipe would require a minimum cover of 3 feet. Maximum depth of the excavation is approximately 12 feet for the main pipeline and 8 feet for lateral pipes. Earthen material removed from the pipeline alignment during excavation would serve as backfill.

2.1.2 Field Irrigation Systems

On-farm water management is essential to optimize crop yield, water-use efficiency, and to obviate land degradation due to waterlogging or salinization. In addition to a good delivery system, in-field work such as land leveling is necessary to facilitate water application and economize on labor. Problematic fields would be leveled to a uniform plane with intermediate benches to reduce depth of cut. Approximately 300 acres would require cut and fill or precision level-basin planing to improve drainage and application efficiency of flood irrigation systems. Land leveling is desirable because it improves the distribution of irrigation water, promotes soil and water conservation, and enhances the uniformity of crop growth and yield. Flood irrigated fields would be equipped with alfalfa risers to improve application efficiency and facilitate equipment operation. Irrigation efficiency for leveled, flood-irrigated fields utilizing alfalfa risers is estimated to be 75 percent (Westland Resources 2003b).

An existing center-pivot sprinkler serving approximately 37 acres in Field 31 would be retained.

2.1.3 Flood Protection

A substantial portion of the farm rehabilitation project involves flood protection. An analysis of the hydraulic capacity of the WBSCR and existing on-farm drainage channels indicated that most reaches had less than a 2-year flow capacity, and local inundation of fields becomes problematic for farm operations when flows exceed a 2-year event.

Implementation of the proposed flood control measures would protect future farm improvements, protect private residences within the farm, and minimize damage to crops. Refinements to the flood protection design reflect close coordination among the District, San Xavier Cooperative Farm Board, Farm Manager, Pima County Flood Control District, ADOT, and Reclamation.

The proposed flood control measures include: (a) a new training dike and floodway to route flows from the southern portion of the farm to the SCR backwater basin north of San Xavier Road, (b) increased capacities of existing on-farm flood channels that receive flows from several prominent washes, (c) a new panhandle flood channel, (d) increased capacity of the off-reservation Los Reales West Floodway, (e) connection of the Los Reales South ditch to the floodway system, and (f) extension of an ADOT dike. Existing and proposed conditions are shown in Figures 5 to 9.

WBSCR Dike and Floodway. Flooding from the WBSCR would be controlled with a riprap-armored, 7,300-foot-long earthen dike placed along the east side of the channel between Campus Drive and San Xavier Road (Figure 7). A dike rather than an excavated floodway was selected for this location in order to preserve the original channel of the WBSCR and mesquite vegetation that has developed along its margins. At San Xavier Road, the dike would transition into a 3,400-foot-long excavated floodway which terminates at the SCR backwater basin. The floodway would be designed to accommodate 100-year frequency flood flows (4,800 cfs). Approximately 1,100 feet of the excavation would involve enlarging portions of an existing unlined ditch that receives flood flows from the WBSCR. Concrete box culverts designed to pass 100-year frequency flows would replace existing corrugated metal culverts under San Xavier Road. The existing culverts are undersized and easily become clogged with debris and silt, causing localized flooding of San Xavier Road between I-19 and the San Xavier Mission. Installation of the box culverts would require raising San Xavier Road approximately 2 feet at the crossing and rebuilding approximately 500 feet of road surface. The footprint of the dike and floodway is approximately 19.2 acres.

Modification of SCR Backwater Basin. Flows from the proposed WBSCR floodway would be discharged into the SCR backwater basin located north of San Xavier Road. A riprap drop structure would be installed at the terminus of the WBSCR floodway within the southern portion of the basin to prevent scour. In order to accommodate 100-year frequency flows from the WBSCR, the crest of an existing riprap-armored spillway at the north end of the basin would be lengthened by partly excavating and armoring a 240-foot section of training dike that separates the basin from the main channel of the SCR.

The existing stabilized embankment on the west side of the basin will be capped with 3 feet of soil. Previous attempts to revegetate the embankment have failed because of the high clay content of the exposed subsoil and steepness of the slope. The soil cap will facilitate establishment of vegetative cover and erosion control.

The ground surface within the northern portion of the backwater basin will be raised 4 feet to address public safety concerns expressed by the San Xavier District regarding the depth of water that temporarily ponds after the spillway has operated. The fill is also expected to improve soil conditions for natural revegetation within the basin.

Construction within the backwater basin would affect approximately 7.3 acres.

Rancho de Martinez. A complex of erosional features forming two small washes on the Rancho de Martinez tract immediately north of San Xavier Road and west of the SCR would be filled to protect a significant archaeological (Hohokam) site against future erosion. Erosion control on this tract would affect approximately 2.4 acres.

WBSCR Campus Drive Road Crossing. The existing low-flow crossing would be paved with concrete. Storm flows at this crossing impede farm traffic.

Modification of Mission and Cemetery Wash Ditches. On-farm unlined ditches receiving flows from Mission and Cemetery Washes currently discharge to the off-reservation Los Reales West Floodway approximately ½-mile north of the San Xavier Mission. The Mission and Cemetery Wash Ditches would be widened to accommodate 100-year frequency flows (5,179 and 1,656 cfs, respectively) (Figure 8). The north end of the Cemetery Wash Ditch would be reengineered with a bifurcation to convey storm flows to the Los Reales West and Los Reales South floodways. Redesign of the Mission and Cemetery Wash Floodways would affect 22.3 acres.

Modification of Los Reales Wash Ditch. The on-farm, unlined Los Reales Wash ditch would be widened to accommodate 100-year frequency flows (1,445 cfs) (Figure 8). This ditch conveys storm flows from Los Reales Wash through the farm and discharges to the off-reservation Los Reales West Floodway. Modification of the Los Reales Wash ditch would affect approximately 3.3 acres.

New Panhandle Floodway. A new 3,200-foot-long floodway would be excavated across the upper panhandle (between Fields 2B and 3A) to intercept flows that enter the farm from several small, unnamed arroyos (Figure 8). These flows currently are dispersed as sheet flow that inundates fields in the upper panhandle. Upon completion, this new floodway would convey storm flows to the Los Reales West Floodway. Construction of the Panhandle Floodway would affect approximately 8.2 acres.

Modification of Los Reales West Floodway. A 2,800-foot section of the Los Reales West Floodway would be widened and lined to accommodate 100-year frequency flows received from the new panhandle floodway (1,027 cfs), Los Reales Wash Ditch (1,445 cfs), and a portion of the combined flows from Mission/Cemetery Wash Ditch (1,600 cfs). The Los Reales West Floodway was built by Pima County and is located outside the District boundary. The Los Reales West Floodway empties into the SCR approximately 2 miles north of the farm.

Modification of Los Reales South Ditch. The Los Reales South drainage ditch is currently isolated from other flood channels and receives storm runoff only from agricultural fields. This ditch would be connected to the north end of the Cemetery Wash Floodway and widened to receive a portion of the combined 100-year frequency flows from Mission and Cemetery Washes (5,235 cfs) (Figure 8). The Los Reales South ditch currently empties into the SCR at the northeastern corner of the farm. Upon completion, the rebuilt Los Reales South Floodway would convey floodwaters to the same discharge point within the SCR. The Los Reales South channel was built by Pima County and is located outside the District boundary.

Modification of ADOT Dike. An existing 500-foot-long ADOT dike on the west side of Interstate 19 would be extended an additional 500 feet to divert a portion of the flow that enters the farm from the south (Figure 9). The ADOT dike was originally intended to divert floodwaters under Interstate 19 to the SCR. In recent years, migration of the wash around the west end of the dike has negated its effectiveness. Extension of the dike would affect approximately 0.6 acre of District land outside the farm.

2.1.4 Farm Roads

The main road system is the primary transportation corridor from the southern to the northern boundary of the farm. Main roads carry a greater volume and weight of farm traffic. These roads would be widened to 24 feet, compacted, and capped with aggregate base course to improve all-weather use by farm equipment. Approximately 2.1 miles of primary farm roads would be improved.

Field roads allow access to individual fields. These roads would be widened to 16 feet, compacted, and capped with aggregate base course. Approximately 7.6 miles of secondary farm roads would be improved.

2.1.5 Farm Administration Building

A new farm administration building would be constructed at the southwestern corner of the existing headquarters and maintenance complex adjacent to San Xavier Road. Approximately 22 full- and part-time staff would be employed once the farm is fully operational. The new administration building would provide office space for business operations and accommodate projected increases in staff.

2.1.6 Crop Mix and Organic Production

The Planning Group consulted with agronomists, community members, and elders to determine the types of crops that could be grown for commercial and traditional purposes. Potential crop mixes were evaluated for commodity value within the District and sale to local markets. Crops specified for large-scale commercial production include alfalfa, tepary beans, melons, squash, corn, pumpkins, pasture mix, and oat hay. Approximately 908 acres would be dedicated to these crops.

Mesquite and fruit-/nut-producing trees (e.g., black walnut and pistachio) would be grown on approximately 41 acres. Plants with high cultural value such as devil's claw, bear grass, gourds, pomegranates, and wildflowers also could be grown on appropriate sites within designated tree plantations.

Strict adherence to organic agricultural production methods would be utilized in the existing farm. Organic management would incorporate sufficient biological diversity within the crop mix to disrupt habitat for pest organisms and allow for replenishment of soil fertility through the application of conservation tillage, composting, and biologically based soil amendments. Weeds would be controlled through crop rotation, mechanical tillage, cover crops, mulches, and other management methods. No synthetic pesticides or fertilizers would be utilized.

2.1.7 Water Budget

A water budget analysis was performed to evaluate projected peak season and annual demand. The water budget was based on likely crop mix, available water supply, expected irrigation efficiency, and pre-irrigation leaching requirement (adapted from Westland Resources 2003b). Assuming the selected crop mix reflects a typical cropping pattern for the farm, approximately 5,102 af of water would be needed for irrigation in the first year of operation (Table 1). Based on climate and likely crop mix, June is the highest water use month for the farm. Approximately 15 cfs, or 6,758 gallons per minute (gpm), would be required 75 percent of the time (18 hours per day) to meet peak season demand on 949 irrigated acres. This equates to a consumptive rate of 672 af during the peak month of June.

CAP Water. Irrigation requirements of future farm operations in the District will rely extensively on CAP water. The CAP Link Pipeline can deliver up to 23 cfs (approximately 1,380 af per month and 16,600 af per year) of water to the on-farm distribution system.

Groundwater. A comparison of the farm's projected annual and peak water demands with production data from the San Xavier well field suggest that the well field supply is inadequate to meet irrigation demand in the event of a peak season CAP outage.[9] The total pumping capacity of the four operating wells (SX-1A, SX-8, SX-13, and SX-16) in the San Xavier well field is 2,535 gpm (approximately 355 af per month). This production would ensure 100 percent reliability during the period October through March but would fall short of anticipated irrigation demand during April through September.

Five other wells on the west side of the SCR are equipped with pumps (SX-2, SX-3, SX-4, SX-7, and SX-10A) but no longer connect to a power source or the irrigation conveyance system. Three of these wells were built in 1934, and the other two were installed in 1953 and 1976. The last recorded total production capacity of these wells is 1,485 gpm which probably overestimates the present capacity because most have not been pumped in more than 20 years, and groundwater levels have since declined. It is also probable that the wells drilled during the 1930s are in poor condition due to corroded or collapsed casings. When last operated, each of these wells had capacities of less than 400 gpm.[10]

Due to insufficient well field capacity, new wells would need to be drilled to ensure future reliability of the water supply. The number of new wells required cannot be accurately ascertained until an assessment of the condition of existing wells is made. This assessment would occur at a later date and is not part of the proposed action. In the future, conservation and the application of CAP water for irrigation and recharge is expected to reverse groundwater declines in the farm area. Rising groundwater levels will increase production and likely reduce the number of wells needed for long-term reliability.

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[9] Deliveries may be interrupted by the need to repair and maintain the CAP canal or by drought shortages on the Colorado River.

[10] Well records indicate historic, individual well pumping capacities were higher than 1000 gpm when groundwater levels were shallow.

Table 1. Annual Water Demand for Flood and Sprinkler-Irrigated Fields (adapted from Westland Resources 2003b).

Crop	Acres	Consumptive Use (af/acre)	Irrigation Efficiency[1]	Pre-Irrigation Leaching Requirement[2] (ft/acre)	Water Demand (af)
Flood Irrigation					
Alfalfa Establishment	114	0.73	0.75	0.5	167.96
Alfalfa Hay	417	5.67	0.75	0.8	3486.12
Traditional Squash	24	1.5	0.75	0.5	60.00
Tepary Beans	115	1.2	0.75	0.5	241.50
Pumpkins	27	2.5	0.75	0.5	103.50
Sweet Corn	49	2.5	0.75	0.5	187.83
Oat Hay	125	2.25	0.75	0.5	437.50
Trees	41	2.0	0.75	0.5	129.83
Sprinkler Irrigation					
Alfalfa Hay	37	5.67	0.8	0.7	288.14
Total	**949**				**5102.38**

1. Percentage of water delivered to the field that is used beneficially.
2. Amount of water required to flush the soils of impurities between growing seasons.

2.2 No Action

Under this alternative, no Federal funding would be provided to support rehabilitation of the farm as described in this EA. Economic constraints associated with the existing farm operation would prevent substantial improvements to the water distribution system. Inefficiencies in the water conveyance infrastructure would limit irrigated acreage to approximately 300 acres. Any future land leveling would likely be restricted to fields capable of receiving water through the existing distribution system. This alternative would also preclude substantial improvements in flood protection and farm roads. Periodic flooding of fields would continue to curb agricultural productivity and farm income.

2.3 Alternatives Considered but Not Analyzed in Detail

The San Xavier Cooperative Association originally considered a high-pressure, piped-water conveyance system to operate up to 13 additional center-pivot sprinkler systems. These new systems would supplement the center-pivot sprinkler that currently operates in Field 31. This alternative was rejected by the Cooperative Association because of practical considerations associated with the high electric cost to operate center-pivot motors. Although additional water conservation would be realized through utilization of sprinkler systems, the higher operating, maintenance, and repair costs limited the economic viability of utilizing this irrigation method.

2.4 Comparison of Alternatives

Table 2 summarizes the two alternatives and environmental consequences of each as a basis for comparison.

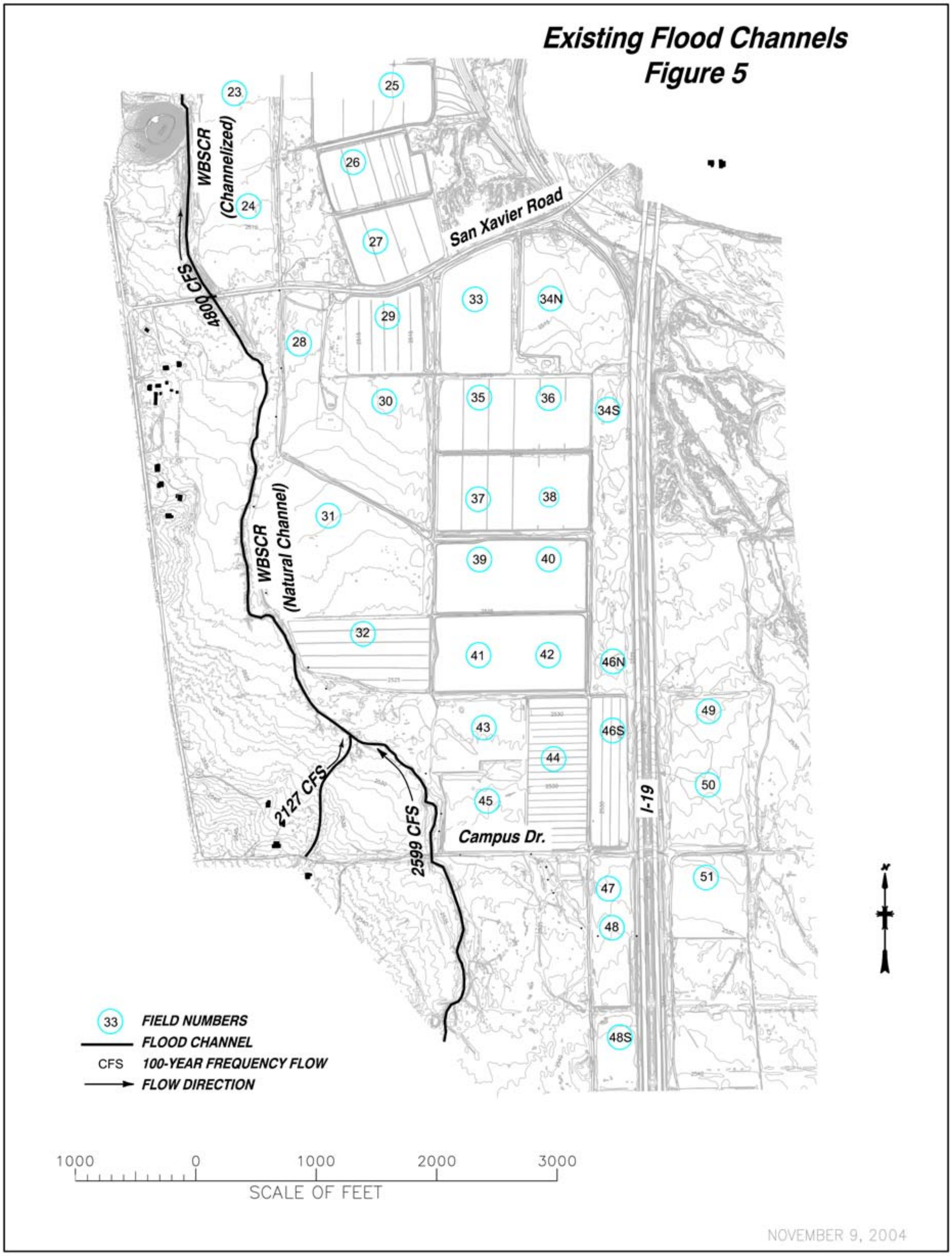
Table 2. Summary Effects of Alternatives for Selected Resources.

Resource	Proposed Action	No Action
Land Use	Complete reestablishment of irrigation agriculture on 949 acres.	No change to existing land use patterns within the farm. Maximum cultivation of 300 acres possible in the future without substantial improvement in the irrigation system. An additional 500 acres of fallow land disked annually to suppress weed growth.
Water Resources	100-year frequency storms flows confined to floodways; reduced risk to property and human safety and welfare. Backwater flooding on 19.3 acres of undeveloped land along WBSCR. Rising groundwater levels from recharge and irrigation; probable increase in total dissolved solids from increases in irrigation.	100-year frequency storm flows inundate entire 1,100-acre farm; higher risk to property and human safety and welfare. Greater reliance on groundwater for farming and resultant decline in groundwater levels.
Soils	Land leveling, pipeline installation, road improvements, flood protection, and cultivation on improved land would affect approximately 1,025 acres of the existing 1,100-acre farm.	Ongoing cultivation, leveling lands currently capable of receiving water, weed control, and other farm operations would affect approximately 750 acres.
Biological Resources	Loss of ~55 acres of mesquite habitat and reduction of storm flows to ~ 9.5 acres mesquite habitat. Up to 41 acres of mesquite, fruit, and nut trees would be planted. Revegetation with mesquite, fruit, and nut trees and retention of existing hedgerows would offset habitat loss.	No loss of mesquite habitat on ~50 acres of abandoned agricultural fields. No loss of ~5 acres of mesquite habitat adjacent to drainages. Storm flows to 9.5 acres of mesquite not impeded.
Cultural Resources	Cultural resources occurring below the active plow zone could be affected by construction of buried water conveyance pipeline and flood protection features. Pre-construction archaeological investigations would provide the basis for developing mitigation strategies.	Ongoing farm operations not likely to affect significant cultural resource material or sites.

Table 2 - Continued

Air Quality	Annual PM_{10} emissions would be reduced to 127 tons from all farm sources.	Annual PM_{10} emissions approximately 183 tons; higher total reflects limited application of irrigation and lack of plant cover on a majority of disturbed fields.
Socioeconomic Resources	Expected to increase employment and income opportunities.	No improvement in employment and income; maintains status quo.
Indian Trust Assets	Enhances the value of District's land and water resources.	No improvement to value of Indian Trust Assets; maintains status quo.
Environmental Justice	Enhances economic growth, development, and self-sufficiency. Economic opportunities consistent with historic cultural and land uses.	No improvement in economic growth, development, and self sufficiency; maintains status quo.

FIGURE 5



Existing Flood Channels
Figure 5
23
25
26
24
27
28
29
30
31
32
33
34N
34S
35
36
37
38
39
40
41
42
43
44
45
46N
46S
47
48
48S
49
50
51
WBSCR
(Channelized)
4800 CFS
WBSCR
(Natural Channel)
2127 CFS
2599 CFS
San Xavier Road
Campus Dr.
I-19
33 FIELD NUMBERS
FLOOD CHANNEL
CFS 100-YEAR FREQUENCY FLOW
FLOW DIRECTION
1000 0 1000 2000 3000
SCALE OF FEET
NOVEMBER 9, 2004

FIGURE 6

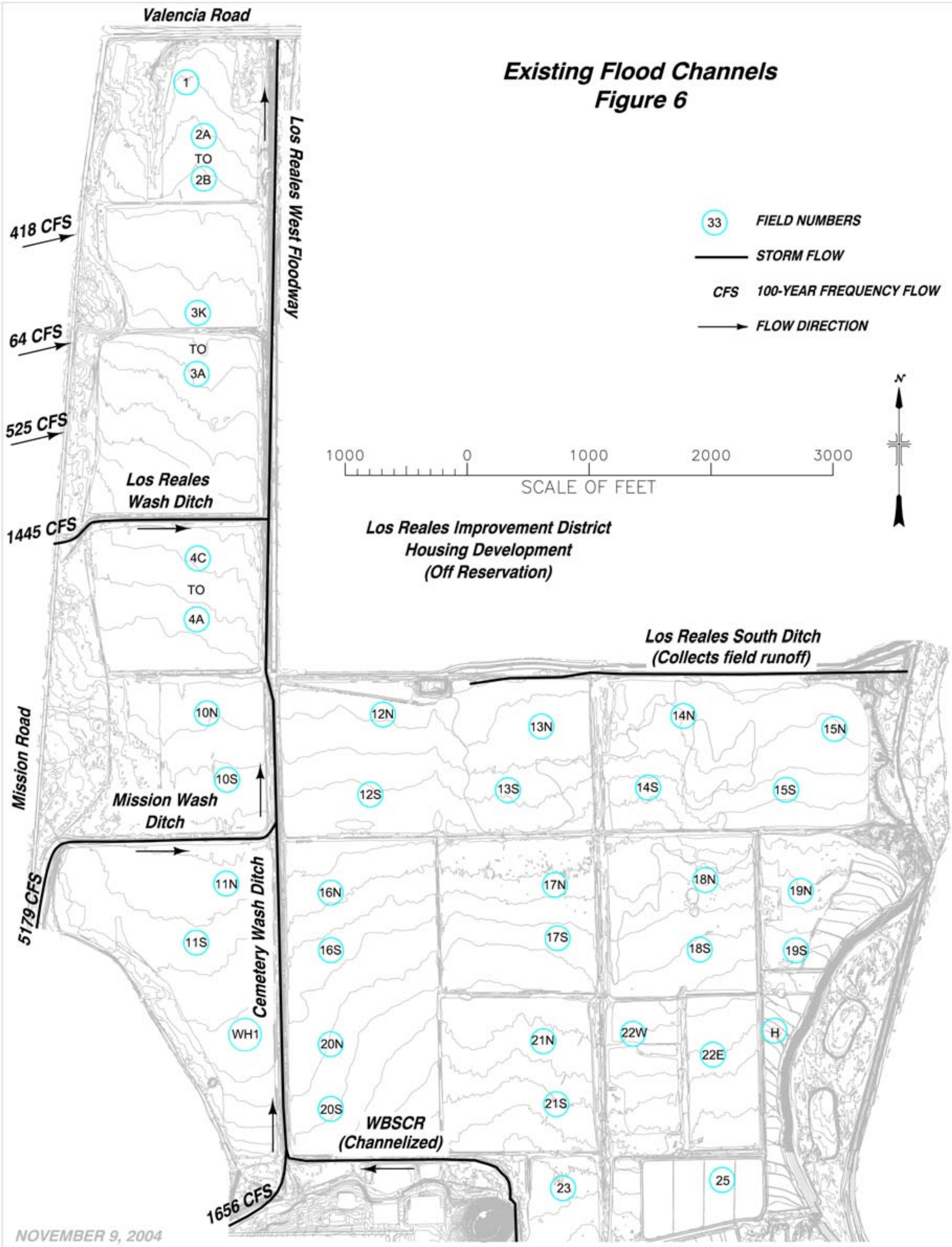

Existing Flood Channels
Figure 6
Valencia Road
Los Reales West Floodway
FIELD NUMBERS
STORM FLOW
CFS 100-YEAR FREQUENCY FLOW
FLOW DIRECTION
418 CFS
64 CFS
525 CFS
1445 CFS
5179 CFS
1656 CFS
Los Reales Wash Ditch
Mission Road
Mission Wash Ditch
Cemetery Wash Ditch
WBSCR (Channelized)
Los Reales Improvement District Housing Development (Off Reservation)
Los Reales South Ditch (Collects field runoff)
1000 0 1000 2000 3000
SCALE OF FEET
N
1
2A TO 2B
3K TO 3A
4C TO 4A
10N
10S
11N
11S
WH1
12N
12S
13N
13S
14N
14S
15N
15S
16N
16S
17N
17S
18N
18S
19N
19S
20N
20S
21N
21S
22W
22E
H
23
25
33
NOVEMBER 9, 2004

FIGURE 7

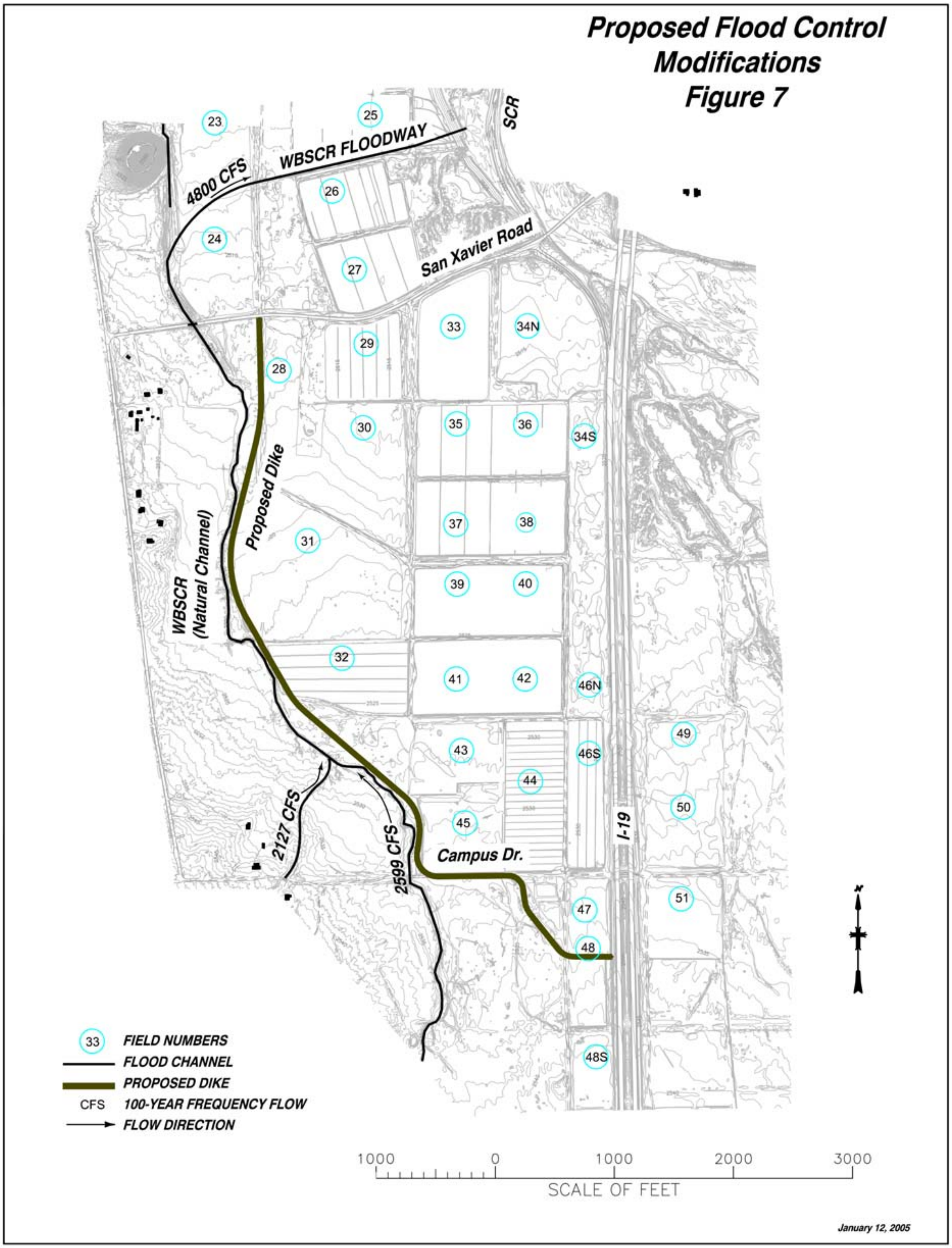
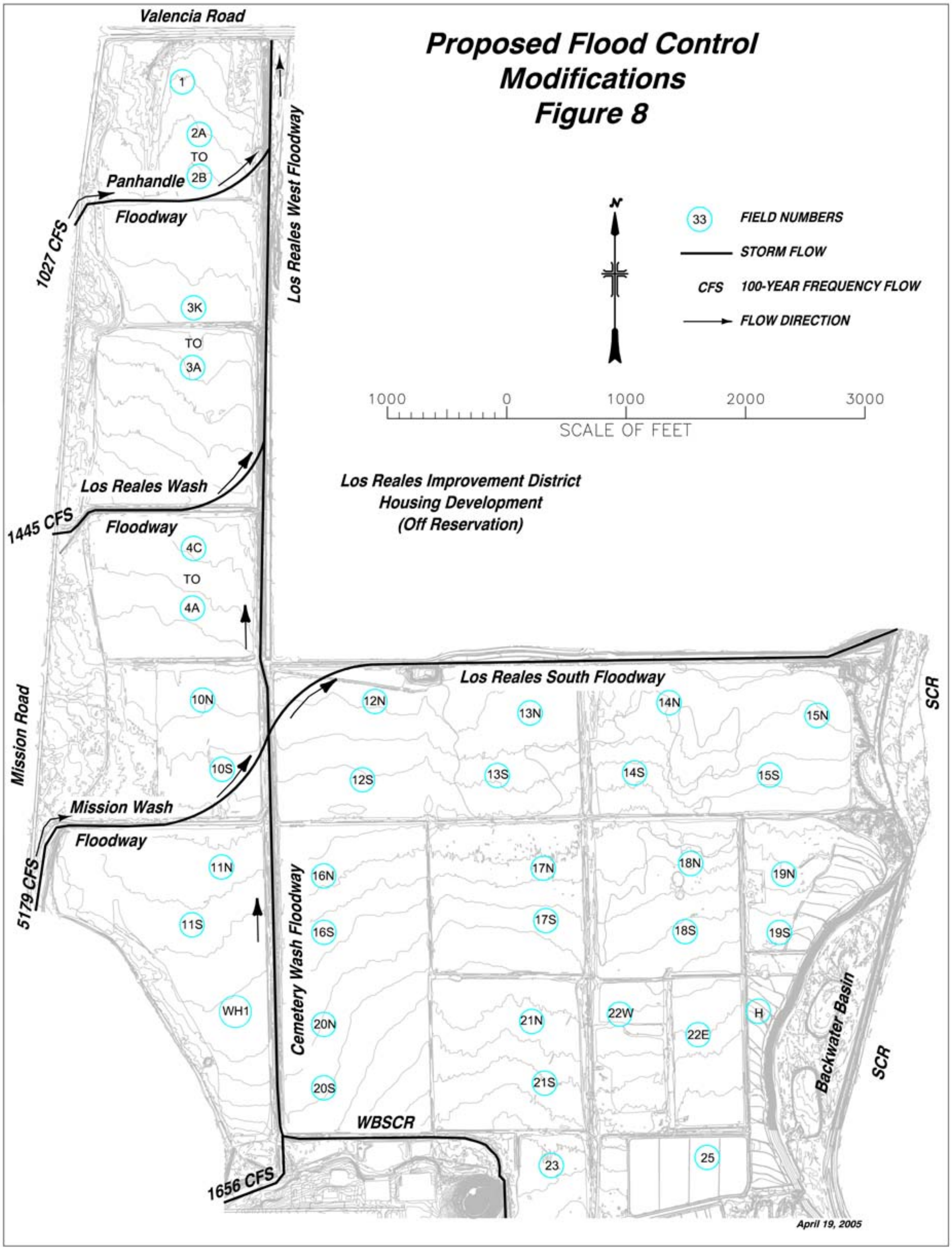
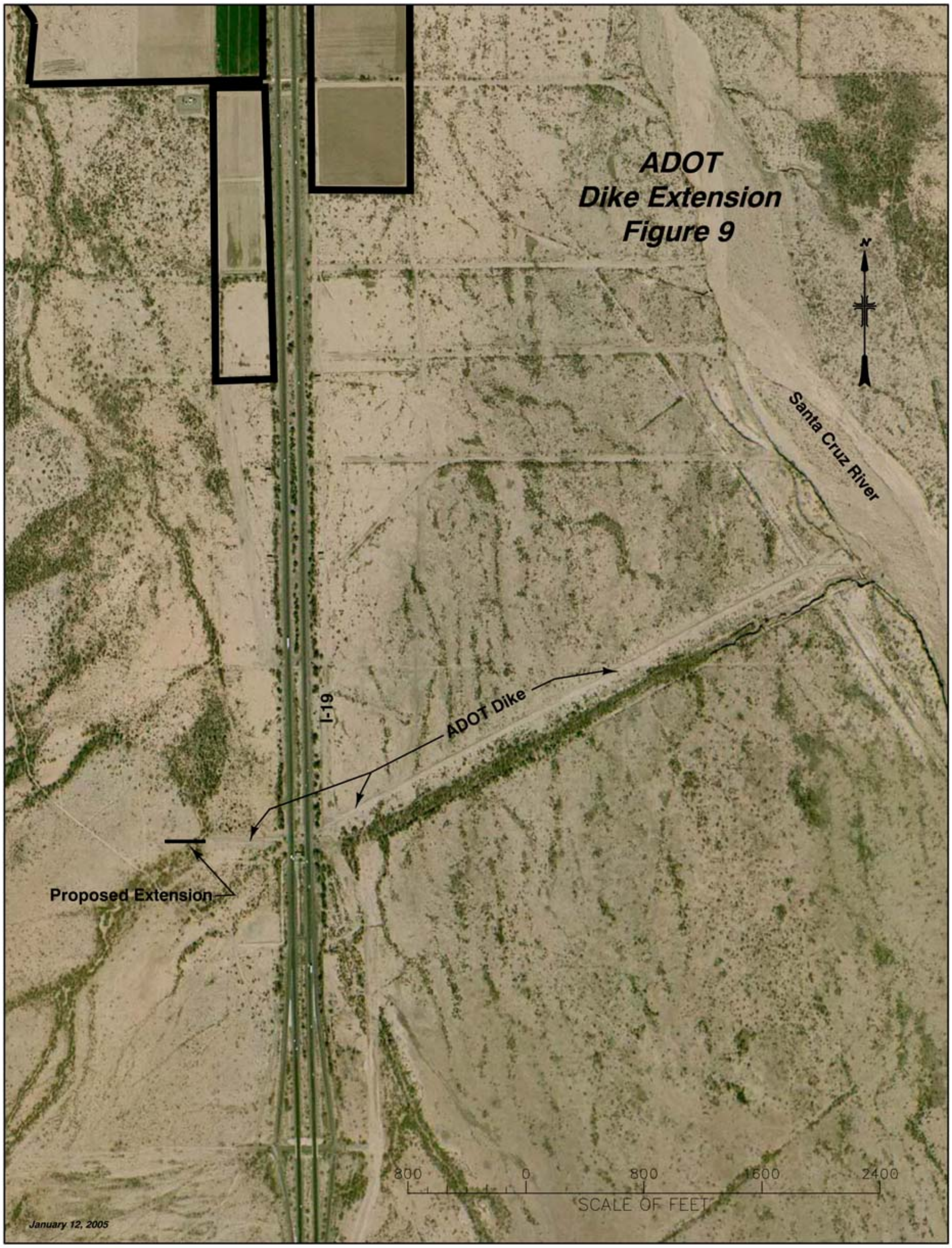

Proposed Flood Control Modifications Figure 7
23
25
SCR
4800 CFS
WBSCR FLOODWAY
26
24
San Xavier Road
27
33
34N
29
28
30
35
36
34S
Proposed Dike
WBSCR (Natural Channel)
31
37
38
39
40
32
41
42
46N
49
43
46S
2127 CFS
44
50
2599 CFS
45
I-19
Campus Dr.
51
47
48
48S
33 FIELD NUMBERS
FLOOD CHANNEL
PROPOSED DIKE
CFS 100-YEAR FREQUENCY FLOW
FLOW DIRECTION
1000 0 1000 2000 3000
SCALE OF FEET
January 12, 2005

FIGURE 8



Proposed Flood Control Modifications Figure 8
Valencia Road
Panhandle
Floodway
1027 CFS
Los Reales West Floodway
Los Reales Wash
Floodway
1445 CFS
Mission Road
Mission Wash
Floodway
5179 CFS
Los Reales South Floodway
Cemetery Wash Floodway
WBSCR
1656 CFS
Backwater Basin
SCR
N
FIELD NUMBERS
STORM FLOW
CFS 100-YEAR FREQUENCY FLOW
FLOW DIRECTION
1000 0 1000 2000 3000
SCALE OF FEET
Los Reales Improvement District
Housing Development
(Off Reservation)
1
2A
TO
2B
3K
TO
3A
4C
TO
4A
10N
10S
11N
11S
WH1
12N
12S
13N
13S
14N
14S
15N
15S
16N
16S
17N
17S
18N
18S
19N
19S
20N
20S
21N
21S
22W
22E
H
23
25
33
April 19, 2005

FIGURE 9


ADOT
Dike Extension
Figure 9
Santa Cruz River
I-19
ADOT Dike
Proposed Extension
800
0
800
1600
2400
SCALE OF FEET
January 12, 2005

CHAPTER 3 - AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter presents the existing conditions in the project area and the environmental consequences that can be expected from implementing the proposed action and no action. Mitigation measures that have been integrated into the project are described at the end of each section.

3.1 Land Use

3.1.1 Affected Environment

The Tohono O'odham people have a long-standing tradition as agriculturists. Historic records of farming in the San Xavier area date to at least the early 1700s (Department of Interior [DOI] 1995). When the allotment system was assigned to District lands in 1890, approximately 400 of 2,289 arable allotted acres were irrigated. Originally, the allotments were irrigated with water from the SCR, but non-Indian diversions and groundwater pumping depleted the perennial surface water supply. During the early 1900s, river flows became sporadic and unreliable, forcing greater dependence on groundwater to sustain agriculture.

The San Xavier farm rehabilitation project can be viewed as a renewed commitment to solve agricultural problems that have burdened area farmers. Efforts to increase crop yields in the face of declining surface water and groundwater supplies and to limit damage from floods have occupied San Xavier farmers since the early 1900s.

Between 1889 and 1929, irrigated acreage in Pima County increased from 3,085 to 18,780 (Kupel 1984). Water demand increased proportionately. In 1912, Congress appropriated funds for the Office of Indian Affairs (predecessor to the BIA) to study conditions on the District. A report published in 1913 proposed several solutions to the problems of erosion and decreasing water supply. In June 1915, four flood control structures (three protective dikes and a floodwater diversion canal) were constructed. Three wells and two pumping plants were also built that year. The success of the dikes, wells, and pumping plants led to an exceptionally productive year in 1916. The 1,320 cultivated acres produced the largest crop grown in the District up to that time (Franzoy Corey 1988). Irrigated lands steadily increased, finally peaking in 1926 with 1,781 acres under production.

The success of the 1915 improvements was short-lived. By the late 1920s, overdraft by development on and off the reservation caused the water table to fall, resulting in insufficient supply to meet the demand of the San Xavier farm. Limited Federal assistance for water development was offered in the 1930s under New Deal programs such as the Public Works Administration and Emergency Conservation Work Program. Despite Federal efforts, groundwater levels at San Xavier dropped almost 30 feet from 1930 to 1940 (Franzoy Corey 1988).

The San Xavier Water Users Association formed in the late 1930s to address well pump maintenance and farming problems. In the 1939, the water users association, working with an agricultural extension agent, developed a rehabilitation program of cleaning and extending an infiltration gallery, drilling wells, constructing irrigation ditches, and building flood and erosion control structures. During the 1940s, some fields were leveled to improve drainage and flood irrigation.

Between 1940 and 1960, seven new wells were drilled to increase the available water supply. Numerous ditches were lined to reduce water distribution losses and maintenance costs. These improvements allowed the farm to gradually expand once again. By the late 1950s, however, there was an increasing trend to lease agricultural land to non-Indian farmers. In 1960, 88 acres were cultivated by members of the District, and 876 acres of allotted land were leased to non-Indian agricultural enterprises (BARA 1984). The total land under cultivation increased to approximately 1,954 acres by 1969, but only 14 percent of this acreage was farmed by allottees (BARA 1984). Leasing allotted land for non-Indian agriculture was discontinued after 1969. Declining groundwater levels and deteriorating irrigation conveyance infrastructure substantially reduced agricultural production during the ensuing decades, restricting agricultural activity to fewer than 200 acres in the 1990s.

The San Xavier Cooperative Association was established in 1971 to revive Indian agriculture in the District and operate the cooperative farm.[11] Members of the District who own allotted farm land and who agree to lease their interest in the land to the Cooperative Association are eligible for membership. In exchange for leasing their land, members are entitled to share in the net profits of the farm. Members also receive preference for jobs within the cooperative. The allottees who formed the cooperative shared interests in approximately 1,100 acres comprised of 55 allotments and minor amounts of Tribal land. This acreage constitutes the present-day cooperative farm, which is managed by a Farm Manager hired by the association's Board of Directors. Currently, the farm is operating under a 25-year lease agreement with allottees which expires in December 2014.

3.1.2 Environmental Consequences

No Action

Existing land use patterns on the farm would continue into the foreseeable future. The deteriorated condition of existing irrigation systems would generally restrict agricultural production to the fields south of San Xavier Road and along the east side of the farm headquarter complex (approximately 300 acres). Residential and commercial development outside the District is expected to continue.

Proposed Action

Farm rehabilitation would substantially improve flood protection and the efficiency of water conveyance and field irrigation systems. The total acreage under active cultivation (including both cropland and tree plantations) would increase almost 380 percent to 949 acres. Fallow and

[11] The San Xavier Cooperative Association is a nonprofit corporation chartered under the Tohono O'odham Nation. The organization is directed by a seven-member board, each member serving a 2-year term.

abandoned fields (except Fields 1 and 34) within the existing farm would be returned to active production.

Construction of flood protection dikes and floodways would affect approximately 54 acres within the farm. The proposed floodway to be located between Fields 2B and 3A would offer improved flood protection for the upper panhandle and greater versatility of future land use options (commercial vs. agricultural) selected for Field 1. Floodwaters that previously entered the upper panhandle as sheet flow would be captured and quickly routed off the farm, improving drainage and lessening the overall flood threat.

Flood protection along the WBSCR south of San Xavier Road would move the 100-year frequency flow boundary further west of the channel, affecting approximately 19.3 acres of allotted land that are currently above the inundation boundary. Although no existing land improvements would be affected, the new flood boundary would potentially limit future land use options on these properties due to increased flood threat.

Construction of the main irrigation pipeline and laterals would affect a 50-foot wide and 5.5-mile long corridor, encompassing 33.3 acres within the farm.

3.1.3 Mitigation

- Flow easements and rights-of-way (ROW) would be acquired by the United States for project effects on allotted land outside the farm lease area.

3.2 Water Resources

3.2.1 Affected Environment

Surface Water. The principal natural surface drainage feature is the SCR which borders the central portion of the farm to the east. Prior to 1900, the SCR was perennial from its headwaters in the San Rafael Valley to the town of Tubac (Tellman et al. 1997). Surface flow reappeared about 2 miles south of Martinez Hill, producing a perennial reach of river and marshy cienega adjacent to and south of the farm area. This surface flow provided a reliable source of water for irrigation and supported the agricultural village and mission of San Xavier del Bac (Lumholtz 1912).[12]

Initial changes to the SCR occurred when local non-Indian residents dammed existing cienegas (Silver Lake in 1857 and Warner's Lake in 1883) in an attempt to provide additional water for crop irrigation. Headcutting (progressive lowering of the channel bed, proceeding in an upstream direction) was observed as early as 1871 (Betancourt and Turner 1988). In the late 1880s, headcutting began as a result of poorly engineered waterworks and high flows in the SCR (Parker 1993).

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[12] The Tohono O'odham village of San Xavier del Bac was formerly called Wa:k, which translates as, "where water rises," "standing water," or "irrigation."

Groundwater use by Tucson settlers in the late 19th century, in conjunction with regional arroyo entrenchment during that time, quickly depleted the perennial surface water supply (Lacher 1996). The combination of headcut initiation, dams, and excavated ditches in the riverbed precipitated a devastating and irreversible incision of the Santa Cruz Channel (Lacher 1996). As a result of entrenchment, the SCR evolved from an ill-defined arroyo with a broad active floodplain and perennial surface flow in some areas to a deeply incised, ephemeral channel (Lacher 1996). Even then, the river flowed sporadically until it finally disappeared due to groundwater pumping in the late 1930s (Sonoran Desert Conservation Plan [SDCP] 1999). Today, most of the SCR and its tributaries are ephemeral and flow only in response to storm runoff.

Surface drainage in the farm area is predominantly south to north along the SCR and the WBSCR. Near Martinez Hill, the SCR channel is wide and capacity high, and floodwaters do not generally threaten the farm. The river threat is primarily from bank erosion and lateral migration. In October 1983, an extreme flood flow of approximately 52,700 cfs promoted lateral migration of the channel that removed about 15 acres from the central portion of the farm. Subsequent armoring with riprap has stabilized the west bank of the SCR opposite Martinez Hill.

A significant source of flood flow is the hilly land south and west of the farm. Ephemeral washes draining the piedmont of the Sierrita Mountains and Black Mountain carry substantial amounts of runoff to the farm. South of San Xavier Road, several major washes drain into the slightly entrenched, meandering channel of the WBSCR. North of the San Xavier Mission, flows from the WBSCR commingle with runoff from other prominent washes (primarily Mission and Cemetery Washes) before emptying into the Los Reales West Floodway. Flows from Los Reales Wash are conveyed to the Los Reales West Floodway through a separate channel that crosses the panhandle. The Los Reales West Floodway discharges to the SCR approximately 2 miles north of the farm.

The existing dikes and ditches are insufficient to protect fields and residences within the farm against all but relatively minor floods. Hydraulic capacity analyses indicate the WBSCR and most reaches of the various on-farm flood channels have less than a 2-year flow capacity (Westland Resources 2003c). Local inundation of fields becomes problematic for farm operations when flows in the WBSCR exceed a 2-year frequency. Significant wide-spread flooding occurs at flood frequencies between 10-year and 25-year events, and full inundation occurs with 100-year flows. Figure 10 illustrates the 2-, 10-, 25-, 50-, and 100-year frequency flood boundaries along the WBSCR in the southern portions of the farm (Reclamation 2004a).

Groundwater. The District lies within the 3,866-square-mile Tucson AMA. Designated under the Arizona Groundwater Management Code, the statutory goal of the AMA is to reduce overdraft and attain safe yield of groundwater supplies by 2025. Safe yield is a balance between groundwater withdrawal and groundwater recharge which, from a practicable standpoint, encourages reduced use of groundwater in favor of renewable supplies such as CAP water. The amount of groundwater in storage in the Tucson AMA is estimated at 12.7 million af (ADWR 1999).

The Tucson AMA consists of two hydrogeologic subbasins: the northern part of the Upper Santa Cruz Valley Subbasin and the Avra Valley Subbasin. The Upper Santa Cruz Valley Subbasin is the primary source of groundwater in the District and is designated a Sole Source Aquifer by the Environmental Protection Agency (EPA) under Section 1424(e) of the Safe Drinking Water Act.[13] Natural recharge in the farm area is dominated primarily by percolation through the bed of the SCR and runoff from higher terrain to the west and south. Average annual recharge through the Santa Cruz Riverbed in this area is estimated to be 200 to 400 af (Franzoy Corey 1988). The regional groundwater flow pattern is from the margins of the basin toward the SCR and beneath the SCR from south to the north-northwest through basin-fill alluvial deposits. Local deviation from the general flow pattern occurs in the southeastern portion of the District where groundwater flows toward and into the ASARCO well field cone of depression.

Sustained groundwater mining in the Upper Santa Cruz Valley Subbasin has had negative consequences for the District. Since 1940, maximum groundwater level declines in the Tucson AMA have ranged from 200 feet in the Tucson area to 150 feet in the vicinity of the ASARCO mine well field near Sahuarita (Arizona Department of Water Resources [ADWR] 1999), reflecting severe overdraft of the regional aquifer from agricultural, mining, and urban pumpage (Betancourt and Turner 1988). Depth to the regional aquifer at the farm ranges between 125 feet and 190 feet.

Provisions of SAWRSA restrict annual groundwater pumping in the District to 10,000 af. All nonexempt groundwater production is credited against the 10,000 af allowance.[14] This includes water pumped by the ASARCO mine, Tohono O'odham Utility Authority (TOUA), and farm. Pumping records from 1990 to 1997 show an average annual withdrawal of 3,156 af for all uses except agriculture (SWCA 2001). In the late 1990s, agricultural pumpage at the farm was approximately 1,100 af per year (personal communication, Bill Worthey, Farm Manager, November 5, 2003). Groundwater depletion coupled with the poor casing condition of many older wells has significantly reduced production capacity of the wells supplying the farm.

Importation of CAP water substantially reduces the farm's reliance on groundwater supplies. However, adequate groundwater production capability must be retained to ensure that a replacement water supply is available during CAP system outages or shortages. Of the 12 wells developed for the farm, 3 are active, 1 is in need of repair, and the remaining 8 are presently non-operable. The total production capacity of active and potentially operable wells is 355 af per month. A production capability of at least 672 af per month would be needed for adequate reliability during the peak irrigation season.

Groundwater quality in most of the District is good. Potable groundwater supplied by the TOUA meets all 86 primary drinking water standards set by EPA under the Safe Drinking Water Act. TOUA operates four potable water wells, two of which are located on the farm. These wells provide drinking water for residential users, schools, District offices, and the Indian Health Services clinic. Local groundwater is also considered to be of sufficient quality for irrigation purposes with moderate levels of total dissolved solids (TDS). Recent water quality data for water sampled at the TOUA wells is included in Appendix A.

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[13] The Sole Source Aquifer program was created to protect drinking water supplies in areas with few or no alternative sources to the groundwater resources. EPA review is required for any federally funded proposal that could affect a designated sole-source aquifer.

[14] Does not apply to water used for domestic and livestock purposes that is pumped from wells that draw less than 35 gpm.

Though the quality of groundwater in the District is generally high, it has been degraded in some areas as a result of industrial and domestic activities. Trichloroethylene and nitrate contamination occur at different locations along the northeastern and southeastern boundary of the District. Groundwater contamination associated with the ASARCO mine occurs as a plume of high TDS and sulfate within the southeastern portion of the District. These contamination plumes do not affect the farm.

CAP Water. The primary source of water for irrigation is imported through the CAP. CAP water is a mixture of water from the Colorado River, Bill Williams River, and Agua Fria River; however, the Colorado River is the principal source. Water supplied through the CAP is of adequate quality for irrigation and meets all primary nonmicrobial drinking water standards under the Safe Drinking Water Act (Appendix B).

Two standards are widely used to evaluate water quality for irrigation: salinity and sodium adsorption ration (SAR). Salinity refers to presence of soluble salts in water such as calcium, magnesium, sodium, sulfate, chloride, and bicarbonate and is commonly expressed as TDS. CAP water has an elevated level of TDS (average of approximately 650 mg/L) compared with local groundwater pumped by TOUA (510 to 550 mg/L; Norma Natividad, TOUA Water Department, personal communication, April 12, 2005).[15] Most crops can tolerate TDS levels in irrigation water around 1,000 mg/L without experiencing significant yield reduction, but increased management is required to ensure that any salt buildup in soils is leached below the root zone (Westland Resource 2002).

Irrigation water containing large amounts of sodium is of special concern due to sodium's effects on the soil. Continued use of water having a high SAR leads to a breakdown in the physical structure of soil. Water with a SAR less than 6 is considered to pose a low sodium hazard (MSU 2001). CAP water measured at the farm has a SAR of approximately 2.2.

Salinity in irrigation water is also measured as electrical conductivity (ECw), expressed in millimhos (mmhos) per centimeter (mmhos/cm). Values of less than 1.0 are associated with low salinity waters that do not limit crop choice or yield potential. CAP water has an ECw of approximately 0.9 mmhos/cm (Appendix C). Salt tolerance levels for various crops are listed in Table 3.

Table 3. Crop Salt Tolerance (Westland Resources 2002).

Crop	**ECw for 10% yield Reduction (mmhos/cm)**	**TDS for 10% yield Reduction (mg/L)**
Alfalfa	2.2	1,470
Barley	6.7	4,470
Beans	1.0	670
Corn	1.7	1,130
Cucumbers	2.2	1,470
Wheat	4.9	3,270

[15] The Safe Drinking Act sets a secondary standard of 500 mg/L. Secondary standards are nonenforceable guidelines that address aesthetic effects such as taste, odor, or color. A water supply with more than 1,000 mg/L of TDS is generally considered to be undesirable for human consumption. By comparison, ocean water carries an average TDS concentration of 35,000 mg/L.

An emerging issue of national significance is the presence of perchlorate in irrigation and drinking water supplies. Subsequent to the development of improved detection technology in 1996, perchlorate has been identified in surface water and groundwater in 34 states, including all the states bordering the lower Colorado River (i.e., Arizona, California, and Nevada). Since 1996, there have been numerous efforts to evaluate the toxicity of perchlorate. The primary concern is disruption of thyroid function and development in children and fetuses from environmental exposure to high levels of perchlorate (EPA 2002).[16]

Most perchlorate salts are a common ingredient in the manufacture of propellants and explosives; therefore, much of the perchlorate-contaminated waterways and groundwater in the U.S. can be traced to military installations and defense contractor facilities. Because perchlorate-tainted waters are used for irrigation, there also is concern that perchlorate could make its way into the human food chain through food plants. A preliminary survey conducted in 2002 to 2003 of food crops irrigated with Colorado River water generally found perchlorate concentrations near or below detection limits for most crops sampled, including most vegetables eaten as root or nuts (UA 2004). The exception was leafy vegetables, such as lettuce, where the foliage is consumed. Recent greenhouse studies have shown a potential for lettuce to accumulate perchlorate. Several other studies also detected perchlorate in milk samples taken from California and Texas.

Levels of perchlorate detected in the lower Colorado River are traced to Las Vegas Wash, a tributary that receives contaminated groundwater seepage from a chemical manufacturing facility operated by Kerr McGee Chemical Corporation in Henderson, Nevada (EPA 2004). In 2003, average perchlorate concentrations in the Colorado River ranged from approximately 10 µg/L at Lake Mead to 5 µg/L near the Havasu Pumping Plant intake to the CAP system (EPA 2004). The Kerr McGee Chemical Corporation, in cooperation with the Nevada Division of Environmental Protection and EPA, recently installed a remediation system to intercept and treat contaminated groundwater entering Las Vegas Wash. This clean-up effort is expected to lower the concentration of perchlorate in the Colorado River.

In 1998, perchlorate was placed on EPA's Contaminant Candidate List for consideration of regulation. Perchlorate was listed as a contaminant that required additional research and occurrence information before regulatory determinations could be considered (EPA 2002). There currently is no enforceable health standard for perchlorate in either Federal or State of Arizona regulations, although the state has an advisory health based guidance level of 14 µg/L. The EPA recently set an official reference dose level of 0.0007 mg/kg/day, which is a scientific estimate of a daily exposure of perchlorate that is not expected to cause adverse health effects in humans. EPA's reference dose translates to a drinking water equivalent of 24.5 µg/L. CAP water sampled at the farm has a perchlorate level ranging from less than the minimum analytical detection level of 1.0 µg/L to 2.6 µg/L (Appendix B).

[16] Perchlorate competes with iodine uptake by the thyroid gland, and the primary concern over its toxicity in environmental exposures is based on an increased sensitivity likely to occur in children and developing fetuses. Impairment of thyroid function may impact infants and children, resulting in behavioral changes, delayed development, and learning disabilities. EPA's draft toxicity assessment on perchlorate also concludes it may produce thyroid tumors.

3.2.2 Environmental Consequences

No Action

No substantial changes in groundwater or surface water conditions at the farm are anticipated in the short term. In the long term, conservation and application of CAP water for irrigation and recharge both on and off the District is expected to reverse groundwater declines in the farm area. The portion of the District's CAP water allocation that is excess to the needs of the farm would be available for other uses granted by the Arizona Water Settlements Act of 2004. Existing flood patterns and inundation frequencies would prevail into the foreseeable future.

Proposed Action

Surface Water. Natural flows of the WBSCR, SCR, and washes within the action area would be minimally affected. Under present conditions, floodwaters that pass through the farm are conveyed to the SCR via the Los Reales West Floodway and as overland flow immediately north of San Xavier Road. The proposed realignment of the WBSCR floodway and addition of the Los Reales South ditch to the floodway system would direct this flow to three distinct discharge points on the SCR formed by the termini of the Los Reales West, Los Reales South, and WBSCR Floodways. Reconfiguration of these floodways would not substantially increase the total flood volume discharged to the SCR.

Construction of the proposed dikes and floodways would prevent floodwaters up to and including a 100-year event from inundating fields, roads, and residences within the farm (Reclamation 2004a). Confinement of flood flows to engineered floodways generally would reduce the risk of property loss and minimize the impact of floods on human health, safety, and welfare within the project area.

South of San Xavier Road, the inundation boundary along the west side of the WBSCR would be pushed further west than current conditions (Figure 11). Backwater flooding caused by the proposed WBSCR Dike ranges from negligible in places to approximately 300 feet, affecting 19.3 acres of allotted land that are currently outside the 100-year flood inundation boundary. No buildings or other land improvements would be affected.

North of San Xavier Road, 100-year frequency flows would be fully contained within newly constructed or re-engineered floodways. These improvements would prevent inundation of agricultural fields and residential properties within the farm. Bifurcation of flows at the north end of the Mission Wash Floodway would add 1,600 cfs to the reconfigured Los Reales South channel during a 100-year event. The WBSCR floodway would discharge 4,800 cfs to the SCR along the central portion of the farm. Total discharge to the Los Reales West Floodway from other on-farm storm water conveyances would be 4,072 cfs.

Groundwater. A portion of the irrigation application in excess of evapotranspiration would percolate through the soil and provide some recharge to groundwater. For flood-irrigated land in the Tucson AMA, incidental recharge is estimated to be about 23 percent of the water applied. Percolation of irrigation water is expected to create localized mounding of perched groundwater associated with impervious layers of clay beneath portions of the farm. Groundwater quality in this perched aquifer would exceed that of CAP water (i.e., higher levels of TDS and sulfate as compared to water sampled from the regional aquifer). Water quality in the deeper, regional aquifer from which drinking water is supplied would also eventually be affected by localized increases in TDS and sulfate. However, substantial changes in groundwater quality would not be anticipated under the proposed action. No exceedance of Arizona Aquifer Water Quality Standards or Federal primary drinking water standards in groundwater is expected.

The perchorate level in local groundwater would approximate that of CAP water at the point of recharge and decrease to trace amounts as a result of dilution. Remediation of perchlorate-tainted groundwater in the Las Vegas Valley is expected to reduce concentrations of perchlorate entering the Colorado River and CAP system. A gradual reduction of perchlorate levels in CAP-supplied irrigation water will likely occur over the next several years. The variety of crops that would be grown on the farm for human consumption has not been shown to accumulate perchlorate and consequently is not anticipated to pose a known health concern based on information currently available.

Cumulative Effects

Higher groundwater levels in the northeastern part of the District would result from deep percolation of CAP water used for irrigation and off-reservation recharge (Reclamation 2000). Incidental and direct recharge within the District would be incremental to other nearby recharge sources utilizing CAP water, such as the Pima Mine Road Recharge Facility operated by the City of Tucson. A groundwater mound would likely develop beneath the northeastern part of the District in response to recharge from all sources. The mound could result in reversal of local groundwater flow between this portion of the District and areas with lower water tables.

The TDS concentration of groundwater underlying the District is generally less than 500 mg/L, although there are some pockets on or near the District to the north and southeast with TDS concentration in the range of 1,000 to 3,000 mg/L. Direct and incidental recharge with CAP water would result in slight to moderate increases in TDS concentrations locally.

A foreseeable effect of SAWRSA is the future expansion of agriculture beyond the boundaries of the existing farm operation. Farm expansion is being considered on approximately 960 acres east of Interstate 19. Part of the District's CAP water allocation would be used to bring lands in the farm extension area under agricultural production. The District anticipates a portion of the remaining CAP water supply could also be utilized for long-term groundwater recharge (either managed or constructed).[17] Expansion of irrigated agriculture and recharge with CAP water would have a localized, additive effect on groundwater quality and quantity. Additional NEPA compliance would be required to evaluate the potential impacts of long-term recharge with CAP water and expanded agricultural development once plans are formulated for these projects.

[17] Managed recharge is possible within existing arroyos; constructed recharge would be through artificial basins.

3.2.3 Mitigation

The following measures would be implemented to reduce impacts on water resources:

- Obtain coverage under appropriate permits, including Section 402 of the Clean Water Act.

- Construction materials would not be stockpiled in areas where they can be washed away by high water or storm flows.

- Contractor petroleum product storage would be sited at least 20 feet from storm water channels, washes, and other watercourses.

- Contractor petroleum storage areas would be lined and diked to permit safe containment of leaks and spills.

- Level all fields subject to flood irrigation to encourage maximum efficient use of water.

- The District would prepare a comprehensive water resource management plan to assist planners in the development of strategies to reduce potential adverse impacts on groundwater quality. Included in this plan would be a groundwater quality monitoring requirement.

- The farm would develop a salt management plan.

FIGURE 10

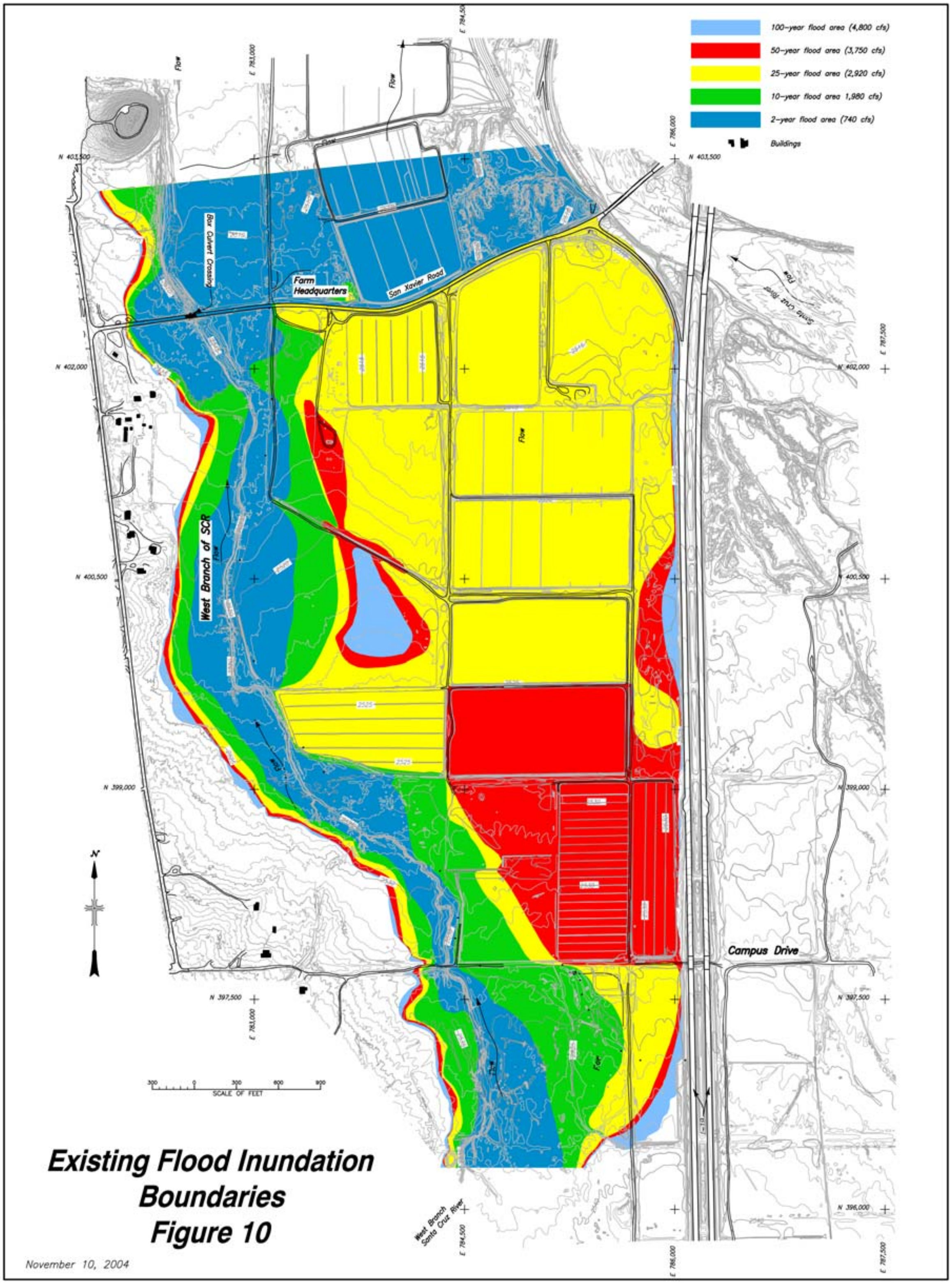
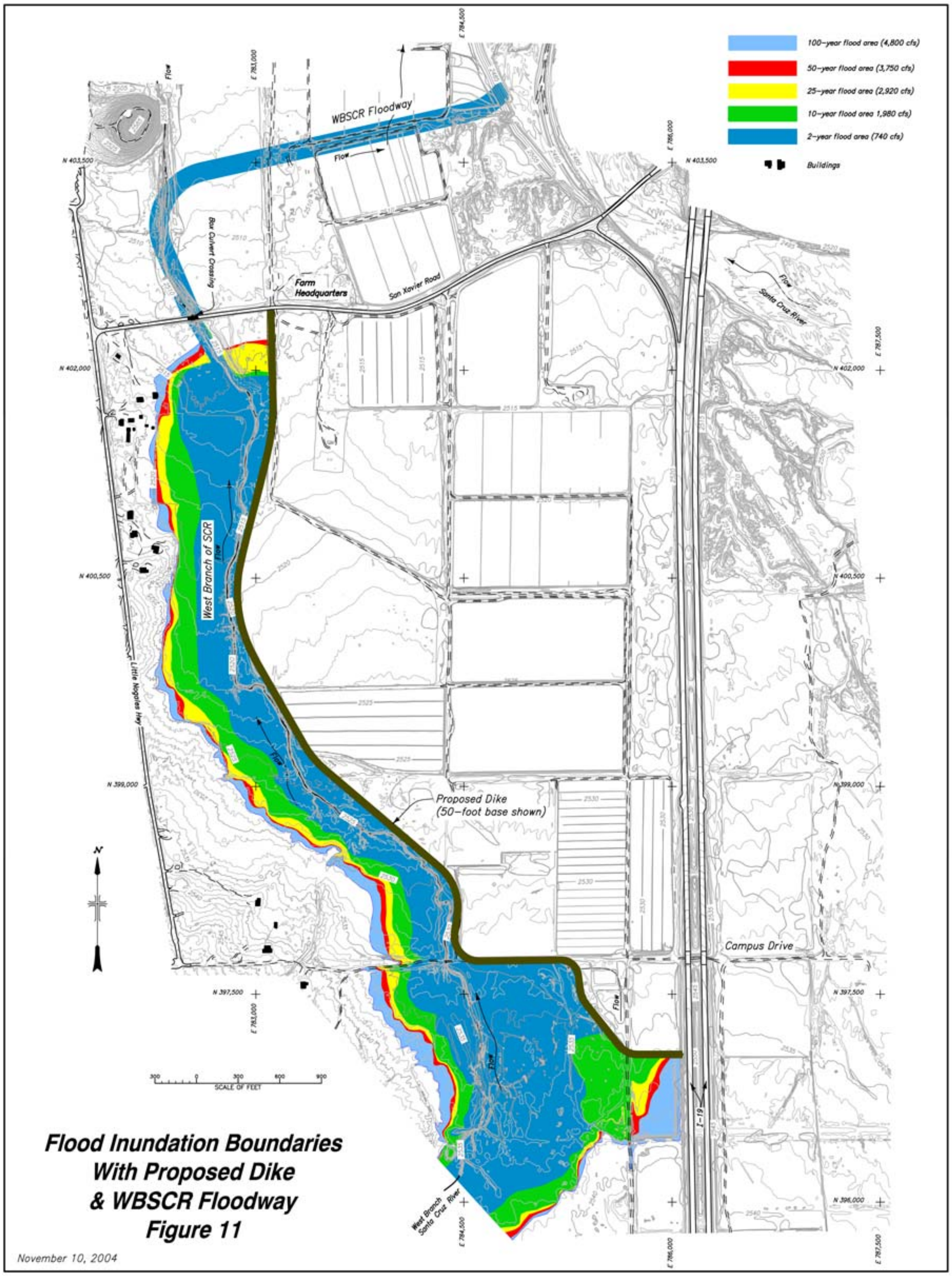

100-year flood area (4,800 cfs)
50-year flood area (3,750 cfs)
25-year flood area (2,920 cfs)
10-year flood area 1,980 cfs)
2-year flood area (740 cfs)
Buildings
Box Culvert Crossing
Farm Headquarters
San Xavier Road
West Branch of SCR
Santa Cruz River
Campus Drive
West Branch Santa Cruz River
N 403,500
N 402,000
N 400,500
N 399,000
N 397,500
N 396,000
E 783,000
E 784,500
E 786,000
E 787,500
SCALE OF FEET
Existing Flood Inundation Boundaries
Figure 10
November 10, 2004

FIGURE 11



100-year flood area (4,800 cfs)
50-year flood area (3,750 cfs)
25-year flood area (2,920 cfs)
10-year flood area 1,980 cfs)
2-year flood area (740 cfs)
Buildings
WBSCR Floodway
Flow
Box Culvert Crossing
Farm Headquarters
San Xavier Road
Santa Cruz River
West Branch of SCR
Little Nogales Hwy
Proposed Dike
(50-foot base shown)
Campus Drive
I-19
West Branch Santa Cruz River
N 403,500
N 402,000
N 400,500
N 399,000
N 397,500
N 396,000
E 783,000
E 784,500
E 786,000
E 787,500
SCALE OF FEET
Flood Inundation Boundaries
With Proposed Dike
& WBSCR Floodway
Figure 11
November 10, 2004

3.3 Geology and Soils

3.3.1. Affected Environment

Geology and Topography. The existing farm lies within the historic floodplain of the SCR. Channel cutting over the last 100 years has entrenched the SCR in a deep arroyo with wall heights of 5- to 25-feet and channel widths of 600 to 1,500 feet. Within the project area, the floodplain is smooth and broad, gently sloping to the north or northeast in grades of one percent or less. The change in elevation across the farm is about 70 feet, ranging from 2,540 feet above mean sea level at the southern end to 2,470 feet above mean sea level in the panhandle.

The Del Bac Hills, a series of low volcanic hills, form a northeast to southwest axis across the farm. Black Mountain, a well-recognized landmark overlooking the farm to the west, is the tallest Del Bac Hill with an elevation of 3,693 feet. Lying closest to the farm are Grotto Hill (elevation 2,565 feet), about 600 feet east of San Xavier Mission, and Martinez Hill (elevation 2,854 feet), east of Interstate 19. These hills are composed mainly of andesitic basalt and porphyry (Heindl 1959; Percious 1968).

The farm is located in the Basin and Range physiographic province characterized by broad, gently sloping alluvial basins separated by north to northwest trending block-faulted mountains that uplifted during the Tertiary period. Down dropping of the blocks between the mountain ranges formed troughs that subsequently filled with water-deposited material eroded from the mountains. During periods of sediment deposition, the SCR cut terraces and the tributaries deposited alluvial fans. Basin fill sediments that underlie the farm area accumulated over 5 million years and include river alluvium and lakebed deposits. The lakebed deposits indicate springs and marshes were once present in the floodplain south of Martinez Hill.

Soils. Soil information was obtained from a Natural Resources Conservation Service soil survey of the existing farm (Westland Resources 2002). The dominant soil type is a Grabe silty clay loam which is relatively uniform throughout the soil profile (0 to 60 inches). These soils developed from medium- to fine-grained mixed fan and stream alluvium. In general, these soils have high available water capacity and moderately slow permeability, with slow runoff and slight erosion hazard. Profile data show these soils are nonsaline to slightly saline, nonsodic to slightly sodic, and moderately alkaline (pH 8). Areas with this soil series are commonly used for production of alfalfa, cotton, corn, small grains, vegetables, and other adapted traditional crops.

Other soils are represented by phases of the Pima and the Hantz-Cashion series. These soils have generally similar profiles to the Grabe series. Pima soils have a dark grayish-brown clay loam surface layer about 26-inches thick over stratified grayish-brown loam and fine sandy loam to more than 60 inches. Hantz-Cashion soils have light brownish-gray clay loam, with intermixed silt loam layers, to more than 50 inches. Permeability within these series is generally slow to moderate, and erosion potential is slight to moderate. Soils are nonsaline to slightly saline, nonsodic to slightly sodic, and moderately alkaline. Crop production potential is similar to the Grabe series.

Great Western Research (1986) prepared a land classification report evaluating the suitability of farm soils for sustained agriculture. The report evaluated soils under the assumption that the farm would be irrigated with water from the CAP. Seven major land characteristics were evaluated: soil type, clay and rock content, slope, topographic irregularities, drainage, and land-leveling costs. All the agricultural land within the existing farm was considered either Class 1 (well-suited for irrigation) or Class 2 (moderately well-suited for irrigation).

3.3.2 Environmental Consequences

No Action

No substantial change from existing conditions would be expected in the foreseeable future.

Proposed Action

Geology and Topography. Topographic elements of the farm would be affected to a minor extent by construction of flood control structures and land leveling. No effect to geologic resources would occur.

Soils. Land leveling and construction of roads, irrigation conveyance systems, and flood protection structures are integral features of the rehabilitation project. Most of the earthen material needed for road and dike construction would be borrowed from adjacent agricultural fields.

Incorporation of high-efficiency level basin flood irrigation would require leveling approximately 300 acres.[18] The remaining fields have already been basin leveled, although some may require minor cut and fill finishing. Land leveling would have a minor, short-term effect on soil chemical and physical properties. Changes in soil fertility and microbial biomass are possible, particularly in locations where relatively deep cuts are made (Brye K.R., et al. 2003). Soil quality and productivity would be expected to improve with addition of organic matter and soil amendments. Organic fertilizers, regular application of irrigation water, and managed cultivation would increase crop yields and general land productivity. The soil biological properties likely would continue to change and equiliberate within a few growing seasons to the new soil conditions created by land leveling and to subsequent cropping systems and soil management practices. Erosion potential of soils would decrease as a result of slope control and greater uniformity of the land surface.

The Class 1 and 2 soils have a moderate to high water-holding capacity, greater than 6 inches in the upper 4 feet of soil. This higher soil moisture capacity reduces the number of required irrigations and lowers the risk of moisture stress in crops. Water infiltration rates of farm soils are sufficient to permit high irrigation efficiency and limit the potential for waterlogged conditions within the root zone, assuming rotations of high- and lower-water intensive crops are utilized (Reclamation 2004b). However, shallow peizometers may be required in locations

[18] Land leveling is the practice of creating a slight, but uniform slope across a field to provide more even distribution of irrigation water. Topsoil is mechanically removed from areas with relatively high elevation and deposited in spots with lower elevation.

where hydraulic restricted layers of soil would preclude deep percolation. Perching of shallow water above these restrictive lenses could result in localized waterlogging, requiring the installation of agricultural drains. Peizometers may be needed in the future to assess long-term water level trends, the potential for waterlogging, and the need for agricultural drains.

Adoption of proper irrigation management practices would have a positive effect on water application uniformity, runoff, the amount of water that is leached below the root zone to remove salts, and the amount of water that is effectively used by crops as evapotranspiration. With appropriate irrigation management, the TDS concentration of CAP water would not affect soil quality.

Construction of flood control facilities would directly disturb approximately 76.2 acres within and outside the farm. During a 100-year frequency flood, approximately 19.3 acres west of the proposed WBSCR dike would be affected by erosive and depositional forces associated with increased backwater flooding. Flood control measures adopted by the project would protect the entire 1,100-acre farm.

Rehabilitation of the farm roads and irrigation conveyance system would affect approximately 87 acres within existing roadway alignments and agricultural fields.

Cumulative Effects

No cumulative effects are anticipated.

3.3.3 Mitigation

- Dust control Best Management Practices (BMPs) would be employed during construction.
- Use of cover crops would be maximized.
- Plant residues would be left on the soil surface during crop rotations.
- Mulching would be encouraged.
- Woody vegetative wind barriers would be maintained along outer field borders.
- An aggregate base course would be applied to main farm and field roads.

3.4 Biological Resources

Groundwater depletion coupled with increased urban and rural development has resulted in a general decline in the abundance and diversity of native plants and wildlife along the SCR. The District's Natural Resource Committee has expressed concern that development and resource exploitation within surrounding areas has reduced local biodiversity and destroyed the vast riparian environment that once contributed to the economy and traditions of the Tohono

O'odham people. The following narrative summarizes natural and human-induced changes along the SCR.

Historic Wildlife and Plant Context. In his book, *The Lessening Stream,* Michael Logan (2002) describes the conditions that prevailed along the SCR when the first Paleo-Indian hunters appeared:

> *"Over 10,000 years ago, the climate in the Santa Cruz River valley was wetter, with heavier winter precipitation resulting in more woodland trees such as pinon, pine, and juniper occurring at the base of the Mountains. Cottonwoods and sycamores lined the banks of the river. Interspersed among the trees were marshy areas, thick with stands of willow, elderberry, ash, walnut, hackberry, and catclaw."*

However, the future climatic trend was toward drier and warmer conditions. Most scholars agree that semiarid conditions have prevailed for the last 6,000 to 8,000 years (Logan 2002). Prior to the 1880s, the perennial reaches of the SCR supported lush vegetation consisting of cottonwood, willow, and walnut trees along the river corridor, as well as a large mesquite bosque near San Xavier Mission (Tellman et al. 1997). Remnants of cottonwood and willow trees persisted at the base of Martinez Hill until the 1940s (SDCP 1999). Swarth (1905) described the mesquite bosque on the San Xavier Reservation:

> *"The bottom lands on either side are covered, miles in extent, with thick growth of giant mesquite trees, literally giants, for the person accustomed to the scrubby bush that grows everywhere in the desert regions of the southwest can hardly believe that these trees, many of them 60 feet in height and over, really belong to the same species. . . ."*

Tellman et al. (1997) describes the wildlife present along the SCR:

> *"The diversity of vegetation contributed to a great diversity in wildlife. The perennial water of the river supported fish and other aquatic species. Early explorers described the SCR as full of fish and tortoises. Beaver and muskrat were present and waterfowl were common. Pioneers describe killing black and grizzly bears, wolves, coyotes, mountain lions, and bobcats. Deer and pronghorn antelope roamed the valley."*

Groundwater pumping, floodplain development, woodcutting, and habitat loss due to erosion have significantly altered the biologically rich SCR. As the perennial reaches of the SCR became increasingly intermittent or ephemeral, habitat values subsequently declined. The SCR around the Tucson area has lost six species of native fish (Gila chub, desert sucker, Sonora sucker, longfin dace, desert pupfish, and Gila topminnow) (SDCP 2000); the Huachuca water umbel, which grew at the base of Sentinel Peak ("A" Mountain); and the local mesquite bosque at Martinez Hill (SDCP 1999).

San Xavier District Vision Statement for Natural Resources. In 1990, the District prepared a "Vision Document" to assist with planning future development. Considerable emphasis was placed on preserving open space. The following paragraph summarizes the District's vision statement for natural resources:

The District believes that future development must be balanced with the protection of the natural resources. The District is interested in the preservation of open spaces by maintaining the hills, washes, and sacred areas in an undeveloped state. The District will encourage the use of native plants for landscaping. Efforts to restore damaged habitats such as the Santa Cruz River will be studied.

3.4.1 Affected Environment

Vegetation. The District encompasses two primary vegetation communities, the Sonoran Desertscrub and the Semidesert Grassland which is the dominant vegetation type. The cultivation of crops has been an integral part of the Tohono O'odham community. Within the farm boundaries today exist cultivated, fallow (left uncultivated for a few years), and abandoned (uncultivated for long periods of time) fields. This differentiation in field type is important when describing the vegetation and subsequent wildlife values. All habitat types located within the District are described below. See Appendix D for a list of plant species that may occur in the project area.

The Semidesert Grassland community is a perennial grass-shrub dominated landscape, where the grass cover has been reduced by encroachment of a wide variety of shrubs, trees, and stem succulents (Brown 1994). In some areas, Brown (1994) notes that trees, half-shrubs, cacti, and forbs may outnumber or completely replace the grasses. Such a "disclimax" grassland is often the result of natural or human-induced intervention into cyclic fire patterns. However, in this case, widespread livestock grazing and increasing aridity caused by a decrease in rainfall and increase in temperature are considered to be the cause (Turner 1974). Typical grass species on the District include needle grama (*Bouteloua aristidoides*), grama grass (*Bouteloua* sp), bush muhly (*Muhlenbergia porteri*), and three awn (*Aristida* sp). Nongrass species are more typical of the paloverde-cacti-mixed scrub association and include mesquite (*Prosopis velutina*), catclaw acacia (*Acacia greggii*), foothill paloverde (*Parkinsonia microphylla*), burroweed (*Isocoma tenuisecta*), four-wing saltbush (*Atriplex canescens*), and triangle-leaf bursage (*Ambrosia deltoidea*). The Semidesert Grassland community occurs primarily in the southern and western parts of the District.

Two vegetation associations (paloverde-cacti-mixed scrub and creosotebush-bursage) occur within the Sonoran Desertscrub community. The paloverde-cacti-mixed scrub association occurs on the hills and bajadas such as Black Mountain. The primary plant species within this habitat type are foothill paloverde, blue paloverde (*Parkinsonia florida*), saguaro (*Cereus giganteus*), catclaw acacia, ocotillo (*Fouquieria splendens*), barrel cactus (*Ferocactus wislizenii*), brittlebush (*Encelia farinosa*), triangle-leaf bursage, and various cholla (*Opuntia*) species. This habitat type is noted for its rich diversity of bird species (Brown 1994).

The creosote-bursage association occupies the lower elevational gradients and is much simpler in structure than the paloverde-cacti-mixed scrub community. It is composed mainly of shrubs and dwarf shrubs such as creosotebush (*Larrea tridentata*), triangle-leaf bursage, and saltbush (*Atriplex* sp.) with a few cacti such as cholla and prickly pear (*Opuntia* sp). This habitat type occurs around the north and west bases of Black Mountain on the alluvial plains (Cornett & Associates with Tierra Madre Consultants 1985).

Desert wash communities are scattered throughout the District and contain distinct assemblages of plants which have higher moisture requirements than those in the surrounding desert. These include mesquite, blue paloverde, white thorn acacia (*Acacia constricta*), desert hackberry (*Celtis pallida*), wolfberry (*Lycium* sp), and canyon ragweed (*Ambrosia ambrosioides*). The WBSCR is a dominant feature of the project area and is lined on both sides with large mesquite.

The SCR runs near the eastern border of the District boundary and is ephemeral, flowing only during flood events. Groundwater pumping resulted in a lowering of the water table and subsequent downcutting of the SCR channel. The lowered water table also resulted in the demise of the gallery forest of cottonwood and willow which helped to stabilize the channel banks resulting in a widening of the SCR channel. The existing vegetation consists primarily of mesquite, whitethorn acacia, and four-wing saltbush. The large mesquite bosques of the past no longer exist, having been replaced by smaller, scrubbier mesquite.

The existing farm encompasses approximately 1,100 acres of active, fallow, and abandoned fields surrounded by farm roads and unlined ditches. Although only approximately 250 acres are currently being cultivated, most fields are actively disked to discourage weed growth. Fallow fields may include annual and perennial weeds such as pigweed (*Amaranthus* spp.), Johnson grass (*Sorghum halapense*), and Russian thistle (*Salsola iberica*). Abandoned fields (such as Fields 14N/S, 15N/S, and 18N) which have not been cultivated or disked for many years have been colonized by second-growth mesquite and a variety of shrubs (four-wing saltbush and acacia). In addition, hedgerows composed primarily of mesquite, but also Mexican elder (*Sambucus mexicana*), four-wing saltbush, wolfberry, and graythorn (*Ziziphus obtusifolia*) line several of the farm fields.

Wildlife. Limited development has taken place within the project area. Surveys conducted by Cornett & Associates and Tierra Madre Consultants (1985) in the project area provide a good description of the local wildlife resources. The following information describes existing conditions with respect to wildlife resources. See Appendix D for a list of wildlife species that may occur in the project area.

Although depauperate when compared to native habitats, agricultural lands are utilized by various native and introduced species due to the interspersion of plowed fields, crops, abandoned farmland, and hedgerows. Common species include starling (*Sturnus vulgaris*), brown-headed cowbird (*Molothrus ater*), and mourning and inca doves (*Zenaida macroura and Columbina inca*). Hedgerows provide good habitat for Gambel's quail (*Callipepla gambelii*), red-tailed hawk (*Buteo jamaicensis*), as well as a variety of sparrows. Unlined farm ditches provide excellent habitat for cotton rats (*Sigmodon arizonae*) and house mice (*Mus musculus*). Fallow fields provide habitat for desert cottontail (*Sylilagus audubonii*) and round-tailed ground squirrels (*Spermophilus tereticaudus*). Herpetofauna (reptiles and amphibians) commonly found in and around farmland include the gopher snake (*Pituophis melanoleucus*), western diamondback rattlesnake (*Crotalus atrox*), and Sonora toad (formerly Colorado River Toad) (*Bufo alverious*).

The diversity of wildlife species can be directly correlated to vegetation diversity and structure. Wildlife species diversity is greater in native vegetation than in disturbed habitats. This has been widely documented with avian species (MacArthur and MacArthur 1961, Carothers et al. 1974, Anderson and Ohmart 1977, Anderson et al. 1983). The paloverde-cacti-mixed scrub community contains an extremely diverse collection of plants (Crosswhite and Crosswhite 1982) and, when combined with the Semidesert Grassland habitat, the undeveloped land within the District supports a diverse array of wildlife.

Common birds found on undisturbed habitats include the curve-billed thrasher (*Toxostoma curvirostre*), mourning dove, Say's Phoebe (*Sayornis saya*), Abert's towhee (*Pipilo aberti*), ladder-backed woodpecker (*Dendrocopos scalaris*) , Gila woodpecker (*Melanerpes uropygialis*), northern mockingbird (*Mimus polyglottos*), and verdin (*Auriparus flaviceps*). In addition to resident species, the Sonoran Desert provides wintering and migratory habitat for various bird species. Sparrow species including white-crowned (*Zonotrichia leucophris*) and Brewer's sparrows (*Spizella breweri*), as well as raptors such as the northern harrier (*Circus cyaneus*) descend into the Sonoran Desert for the winter.

The Sonoran Desert also exhibits a wide diversity of mammal species (Crosswhite and Crosswhite 1982). The District is host to three rabbit species, the desert cottontail (*Sylvilagus audubonii*), black-tailed jackrabbit (*Lepus californicus*), and the antelope jack rabbit (*Lepus alleni*). Other typical desert mammals include the highly desert-adapted Merriam's kangaroo rat (*Dipodomy merriami*), the ubiquitous white-throated woodrat (*Neotoma albigula*), and the coyote (*Canis latrans*).

A wide variety of reptile species occur throughout the District, but the number of amphibian species is limited. Common lizards include the western whiptail (*Cnemidopherus tigris*), side-blotched lizard (*Uta stansburiana*), and the poisonous Gila monster (*Heloderma suspectum*). The variety of small mammals provides an abundant prey source for coachwhip (*Masticophis flagellum*), western diamondback, and gopher snakes. Desert tortoise (*Gopherus agassizii*) are limited primarily to Black and Brown Mountains. Three species of amphibians identified by Cornett & Associates (with Tierra Madre Consultants 1985) include red-spotted toads (*Bufo punctatus*), Sonoran green toad (*Bufo retiformis*), and Couch's spadefoot toad (*Scaphiopus couchi*).

Special Status Species. A compilation of federally listed, proposed, and candidate species that occur in Pima County was retrieved from the Fish and Wildlife Service (FWS) website which was last updated on April 21, 2005. Pima County lists 17 species as endangered or threatened, 1 proposed endangered, 3 candidates, and 2 species which have Conservation Agreements. Section 7 of the Endangered Species Act (ESA) requires consideration of only listed and proposed species. The known range of the following species occur outside of the project area: Kearney's blue star (*Amsonia kearneyana*), Nichol's Turk's head cactus (*Echinocactus horizonthalonius* var. n*icholii*), masked bobwhite (*Colinus virginianus ridgewayi*), Mexican spotted owl (*Strix occidentalis lucida*), and ocelot (*Leopardus pardalis*). There is no habitat in the project area for the following species: Huachuca water umbel (*Lilaeopsis schaffneriana* ssp. *recurva*), California brown pelican (*Pelecanus occidentalis californicus*), southwestern willow flycatcher (*Empidonax traillii extimus*), jaguar (*Panthera onca*), Sonoran pronghorn

(*Antilocapra americana sonoriensis*), Chiricahua leopard frog (*Rana chiricahuensis*), desert pupfish (*Cyprinodon macularius*), Gila topminnow (*Poeciliopsis occidentalis occidentalis*), and the proposed Gila chub (*Gila intermedia*). Table 4 lists only those species that may occur near the project area.

Table 4. Federally-listed species that may occur near the project area.

STATUS	**SPECIES**	
Endangered	Lesser long-nosed bat	*Leptonycteris curasoae yerbabuenae*
Endangered	Cactus ferruginous pygmy-owl	*Glaucidium brasilianum cactorum*
Endangered	Pima pineapple cactus	*Coryphantha scheeri var. robustispina*

Lesser long-nosed bat - The lesser long-nosed bat was listed as endangered on September 30, 1988 (Federal Register Vol. 53 No. 190). Known threats to this species include disturbance of roost sites and loss of food resources through over harvesting of agaves in northern Mexico, spread of agriculture, and livestock grazing. The lesser long-nosed bat feeds on nectar and pollen from saguaros and agaves forming a mutualistic relationship with these plants (FWS 1991). They cannot tolerate prolonged exposure to cold, do not hibernate, and spend winters in Mexico.

This species is found mainly in desertscrub habitat dotted with agaves (*Agave* sp.), mesquite, creosotebush, and columnar cacti. Daytime and maternity roosts are located in caves and abandoned mines. The nearest recorded maternity roost to the project area is located in the Rincon Mountains approximately 16 miles to the northeast (Sabra Schwartz, Arizona Game and Fish Department (AGFD), personal communication, October 20, 2004). No roost sites occur in the project area.

Cactus ferruginous pygmy-owl (pygmy-owl) - The pygmy-owl is similar in appearance to its relative, the northern pygmy-owl, which is also found in the State. This small 7-inch owl can be distinguished from other small owls in the State by its long tail and round earless head. The pygmy-owl can be identified from the northern pygmy-owl by the dark barring in the tail (northern pygmy-owl has light barring in the tail). However, the best criteria for identification is its call.

According to the FWS (1993 and 1998), the primary threats to this species are the widespread loss and modification of riparian habitat. Additional impacts to the pygmy-owl may result from harassment by birdwatchers, lack of management plans for this species on Federal and State lands, as well as competition for nest sites from introduced starlings. Recent increases in the loss of upland habitat, such as is occurring around the Tucson area, are also of concern (FWS 1998).

Historic accounts indicate the pygmy-owl may have been more common and widespread in the State. Records have shown this species utilized cottonwood (*Populus fremontii*) and Gooding willow (*Salix goodingii*) for nesting in riparian woodlands (Rea 1983). Records prior to 1971 indicate this species was found as far north in the State as the Blue Point Cottonwoods near the confluence of the Salt and Verde Rivers (Millsap and Johnson 1988). Today confirmed reports of pygmy-owls in Arizona are exclusively from Sonoran Desertscrub below 3,000 feet in elevation and south of Picacho Peak (AGFD 1996).

The subspecies of pygmy-owl found in Arizona was listed as endangered with critical habitat on March 10, 1997 (Federal Register Vol 62, No. 46, 10730-10747). On September 19, 2001, the critical habitat designation was remanded back to the FWS for further review; consequently, the final rule designating critical habitat for the Arizona population was vacated. FWS reissued proposed critical habitat on November 27, 2002. To date, no final determination has been made on the proposed critical habitat.

On August 19, 2003, the Ninth Circuit Court published an opinion finding that the FWS listing of the pygmy-owl was arbitrary and capricious. The Circuit Court reversed and remanded the issue back to the District Court for further proceedings consistent with the opinion. A petition filed with the Ninth Circuit for rehearing by the Defenders of Wildlife was denied on October 28, 2003. In December 2003, the FWS filed papers with the District Court indicating they were in agreement with the decision to vacate the listing. On June 28, 2004, the District Court ordered the FWS to reconsider the legal status of the pygmy-owl and prepare a report by January 31, 2005. As of May 2005, the Washington office of the FWS is reviewing the report. The pygmy-owl shall remain under the protection of the ESA until a final decision is rendered.

Breeding success for pygmy-owls improved in 2004. Mr. Scott Richardson (FWS, personal communication, September 16, 2004) indicated that as of September 16, 2004, the Arizona population totaled 17 adults and 7 young. The closest nesting pygmy-owls to the project area are located approximately 18 miles to the north/northwest; several visual observations have also been noted to the north and northeast approximately 18 miles away (Sabra Schwartz, AGFD, personal communication, September 16, 2004). Personnel from the Nation's Wildlife and Vegetation Management Program conducted surveys along the ADOT dike east of Interstate 19 from 2000 to 2003. No pygmy-owls were found in the area, and there are no known sightings close to the District Farm (personal communication, Jefford Francisco, Tohoho O'odham Nation, December 9, 2004). Reclamation also conducted surveys in suitable habitat within the project area from 2001 through 2005; no pygmy-owls were detected.

Pima pineapple cactus (PPC) - The PPC was listed as endangered on September 23, 1993 (Federal Register, Vol 58, No. 183). This cactus is also known as the stout-needled mulee cactus or Sheer's strong-spined cory cactus. It is a low-growing, round cactus with finger-like projections called tubercles extending outward from the stem. The tubercles are marked with a prominent groove on the upper side, a characteristic of the genus *Coryphantha*. The spine cluster has one slightly hooked central spine and 10 - 15 straight strawberry-colored radial spines. The large yellow flowers have a narrow floral tube; the fruit is green (Ecosphere 1992).

Ecosphere (1992) documented the current distribution of the cactus as west to the Baboquivari Mountains, east to the Santa Rita and Patagonia Mountains, north to Tucson, and south into Sonora, Mexico. Angie Brooks (formerly FWS, personal communication, March 11, 1997) indicated that several plants have been located on the west side of the Baboquivari Mountains on the Nation lands.

In general, PPC is found in open patches of habitat within the semidesert grassland and Sonoran desertscrub vegetation communities (Brown 1994), from 2,300 feet to 5,000 feet elevation (Ecosphere 1992). PPC appears to be most abundant in the ecotonal boundary between these two communities (FWS, draft recovery plan, unpublished). This species seems to prefer deep alluvial soils of granitic origin (Ecosphere 1992a). They are most often found on south- or east-facing slopes (with less than 5 percent slope) between 2,500 feet and 3,800 feet elevation (Ecosphere 1992a). Associated vegetation includes primarily mesquite, triangle-leaf bursage, burroweed, chain fruit cholla (*Opuntia fulgida*), barrel cactus, cane cholla (*Opuntia spinosior*), and purple-fruited prickly pear (*Opuntia phaeacantha*). Few grasses are associated with this species (Mills 1991).

The main threat affecting this cactus is habitat loss from construction associated with a rapidly growing human population (FWS, draft recovery plan, unpublished). The second cause is the introduction of nonnative species such as Lehman's lovegrass (*Eragrostis lehmanniana*) which outcompetes native grasses and forms monotypic stands (Rutman 1992, FWS draft recovery plan, unpublished). The spread of nonnative grasses has modified the patchy distribution of grass to contiguous stands resulting in increased losses of cacti as a result of fire. Other potential impacts include grazing and illegal collection of this species.

Important Plant Species of the Tohono O'odham Nation - A list of plants that are of special importance to the Tohono O'odham Nation can be found in Appendix E. The list includes not only the plant name but its use based on anthropological studies only. All of the plants identified are common in the Sonoran Desert.

3.4.2 Environmental Consequences

No Action

Under this alternative, there would be no drainage control features constructed. Consequently, no subsequent vegetation impacts would occur along the existing drainages. There would be no impact to mesquite along the WBSCR; flood-flows would continue to support the mesquite along the main drainage and a small tributary downstream of the ADOT dike. No fields would be rehabilitated thereby retaining the second-growth mesquite vegetation located in Fields 14N/S, 15N/S, and 18N. There would be no change to current farm management practices and therefore little change to wildlife and special status species in the project area.

Proposed Action

Vegetation. In general, impacts to vegetation resources would be minor. The majority of the farmland is routinely plowed to remove weeds; consequently, few native plants species occur within the fields. Several of the proposed drainage features would be constructed within the farm fields. The features with the greatest vegetative impact are construction of the WBSCR dike and flood channel and the rehabilitation of abandoned Fields 14N/S, 15N/S, and 18N. The proposed project would result in both beneficial and adverse effects to vegetation resources. Figure 12 identifies locations within the project area where vegetation will be removed and where mesquite trees (mitigation) will be planted.

Rehabilitation of Farm Fields - The District and San Xavier Cooperative Association are interested in maintaining their historic connection to the land. Up to 28 acres of mesquite would be planted in portions of Fields 3A, 10S, 12N, 19S, 19N, 23N, 24S, H, and HS. An additional 13 acres of mesquite, fruit, and/or nut trees may be planted in Fields 46N and 34S. Restoration of native trees would have a beneficial effect on vegetative resources within the farm.

The greatest adverse impact to vegetation occurs from the rehabilitation of abandoned Fields 14N/S, 15N/S, and 18N, which would remove approximately 50 acres of second growth mesquite and associated shrub species.

WBSCR Dike and Floodway - Approximately 58 percent of the WBSCR dike would be located on or immediately adjacent to the existing farm roads thereby avoiding impacts to mesquite habitat. The existing mesquite would benefit from increased moisture as a result of the temporary ponding of floodwaters along the inundation zone west of the dike. Flood water retention would not last more than 1 day following a storm event.

Construction activities would result in the removal of approximately 3.4 acres of mesquite habitat along the dike alignment. Habitat quality varies from dense, large mesquite to more open, scrubby mesquite vegetation.

The existing culverts underneath San Xavier Road lack the capacity to pass flood flows. Debris becomes lodged in the culverts, water backs up, and overtops the channel spreading out over the terrace. Over time, this process has resulted in the growth of netleaf hackberry (*Celtis reticulata*), Mexican elder, and mesquite vegetation. Approximately 1 acre of mesquite and open channel habitat would be removed for installation of a box culvert underneath San Xavier Road and the subsequent deepening of the WBSCR flood channel. Secondary impacts to approximately 1 acre of mesquite habitat adjacent to the WBSCR upstream of San Xavier Road would occur as a result of reduced flood flows. Channel deepening would reduce overbank flooding, potentially resulting in reduced vegetative vigor, reduction in ground cover, and a subsequent reduction in canopy density.

Finally, the construction of the new floodway would divert all WBSCR flows from the remaining portion of the old channel immediately east and north of the San Xavier Mission. This alignment is currently vegetated with a dense stringer of large mesquite trees (~1.4 acres) that could lose vigor when channelized flows are diverted into the new floodway. The old channel, however, would continue to receive sheet flow from the San Xavier Mission parking lot located to the west.

However, it should be noted that flood flows frequently break out of the channel at the San Xavier Road crossing and flow across the farm fields in a north to northeasterly direction. This flood pattern deprives the remainder of the WBSCR of the full benefits of flood flows. The frequency of flows would be reduced to 1/4 of the current flow frequency (Jeff Riley, Reclamation, personal communication, October 26, 2004). It is expected that the reduced flood flows would stress the large mesquite trees potentially resulting in reduced vigor or death.

SCR Backwater Basin - No vegetation or habitat values will be impacted as a result of the modification of the backwater basin. However, this area will now receive flood flows from the redirected WBSCR. The flood flows will be impounded behind the spillway and will likely result in increased vegetative growth.

WBSCR Campus Drive crossing - No vegetation will be impacted by paving the road.

Mission Wash Ditch - Approximately six small mesquite trees would be removed as a result of the enlargement of this man-made channel.

Cemetery Wash Ditch - Approximately 25 mesquite and paloverde trees scattered along 3,300 feet of the east bank of this man-made channel would be lost when the channel is widened. No impacts will occur to the more heavily vegetated west bank.

Los Reales Wash Ditch - Construction would avoid impacting mesquite along the entire south bank of the existing alignment. A stringer (0.3 acre) of small mesquite trees along the north bank of this man-made channel would be removed when the channel is enlarged.

New Panhandle Floodway - The new Panhandle Floodway would be constructed within the existing fields. No trees would be impacted by construction of this flood channel.

Los Reales West Floodway - A 1,500 foot-long linear stringer of bosque-sized mesquite trees (0.7 acres) along the west bank of the flood channel would be removed when the channel is enlarged.

Los Reales South Ditch - The new channel would be constructed along the edge of the existing farm fields; a few scattered trees would be impacted.

ADOT Dike - Extension of the existing ADOT dike for approximately 500 feet would impact approximately 0.6 acres, of which less than 0.1 acres is vegetated with mesquite. Secondary impacts to approximately 7 acres of mesquite would occur as a result of reduced flood flows. The majority of the dike would be constructed in open desert scrub habitat with minimal impact to vegetation.

Wildlife. In general, impacts to wildlife resources would be minor. The majority of the farmland is routinely plowed to remove weeds, which has reduced its value for wildlife. Several of the proposed drainage features would be constructed within the farm fields. The features with the greatest impacts to wildlife would be construction of the WBSCR dike and floodway and the rehabilitation of abandoned Fields 14N/S, 15N/S, and 18N. The proposed project would result in both beneficial and adverse effects to wildlife resources.

Rehabilitation of Farm Fields - The mesquite, fruit, and nut plantings around the farm would provide replacement wildlife habitat to offset the habitat lost as a result of the rehabilitation project. Species such as the tree lizard, white-throated wood rat, Gila woodpecker, northern oriole, and wintering and migratory warblers may benefit from these plantings. Finally, existing hedgerows would be retained to the extent practicable, thereby maintaining the existing wildlife habitat.

Adverse impacts to wildlife would result from the loss of approximately 50 acres of second-growth mesquite and associated shrub understory in Fields 14N/S, 15N/S, and 18N. The abandoned fields represent the largest block of wildlife habitat within the established farm boundaries. The fields provide habitat for herpetofauna, small mammals, passerine birds, and raptors; all of which would be impacted to varying degrees. However, this habitat is also isolated on all sides by high-density residential development (north), agricultural fields (west and south), and the Interstate 19 freeway (east), thereby diminishing the overall value for wildlife.

WBSCR Dike and Floodway - Impacts to wildlife from construction of the dike would be minor. Over half of the dike would be constructed on existing farm roads, and the construction width is small. A total of 3.4 acres of habitat (spread out along a 1.5 mile, 50-ft-wide ROW) would be impacted by construction.

WBSCR Floodway and culvert construction would remove approximately 1 acre of mesquite and open channel habitat resulting in minor losses of small mammals and herpetofauna. Impacts to avian species would be negligible. Diminished overbank flooding upstream of the San Xavier Road crossing may reduce the vegetative density in a small patch of mesquite habitat. However, this could be offset by construction of a small wing dike to direct flows onto the terrace. In addition, the WBSCR dike will provide additional moisture through the temporary ponding of water during the larger flood events. Overall effects to wildlife would be highly localized.

Construction of the new channel section would divert all of the water from the remaining portions of the WBSCR (north of San Xavier Road) resulting in minor impacts to wildlife. Although sheet flow from the west would continue to supply water to the channel, the flow frequency would be reduced. Large mesquite trees along this alignment are likely to become stressed as a result of the reduced moisture. If these trees die, the primary effect would be loss of foraging and nesting habitat for avian species. There would be a short-term increase in insectivorous bird species as they forage on the dying trees. Loss of this habitat would be greater from a "visual perspective" than from actual impact to wildlife. Compared to the amount of wash habitat that exists throughout the District, the impact to wildlife habitat would be minor.

The construction corridor for a section of the WBSCR floodway was realigned to avoid an existing mesquite hedgerow. The proposed alignment would benefit wildlife by preserving this field border habitat.

SCR Backwater Basin and WBSCR Campus Drive Crossing - There will be no adverse effect to wildlife resources from construction of these features. The potential for regeneration of mesquite (or cottonwood/willow depending upon the amount of soil saturation) trees may provide some additional wildlife habitat in this area.

Modification of Wash Ditches - Effects to wildlife from construction and/or modification of Mission, Cemetery, Los Reales, and Los Reales South Ditches and the new Panhandle Floodway would be minor. All of the channels are located within the existing farm fields or adjacent to high-density development. These manmade channels provide low-quality wildlife habitat with the exception of Los Reales West Floodway. The 1,500 foot stringer of large mesquite trees provides higher-quality habitat; however, the habitat value is diminished by the high-density residential development immediately east of the channel and the plowed farm land west of the channel which effectively isolates the habitat.

ADOT Dike - There would be minor impacts to wildlife from dike construction; the diversion of flows would impact 7 acres of mesquite habitat downstream. Primary effects would be loss of small mammals and herpetofauna due to construction activities.

Special Status Species. Farm rehabilitation is not likely to adversely affect federally listed species. This conclusion is based on surveys conducted by Reclamation biologists and the condition of habitat in the action area. A Biological Assessment (BA) which concluded “no effect” to the lesser long-nosed bat and Pima pineapple cactus and “may affect, not likely to adversely affect” the pygmy-owl was submitted to the FWS on December 21, 2004. In a letter dated January 31, 2005, the FWS concurred that the proposed action was not likely to adversely affect the pygmy-owl. In accordance with FWS policy not to issue concurrence letters on no effect findings, the January 31, 2005, letter was silent on Reclamation’s no effect determination regarding the Pima pineapple cactus and lesser long-nosed bat.

Lesser long-nosed bat - There is minimal habitat for foraging lesser long-nosed bats in the immediate project area. All native vegetation has been removed from the active and fallow farm fields. No agaves, yucca, or organ pipe cacti occur in the project area. There are only widely scattered saguaros surrounding the farm fields. No saguaros would be impacted by construction of the diversion structures or the temporary impoundments they create. There would be no effect to foraging or roosting habitat of the lesser long-nosed bat from the proposed project.

Cactus ferruginous pygmy-owl - Approximately 25 mesquite trees (>6 in dbh) along with an undetermined number of smaller mesquite trees would be removed during construction of the WBSCR dike. Surveys for pygmy-owls were conducted in all suitable habitats within ¼ mile of the project area from 2001 through the 2005 breeding season. A proposal to extend the ADOT dike south of the existing farm was made in early 2003. The dike would be extended approximately 500 feet resulting in loss of several mesquite trees. Surveys at this location were conducted from 2003 through 2005.

To date, no pygmy-owls have been observed during any survey. A BA was submitted to the FWS on December 21, 2004, which concluded that the proposed project may affect, but would not likely adversely affect the pygmy-owl. Pygmy-owl surveys would be continued until construction of the drainage features has been completed.

Pima pineapple cactus (PPC) - Surveys were conducted by Reclamation personnel on November 12 and 20, 2003, in all areas suitable for PPC where habitat would be removed or otherwise impacted. No PPC were found during the surveys. A site visit conducted by Ms.

Mima Falk (FWS) on December 5, 2003, determined that habitat within the abandoned farm Fields 14N/S, 15N/S, and 18N was not suitable for PPC, and therefore surveys were not conducted. The proposed project would not affect the PPC.

Important plant species of the Tohono O'odham Nation - There would be loss of mesquite and other plants potentially important to the District from construction of the drainage features and rehabilitation of Fields 14N/S, 15N/S, and 18N. The exact number and type of plants has not been quantified. District members would be afforded the opportunity to salvage mesquite and other native plants for personal use.

Summary of Environmental Consequences

The following information is summarized in Table 5. Vegetation effects are shown in Figure 12.

Beneficial effects (vegetation) – Up to 41 acres of mesquite, fruit, or nut trees would be planted in 3 to 5-acre blocks within the farm. The majority of existing hedgerows would be preserved during construction of the drainage control features and field rehabilitation. Existing vegetation along several of the dikes and drainage features was preserved by realignment of the features. Mesquite and other native plants that would otherwise be lost through construction would be salvaged for use by District residents.

Adverse effects (vegetation) - Subjugation of the abandoned farm fields would result in the loss of approximately 50 acres of second-growth mesquite. Construction of the dikes and drainage control features would result in the loss of approximately 5 acres of mesquite, of which approximately 1.2 acres consist of bosque-sized trees. Approximately 2.5 acres of large mesquite would be affected by reduced flows in the WBSCR channel; while approximately 7.0 acres of scrub mesquite habitat would be affected by reduced flows from construction of the ADOT dike.

Beneficial effects (wildlife) - Revegetation with mesquite would offset some of the habitat loss. Retention of existing hedgerows and realignment of existing drainage features to avoid existing vegetation would benefit those wildlife species currently utilizing the habitat.

Adverse effects (wildlife) - Rehabilitation of the abandoned farm fields would result in the loss of foraging, resting, and/or breeding habitat for herpetofauna, small mammals, passerine birds, and some raptor species. Construction of the dikes and drainage control features and rehabilitation of active and fallow fields would result in the actual loss of herpetofauna and small mammals.

Sensitive Species – There would be no impact to the lesser long-nosed bat and PPC. No adverse effect to the pygmy-owl is likely. There would be a loss of mesquite and other native plants important to the District members.

Table 5. Summary of Effects Biological Resources.

	VEGETATION		WILDLIFE		SENSITVE SPECIES	
	BENEFICIAL EFFECTS	**ADVERSE EFFECTS**	**BENEFICIAL EFFECTS**	**ADVERSE EFFECTS**	**BENEFICIAL EFFECTS**	**ADVERSE EFFECTS**
DRAINAGE CONTROL FEATURES AND FIELD REHAB	• up to 41 acres of mesquite, fruit and nut trees planted in fields • preservation of hedgerows and mesquite through realignment of drainage features • SXD members salvage mesquite and other important plant species for personal use	•loss of ~54 acres of scrub mesquite habitat •loss of ~1.2 acres large mesquite • reduction in flows to ~7.0 acres of scrub mesquite • reduction in flows to 2.5 acres of large mesquite	•revegetation with mesquite, fruit and nut trees will offset habitat loss • retention of hedgerows and mesquite will maintain existing wildlife values •construction of dike will maintain flows to ~1 acre of large mesquite	• loss of small mammals and herpetofauna from general construction activities • loss of foraging, resting and/or breeding habitat for small mammals, herpetofauna, passerine birds and/or raptors from rehabilitation of abandoned fields	• revegetation with mesquite will benefit the District	loss of mesquite and other plants important to District

<u>Cumulative Effects</u>

The proposed action would have minor cumulative affects on vegetation and wildlife resources. Pima County has been experiencing rapid growth and development over the last 30 years resulting in the direct loss of wildlife habitat. The rate of development is not expected to decrease in the foreseeable future. San Xavier District (approximately 71,000 acres) comprises only 1 percent of Pima County (approximately 5,877,760 acres). The total amount of undisturbed habitat impacted by the proposed action (approximately 65 acres) represents an infinitesimal percentage of land within Pima County.

The majority of future impacts will occur outside of the District boundary.

3.4.3 Mitigation

Avoidance of impacts is a recognized form of mitigation. Several features of the project have been designed or located to avoid impacts to existing vegetation. The large amount of contiguous undeveloped habitat within the District would continue to remain an important area for wildlife. Establishment of mesquite within the farm fields, and in some respects the fruit and nut crops, would offset some of the impacts to habitat associated with this project. The amount of habitat removed as part of the proposed project is considered to be minor based on the overall amount of these habitat types within the District boundaries.

- Approximately 58 percent of the WBSCR flood dike would be located on adjacent farm roads to avoid impacts to mesquite habitat. A section of the WBSCR flood channel has been realigned to avoid impacting a hedgerow of mature mesquite.

- Up to 41 acres of mesquite, fruit, and nut trees would be planted in 3- to 5-acre blocks throughout the farm (Figure 12). No less than 50 percent of the total area planted in trees would be in mesquite. Revegetation would provide some wildlife benefits to offset the habitat removed as part of the rehabilitation project.

- Installation of wing dikes south of San Xavier Road along the WBSCR drainage can redirect flood flows onto the terrace in order to support the existing mesquite vegetation.

- Existing hedgerows would be avoided to the greatest extent practicable.

- Drainage features would be located to avoid existing habitat to the greatest extent practicable.

- Members of the District would be given the opportunity to salvage plant species within the project ROW.

- All work in the immediate area would cease if any federally listed species are observed in the construction area. Reclamation and FWS personnel would be notified immediately.

- Construction personnel would be instructed not to collect, disturb, or molest wildlife species during construction. Personnel would be advised of legal consequences associated with collection or disturbance of a protected species.

- The contractor would be instructed to exercise care to preserve the natural landscape and conduct operations so as to prevent unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the work.

- All new, replaced, or upgraded power poles shall include features to avoid raptor electrocution.

INSERT FIGURE 12

3.5 Cultural Resources

Cultural Background on the Project Area. The following discussions on the history of the project area, the floodplain environment, and previous archaeological work draw heavily and often directly from the 1988 EA (Franzoy Corey 1988). It also incorporates new data acquired during the late 1990s.

People practicing a hunting and gathering subsistence lived in southern Arizona nearly 10,000 years ago. These Indian groups are noted for hunting mammoth, camel, and giant ground sloth until these megafauna became extinct around 7000 B.C. They continued to hunt smaller game such as deer and rabbits and increasingly relied on gathered plant resources. This subsistence strategy allowed a more sedentary way of life. Archaeological evidence dates semipermanent, if not permanent, settlements along the floodplain of the SCR since around 4500 B.C. (Gregory 1999). By 1200 B.C., pit house villages were established along the SCR downstream from today's cooperative farm. The inhabitants of these villages, while still relying on hunting small game and gathering wild plant foods, began to cultivate and harvest domesticated plants. Over time, these early farmers relied more and more on cultivated crops like maize, beans, squash, cotton, and wild plants such as mesquite, amaranth, and agave. The addition of irrigation technology and ceramics helped ensure more stable food production and storage and contributed to a fully sedentary lifestyle. Eventually, these farmers became the Hohokam, who continued to live along the SCR until the mid-fifteenth century when their culture was drastically altered and population decreased. O'odham traditions maintain that the O'odham are the descendents of this prehistoric farming culture.

In the late 1600s, Spanish missionaries encountered the native village of Bac inhabited by a group of Piman-speaking (O'odham) people known as the Sobaipuri and located near the present site of San Xavier Mission. The Piman word "Bac" means a place where water emerges from its underground flow. Access to a year-round source of water and the fertile floodplain supported an agricultural economy that allowed a permanent occupation. Descriptions in the letters and journals of Father Eusebio Kino and Lieutenant Juan Mateo Manje tell of the springs, irrigation ditches and fields, and of plains and meadows covered with grasses suitable for grazing livestock.

Father Kino first saw Bac in 1692. During the next decade, Kino imported ideas and technology that would gradually change the culture of the Bac population. Kino's primary interest was teaching Catholicism; but in his efforts to support himself and future priests, Kino brought to the area cattle, sheep, goats, horses, and wheat.

Before Kino's arrival, the O'odham's principal domesticated crops were corn, cotton, beans, squash, and gourds; these were all grown during the summer and supplemented by wild plant and animal resources. When Kino introduced wheat, he introduced a winter crop that allowed year-round agriculture that would eventually alter the traditional O'odham subsistence patterns. Other Old World crops introduced by the Spanish included barley, chickpeas, lentils, cowpeas, and watermelon. In 1699, Manje wrote, "There are sufficient cultivated lands watered by means of good ditches and large extensive plains of meadows or pasture lands with luxuriant growth for a ranch of cattle, sheep, goats and horse" (Effland et al. 1989). That same year, Father Visitor Leal saw the area and pronounced the fields “were sufficient for another city like Mexico” (Bolton 1948, Effland et al. 1989).

In 1700, Kino laid foundations for a church and house he called San Xavier del Bac near the Sobaipuri settlement. The structure was never completed, and the Jesuit presence in southern Arizona disappeared after Kino’s death in 1711 until they returned to San Xavier in the 1830s. At this time, Apache raids and the spread of European diseases disrupted the traditional native settlement patterns and lifeways. As early as 1744, the Tohono O’odham, living in the Papagueria to the west, were seasonal occupants of San Xavier, helping the Sobaipuri with the winter wheat harvest in exchange for food. By 1767, Franciscan missionaries replaced the Jesuits, and the area around San Xavier Mission offered the Tohono O’odham a stable food supply, a permanent water source, and agricultural land. In the 1700s, the Sobaipuri began to abandon their rancheriás along the Upper SCR, often joining Akimel O’odham communities along the Gila River or Tohono O’odham groups in the Papgueria. In the 1820s, Mexico gained independence from Spain, and the Franciscans abandoned the San Xavier Mission. Irrigation agriculture continued to be practiced at San Xavier by a population that was increasingly Tohono O’odham (Effland et al. 1989). By 1850, San Xavier del Bac was identified as a Tohono O’odham village with close ties to the villages in the Santa Rosa area.

Ranching and mining activities of Spanish settlers contributed heavily to the region’s developing cash economy. During the 1700s to early 1800s, large numbers of Spanish ranchers scattered across Sonora and southern Arizona. The O’odham traded with the settlers, and many O’odham took seasonal jobs as ranch hands or domestics. Strikes by mine workers during this period created a demand for O’odham labor and products (Bureau of Applied Research 1984).

In 1854, under the provisions of the Gadsden Purchase Treaty, most Tohono O’odham lands became part of the United States. The Tohono O’odham people were then subject to American laws but lacked the rights to full citizenship. For the next 20 years, non-Indian ranchers, farmers, and miners encroached on O’odham land in the San Xavier area.

Non-Indian migration into the San Xavier lands came to a halt in 1874 with the creation, by executive order, of the 71,095-acre San Xavier Reservation. The reservation reflects, in part, an early effort to consolidate all O’odham in one region, an idea that was abandoned with the subsequent creation of the Gila Bend Reservation in 1882 and the main Tohono O’odham Reservation in 1916.

Cultural Resource Investigations. Cultural resource investigations for the farm rehabilitation project were first conducted in 1985 to 1986 by a multidisciplinary team of archaeologists, geologists, and geomorphologists from Archaeological Consulting Services (ACS) (Effland et al. 1989). The team from ACS assessed the extent of archaeological deposits within the farm area through very limited surface and subsurface testing. Guiding them in their research was the knowledge that over the last 1,000 years the SCR has meandered within its floodplain and the question of how this changing floodplain environment affected the cultural adaptations of the area’s early inhabitants.

The arrangement of alluvial deposits and associated soils was examined by geologists and geomorphologists. The river channel served as a north-south cut for geologists seeking to learn how soils were formed over time. They used a series of backhoe trenches to examine the soil profiles from east to west. Archaeologists searched the backhoe trenches for cultural features and artifacts and evaluated the combined effects of the field cuts (from land leveling) and the proposed plow zone (approximately 5 feet) on cultural resources. At the time the 1988 report was written, more extensive field modifications were anticipated than are currently proposed.

At about the same time, the Arizona State Museum (ASM) excavated portions of the San Xavier Bridge Site (AZ BB:13:14[ASM]) to be impacted by road construction following the destruction of the San Xavier Bridge during the 1983 floods (Ravesloot 1987). The affected area is located on the bank of the SCR in the ADOT ROW within the Farm boundary, just north of Field 34.

In the 15 years since the publication of the first farm rehabilitation cultural resource study (Effland et al. 1989), a considerable amount of archaeological work has been done in the greater Tucson Basin, including the area in and around the District. In 2001, ACS published a report (Glass 2001) on archaeological investigations associated with the construction of the CAP Link Pipeline that was constructed to deliver CAP water to the farm. Germane to the current project is an in-depth geomorphologic assessment conducted as part of the CAP Link Project (Phillips 2001). In early 2005, as part of Reclamation's National Historic Preservation Act (NHPA) Section 106 obligations, ACS initiated a testing and excavation project along the projected farm rehab irrigation pipeline and flood control ROW (Stokes 2004). Currently only initial, preliminary information is available for the results of this project. Data collected during field work and artifact analysis will be presented in a final report

3.5.1 Affected Environment

Cultural Resources within the Farm Area. Cultural resources are difficult to identify within the farm because of centuries of agricultural practices that have erased many of the surface indications of buried cultural deposits and features. In the San Xavier area, historic deposits are often found on or near the surface and are the most likely to have lost integrity as the result of plowing and other agricultural activities. Protohistoric and late prehistoric deposits may also have been affected by plowing, as evidenced by the widespread scatter of artifacts on the surface of Fields 14, 15, and 18 and Fields 3 and 4. The proposed farm rehabilitation project will affect deeper, probably undisturbed, strata with the installation of the irrigation pipelines and creation of flood control channels. The recent intensive testing project focused on identifying and interpreting cultural resources in the undisturbed strata in the affected right of way (Stokes 2004).

Ten cultural features were identified during trenching of 5,314 linear feet of backhoe trenches in the 1985 to 1986 investigations (Effland et al. 1989). These features included possible human burials, fire-fractured rock concentrations, and a 1800s canal. Artifacts were recorded and the corresponding geologic strata were identified, which helped geomorphologists date the geologic strata. A concentration of rock and fired-adobe brick, debris from the Franciscan building period after 1774, was found in Field 20N/S north of San Xavier Mission. High numbers of artifacts were found in Fields 14N/S (237 artifacts) and 15N/S (134 artifacts).

Historic artifacts (artifacts that date from A.D. 1700 to the present, including glass, adobe brick materials, metal, porcelain, and ceramics) were found generally within 40 inches of the ground surface. Prehistoric artifacts (for example, ground stone implements, chipped stones, and ceramics that date from A.D. 950 to 1450) generally were found more than 40 inches below the surface. Protohistoric artifacts (items that date from A.D. 1450 to 1600) were found in their proper stratigraphic placement, that is, in between earlier and later cultural material. Possible Archaic artifacts (from 7500 B.C. to the beginning of the Christian era) were found in one location at 5.8 feet beneath the ground surface.

The investigation documented historic features, such as homes and farmsteads, like the Rancho de Martinez property and irrigation system of the late 1800s. One of the Martinez system canals was identified in three trenches in Field 22a.

Preliminary results from the recent 2005 investigations by ACS are derived from about 86 trenches along the pipeline right of way and projected flood control features, totaling about 5700 linear feet. Roughly 40 subsurface features were encountered, over half of which represent historic, probably late 19th to early 20th century, irrigation ditches. The historic irrigation features were primarily located in Fields 3, 4, 18, 28, 37, and 48. They represent several large ditches that may be part of the Martinez irrigation system, as well as smaller, feeder ditches. All the historic ditch segments were truncated by the plow zone. In Field 34, a series of postholes found just under the plow zone appear to represent a historic corral or other outdoor feature. Historic artifacts associated with these features include metal and glass fragments, domesticated animal bone, and historic O'odham ceramics.

Four inhumations excavated into a stratum lying below that of historic feeder ditches in Field 18 appear to be protohistoric. Although they exhibit characteristics of prehistoric burials (flexed position, shell beads), glass beads recovered from one inhumation suggest they represent protohistoric or early historic times. An isolated Hopi bowl recovered from the same stratum, but not directly associated with the burials, also suggests the presence of protohistoric remains in this area.

Prehistoric features included several roasting pits, other pits, midden deposits, a cremation, and one pit house. They are clustered in Field 18 S/N and Fields 3/4, although isolated pit features were encountered throughout the farm. A cluster of three roasting pits, with an associated ash pit, was encountered during the testing for, and construction of, a temporary holding pond in Field 18 just southeast of the Field 18 excavation area. The cremation, located well below the plow zone, was encountered during sinkhole repairs in Field 22 and represents a Preclassic time period. All burials were transferred to a San Xavier Cultural Preservation Committee representative as outlined in the project research design (Stokes 2004).

Prior to investigations, a light scatter of prehistoric artifacts in Field 34 suggested that the San Xavier Bridge Site (AZ BB:13:14[ASM]), located immediately to the north, extended down into this field area. Ten test trenches were randomly placed in the field to determine the southern boundary of this site. Eight trenches lacked evidence of cultural deposits, one included the historic postholes noted above, and one trench included a prehistoric midden deposit (4-5 feet below the surface) that appears to reflect the Tanque Verde occupation of the Bridge Site. The results of this limited testing in Field 34 suggest that the San Xavier Bridge Site does not extend into Field 34 to a significant degree, and that limited trash deposits along the northern edge of the field are 4 to 5 feet below the present surface. Neither the main pipeline nor any laterals will be placed in this field.

The 500-foot extension of the ADOT berm south of the farm will minimally impact the eastern border of Locus O (also known as Locus A) of the Punta de Agua Site (AZ BB:13:16[ASM]), a significant, large Hohokam site distributed along the low terraces just west of the SCR floodplain. This locus includes a prehistoric ball court. The undisturbed surface artifact scatter suggests that numerous subsurface features are present within the locus as well. A single test trench along the length of the proposed dike extension revealed a roasting pit and a dense trash midden area.

3.5.2 Environmental Consequences

No Action

Cultivation and maintenance tillage would continue to affect soils within the 24-inch active plow zone. Cultural material buried within the plow zone has been destabilized by ground disturbances associated with more than a century of farming in the project area. Minimal impact to cultural resources would be anticipated by maintaining farm operations at current levels.

Proposed Action

Cultivation and maintenance tillage would continue to affect soils within the plow zone. Field leveling would also impact these disturbed deposits. Two elements of the proposed farm rehabilitation, the construction of an on-farm water distribution system, and the creation of flood protection structures would have the greatest potential to affect undisturbed cultural deposits underlying the active plow zone. Farm roads would generally follow existing roadways and not impact undisturbed deposits.

The following discussion from Franzoy Corey (1988) has been updated to reflect current rehabilitation plans and field numbers. It also includes preliminary information from the just-concluded testing and excavation project undertaken by ACS. The results of the project will be presented in a final report following completion of artifact and sample analyses.

Farm Rehabilitation. The distribution of prehistoric remains within the farm area that would be impacted by proposed actions may be estimated by the location of known archaeological sites as well as the location of features encountered during recent archaeological testing. With the exception of the San Xavier Bridge Site, most known prehistoric sites in the farm area are located on the low terraces along the west and east sides of the SCR floodplain. These include the Classic Hohokam sites situated around the base of Martinez Hill (e.g., AZ BB:13:8 [ASM], AZ BB:13:3[ASM]). Ravesloot (1987) has suggested that the Bridge Site may have been an extension of these large habitation sites, although it contained mostly pit features interspersed with some burials and pit structures. Prehistoric sites along the western terraces are largely Preclassic Hohokam habitation sites.

The test trenches south of San Xavier Road yielded little prehistoric material in either the recent testing program (Stokes 2004, Stokes in prep) or the earlier 1980s trenches (Effland et al. 1989). Although recent work along the SCR floodplain (Gregory 1999, 2001; Mabry (editor) 1998) several miles north of San Xavier has confirmed the presence of deeply buried Middle and Late Archaic remains, deep test trenches (approximately 8 feet) in this area failed to retrieve evidence of an Archaic occupation. Prior stratigraphic studies as well as historical references indicate that, due to the volcanic dike impeding water flow, the southern farm area supported relatively lush vegetation, *cienagas,* near-marshy conditions, and frequent flooding; all factors that may have prevented intense occupation of the floodplain. Alternatively, these same factors, particularly the flooding, may have destroyed much evidence of previous occupation on the floodplain. Ten trenches placed in Field 34 did not contain abundant prehistoric material, indicating that the San Xavier Bridge Site (AZ BB:13:14[ASM]) did not significantly extend south into this area.

Subsurface evidence of prehistoric occupation north of San Xavier Road appears to cluster in Fields 3, 4, 18, and 22, with surface scatters also visible in Fields 14 and 15. Isolated pit features were noted in a few trenches scattered across this part of the farm. Deep trenches in this area also failed to yield evidence of an Archaic occupation.

Prehistoric features encountered in Fields 3 and 4 trenches appear to represent an extension of known site (AZ AA:16:44[ASM]), a prehistoric Hohokam site located on a low terrace just west of this portion of the farm. Features encountered include several roasting pits as well as a partially eroded pithouse.

Three roasting pits and an ash pit were encountered during the recent testing and construction of a temporary holding pond in Field 18. A trench along an irrigation lateral just to the north of this encountered four inhumations and a reconstructable Hopi ceramic bowl, all of which probably represent the protohistoric period. Although a light artifact scatter is visible on the surface of Fields 14 and 15, to the north of Field 18, test trenches by both projects failed to encounter any buried cultural features or deposits. The 1986 testing project encountered three fire-cracked rock concentrations below the plow zone along the southern edge of Field 22. Recent sinkhole repairs in the southwestern portion of Field 22 uncovered a Preclassic Hohokam cremation below the plow zone; no other prehistoric deposits were noted in that area.

Historic cultural remains that might be affected by the proposed actions may represent O'odham habitation and activities as well as deposits representing non-Indian, largely Hispanic occupations. While most surface indications were probably destroyed by agricultural practices within the farm, some evidence of historic uses remain. Recent test trenches placed south of San Xavier road encountered a number of historic (probably 1800s) irrigation ditch and a possible reservoir/*cienega*. The largest ditch cross-section was encountered in Field 48 and may be a portion of the Martinez irrigation system that originated at the Punta de Agua spring to the south. Other smaller ditch segments were encountered in trenches along the proposed main irrigation line, laterals, and in the WBSCR flood channel.

Surface artifacts in the southern portion of Field 34 included historic O'odham ceramics (e.g., O'odham, formerly Papago, Glazed). Subsurface testing revealed a series of postholes that appear to represent a portion of a historical fence, corral, or other post feature just below the plow zone.

The 1986 testing project encountered a probable section of the historic Martinez ditch along the southern edge of Field 22. Smaller ditch segments uncovered by the recent testing in Field 18 may represent an extension of the same ditch system. Another large ditch was encountered in Field 3, while smaller ditch segments were encountered in several trenches in the panhandle. Although not detected by either testing project, it is possible that some agriculture-related features, such as ramadas and seasonal houses, were scattered throughout the area and might have survived destruction by plowing.

The majority of historic features located by the two testing projects appear to be irrigation-related ditches, although the 1986 project uncovered several non-irrigation features along the southern edge of Field 20, just north of the San Xavier Mission. While three of these are fire-cracked rock concentrations, one feature contained cobbles and fired adobe brick fragments that may have been debris from the Franciscan Mission (post-1740). One historic pit along the southern edge of Field 12 may be a historic burial (Effland et al. 1989).

To summarize, test trenches along the proposed main and lateral irrigation ROW contained fewer than estimated features, and far fewer prehistoric features than originally anticipated (Stokes 2004). Historic irrigation ditch segments comprised almost half of the approximately 40 features encountered during the project. The ditch features varied in size and were found in both northern and southern sections of the farm area. This suggests that historic irrigation features will be impacted by the pipeline ROW in all areas of the farm. Other historic features encountered by the recent project appear to be limited to Field 34. Historic features were identified by Effland in Fields 20 to 21 just north of the mission, but this area will not be impacted by the irrigation ROW.

Protohistoric and prehistoric cultural deposits and features appear to be clustered in Fields 3, 4, 18, and 22, areas where the pipeline and flood channel construction may impact undisturbed cultural resources. These areas may be extensions of known sites AZ AA:16:44(ASM) and AZ BB:13:14(ASM), respectively. Historic references indicate the SCR floodplain within San Xavier was used for agriculture from at least early historic (and probably prehistoric) times and was subject to regular flooding. The testing program suggests that cultural features are not widespread in the farm area.

Flood Protection. A 500-foot extension to an existing ADOT dike is being considered to direct watershed runoff away from the farm and into the SCR. The extended dike would affect a portion of Locus O of the significant Punta de Agua site, AZ BB:13:16 (ASM). Locus O (indicated as Locus A on some maps) includes a prehistoric ball court in the dike area, and probably other buried features. Coordination with designing engineers has avoided impact to the ball court and minimized disturbance, limiting the damage to the eastern margin of the site.

The proposed WBSCR dike would minimally affect known cultural remains. In 2005, test trenches placed in the dike's footprint south of San Xavier Road encountered sections of historic irrigation ditches; very little evidence of other subsurface cultural deposits was encountered in the area to be affected.

Excavation of the proposed WBSCR floodway north of San Xavier Road could affect cultural remains near the Bridge Site, AZ BB:13:14 (ASM). The exact extent of this site is not known, but cultural remains are exposed in the river bank well north of the bridge, suggesting that remains are present in the fields bordering the river along the eastern edge of the farm. In 2005, a test trench in the proposed floodway area along the southern edge of Field 25 encountered a section of an historic irrigation ditch but no prehistoric deposits. A trench placed in the floodway ROW east of Field 25 did not contain any cultural deposits.

Flood channel excavation in the panhandle (along Fields 2B, 3A, 3K, 4A, 10S, and 11N) may have some impact on buried cultural resources. Test trenches placed along the southern edge of Field 10 in 1986 did not encounter any cultural features in the undisturbed strata. Only a few of the trenches dug in the panhandle in 2005 contained pit features or historic irrigation ditches. Prehistoric deposits and features in the panhandle appear to be concentrated in Fields 3 and 4, an area located downslope from a known Hohokam site (AZ AA:16:44[ASM]).

Mitigation

Mitigation efforts for the San Xavier Farm Rehabilitation project concentrated on intensive testing and data recovery in the areas to be impacted by the construction and placement of the irrigation pipeline and flood control features. Efforts to recover information will minimize the impact by recovering information about cultural resources that would otherwise be destroyed. The results of the intensive testing project will be fully reported and serve as the basis for a monitoring plan to be implemented during the construction phase of the project.

The mitigation plan was developed by the staff of ACS, Reclamation's archaeological contractor (Stokes 2004). The plan was developed in consultation with the Arizona State Historic Preservation Office (SHPO), the District, the Nation, and the BIA. The farm rehabilitation project complies with Federal laws and regulations and District and tribal ordinances that relate to cultural resources. It incorporates data acquired from the 1986 trenching program, as well as more recent information from the CAP Link Project (Glass, Compiler, 2001) and from recent investigations of deeply buried floodplain sites (Gregory 1999, 2001; Mabry 1998). These provided the basis for developing the mitigation plan using a combination of standard and deep trenching along the main pipeline and lateral alignments and new and expanded flood control channels.

As with the 1985 to 1986 ACS investigations, the current project focused efforts on subsurface trenching because:

> ….a surface survey would not detect the presence of suspected buried cultural resources in a dynamic depositional situation such as the floodplain, it was determined that the traditional survey approach for an assessment….

> would not have been appropriate. A methodology was devised that would allow us to test below the surface within the floodplain in an effort to examine not only the cultural universe but also the geological processes that have operated on the floodplain over the past several thousand years. If protohistoric and prehistoric remains were lying under nearly a meter of recent alluvium, then it is likely that not even modern agricultural disturbance (plowing) at a depth of 32 to 36 inches should have brought these deposits to the surface (current plowing is only about 24 inches). Therefore, to assess both the geological and the archaeological records adequately, it was decided to excavate a series of backhoe trenches within the farm area… (Effland et al. 1989).

Much of the farm field area has been subjected to repeated plowing and some leveling over the past 100 years. According to several members of the Farm Cooperative, during mid to late twentieth century some of the fields were ripped to a depth of 4 feet. Any field leveling planned as part of the rehabilitation would stay within the 24-inch active plow zone. Decades of field leveling, repeated plowing, and occasional deep ripping have damaged or destroyed the integrity of subsurface (primarily, but not necessarily exclusively, historic) features to a depth of 2 to 4 feet.

Because of the potential for buried cultural resources and features at depths greater than 2 feet, it was generally agreed that the main mitigation strategy should focus on intensive trenching at depths ranging from about 5 to 10 feet or more in certain areas, and in length from 30 to 150 feet. Flexible data recovery strategies allowed for excavation in deep trenches where the options for expanding the investigation are extremely limited. The main focus of the intensive testing program and data recovery included (preliminary field data are incorporated):

- *Standard Trenching/Data Recovery along the Main and Lateral Pipeline Corridors, Flood Channels and Diversion Dikes* - Standard test trenches (4-feet deep) were placed in the center of the pipeline (ROW), new flood channels, and approximately 25-foot-wide by 5-foot-deep ROW that would be excavated to anchor the riprap armor used to protect the main WBSCR dike. A roughly 8 percent sample of the pipeline and flood control ROW is represented by about 86 standard test trenches totaling about 5,700 linear feet with about 40 features detected. Historic irrigation features make up almost half of the features recovered; other features include an historic corral/fence, a number of roasting pits, other pit features, five burials, trash middens, and a pithouse. The nonirrigation cultural features cluster in Fields 3, 4, and 18.

  Excavation of significant features within the right of way was accomplished by mechanically removing overburden and hand-excavating the features. Some irrigation features were partially excavated while others were recorded in profile only. Because portions of the farm area were in production during the trenching and data recovery phase, archaeologists worked closely with the Farm Cooperative to minimize impacts to farm operations.

- *Deep Trenching/Data Recovery along the Main and Lateral Pipeline Corridors, Flood Channels, and Diversion Dikes* – In order to determine if deeply buried strata within the farm contain early prehistoric strata, an evenly distributed sample of deep, stepped trenches (8 feet deep) was excavated within the standard trenches. Approximately 15 deep trenches representing around 2,025 linear feet were excavated, with one trash midden feature encountered. No Archaic deposits were found.

- *Trenching/Data Recovery near San Xavier Mission* - Previous trenching by ACS in the farm field north of Mission San Xavier del Bac yielded materials dating to the late eighteenth century and likely related to construction efforts at the mission (Effland et al. 1989). Test trenches were placed along laterals located in Fields 20N/S and 21N/S to evaluate the significance of these remains, but no cultural features were encountered.

Construction Monitoring Plan

Based on the results from the trenching and data recovery program, an archaeological monitoring plan will be developed for use during the construction phase of the farm rehabilitation project. The plan will be put together by ACS and developed in consultation with the SHPO, the District, the Nation, and the BIA. Monitoring will concentrate on areas where trenching and data recovery have indicated the potential for or the presence of buried features. Preliminary information suggests that, minimally, monitoring will be called for during construction in Fields 3, 4, 18, 20, 21, and 22, and probably for Fields 14 and 15. The monitoring plan will present strategies for dealing with buried features that would limit impacts to construction schedules.

3.6 Air Quality

3.6.1 Affected Environment

Air quality is evaluated by measurement of ambient concentrations of pollutants that are known to have deleterious effects on human health. Pursuant to the Federal Clean Air Act (CAA), the EPA has established National Ambient Air Quality Standards (NAAQS) for six air pollutants: ozone (O_3), airborne particulate matter (PM_{10} and $PM_{2.5}$),[19] carbon monoxide (CO), sulfur dioxide, nitrogen dioxide, and lead (Table 6). Primary standards are adopted to protect public health, while secondary standards are adopted to protect public welfare. Areas of the country that persistently exceed the NAAQS may be designated “nonattainment” by EPA. Designation of nonattainment submits an area to regulatory control of pollutant emissions so that attainment of the NAAQS can be achieved within a designated time period.

Air quality planning within eastern Pima County, including the Tucson Air Planning Area, is the responsibility of the Pima Association of Governments (PAG). The PAG coordinates with local agencies and the Arizona Department of Environmental Quality to address regional air quality issues. As the designated air quality planning body for eastern Pinal County, the PAG develops regional air quality plans, conducts air quality conformity analysis as a function of transportation planning, and ensures air quality programs are in compliance with Federal, state, and local requirements. Local members of the PAG include the city of Tucson, Pima County, and the Nation.[20]

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[19] PM10 and PM2.5 refers to airborne particulates less than 10 microns and 2.5 microns in diameter, respectively.
[20] Other PAG members are the town of Oro Valley, city of South Tucson, town of Marana, town of Sahuarita, Arizona State Transportation Board, and the Pascua Yaqui Tribe.

Table 6. Criteria Pollutants and Federal Ambient Air Quality Standards.

Pollutant	Regional Sources	Primary (Health Related)		Secondary (Welfare Related)	
		Type of Average	**Standard Level Concentration**	**Type of Average**	**Standard Level Conc.**
CO	Major source is motor vehicles; minor sources are aircraft, trains, and burning vegetation	8-hour	9 ppm (10 µg/m^3)	No secondary standard	
O_3	Major sources of precursor compounds are vehicles and industrial processes	1-hour	35 ppm (40 µg/m^3)	No secondary standard	
PM_{10}	Major sources are vehicle exhaust and road dust; minor sources are construction, agriculture, and industrial processes	24-hour	150 µg/m^3	Same as primary	
		Annual Mean	50 µg/m^3		
$PM_{2.5}$		24-hour	65 µg/m^3	Same as primary	
		Annual Mean	15 µg/m^3		
NO_2	Major source is vehicle exhaust; minor sources are power plants and industry	Annual Mean	0.053 ppm (100 µg/m^3)	Same as primary	
SO_2	Major sources are coal burning, copper smelters, and diesel fuel	24-hour	0.14 ppm (365 µg/m^3)	3-hour	0.5 ppm (1,300 µg/m^3)
		Annual Mean	0.03 ppm (80 µg/m^3)		
Pb	Major sources are leaded gasoline, battery manufacturing, and recycling	Calendar Quarter	1.5 µg/m^3	Same as primary	

Source: Adapted from PDEQ 2002

The farm rehabilitation project is within the boundaries of the Tucson Air Planning Area, which is presently in attainment of national air quality standards. In the 1970s, the Tucson area frequently exceeded the standard for CO and was subsequently classified as nonattainment for that pollutant. Permanent and enforceable measures instituted within the Tucson area (e.g., locally adopted travel reduction and control measures, use of cleaner oxygenated fuels, and improved tailpipe emission standards for new vehicles) gradually reduced CO concentrations to acceptable levels. These sustained improvements allowed EPA to grant final approval for redesignation of the Tucson Air Planning Area to attainment in 2000.

The quality of air in the Tucson Air Planning Area is primarily affected by mobile (i.e., car and truck traffic), industrial, and construction-related sources. Despite regional improvements to air quality, CO, ozone, and particulate matter are of continuing concern. Urban growth and increases in traffic could result in higher concentrations of CO, O_3 precursors (reactive organic gases [ROG]), $PM_{10,}$ and $PM_{2.5}$. Agriculture is not a major source of ROG or CO (Table 7).

Nitrogen dioxide, sulfur dioxide, and lead[21] as measured by the Pima County Department of Environmental Quality (PDEQ) have remained consistently at low levels in the past 10 years (PDEQ 2003), and these criteria pollutants are not problematic for rehabilitation of the San Xavier Farm.

Table 7. Pima County Emission Projections (tons per year).

Source	ROG	NO_x	CO
1996-Agriculture	0.03	0.2	0.2
1996-Mobile Sources	41.1	52.7	382.8
2010-Agriculture	0.04	0.3	0.2
2010-Mobile Sources	50.6	64.9	471.3
2020-Agriculture	0.05	0.3	0.2
2020-Mobile Sources	58.7	75.3	471.3

Source: Reclamation 2000; based on EPA's 1996 emission inventory for Pima County.

In 1999, Pima County violated the PM_{10} standard set by EPA as the result of wind-blown dust (PDEQ 2003). Pima County has developed a Natural Events Action Plan (NEAP) and relevant control measures in an effort to remain in attainment status and protect public health and welfare when ambient levels of PM_{10} are high (PDEQ 2001). Since 1999, PM_{10} concentrations have approached the national standard several times, with the highest recorded in 2001 (149 $\mu g/m^3$ [24-hour maximum]) at the Geronimo Air Monitoring Station in Tucson. Major sources of dust in the Tucson area include unpaved roads, construction sites, unpaved high-traffic industrial areas, sand and gravel operations, and paved roads.

According to PDEQ, agriculture is considered to be a minor source of particulate matter in eastern Pima County (PDEQ 2002). By 2010, agriculture is expected to account for approximately 8 percent of PM_{10} emissions in Pima County (EPA 1996). Most agricultural PM_{10} is in the form of fugitive dust[22] emitted from wind erosion and, to a lesser extent, on-field operations such as tilling, harvesting, and land leveling. Travel on unpaved farm roads is an additional source of PM_{10}.

Fugitive dust is a relatively small component of $PM_{2.5}$. The airborne $PM_{2.5}$ contribution from crop production (i.e., fugitive dust, ammonia, and NO_x) nationally is estimated to be less than 3 percent of all $PM_{2.5}$ emissions (CRS 1997).

3.6.2 Environmental Consequences

No Action

In the absence of the rehabilitation, less than 300 acres of land would be actively cultivated into the foreseeable future. As is the current practice, an additional 500 acres representing most of the remaining cropland would be periodically disked to discourage weed growth. This would expose soils to agricultural wind and tillage dust emissions. Dust emissions from wind would be substantially higher than the proposed action due to the lack of plant cover and irrigation on a

[21] Negligible lead levels have been recorded in Pima County. Lead monitoring was discontinued in 1997 after Pima County received an exemption from EPA's Region 9.

[22] Fugitive dust is a type of nonpoint source air pollution that generally arises from mechanical disturbance of soil, or other granular material, and entrainment of dust particles by the action of turbulent air currents, such as wind erosion.

majority of agricultural fields. Emissions generated during active tillage and harvest operations would be less than the proposed action due to the fewer number of passes per annum required for crop production and weed control. Overall, PM_{10} dust emissions would be approximately 183 tons per year, or 30 percent higher than the proposed action (see analysis in Appendix F).

Proposed Action

Without refined dispersion modeling, it is difficult to assess pollutant impacts that may result from ground-disturbing activities. However, a rough estimate of particulate emissions is possible using generic emission factors developed by the EPA and other sources.

Particulate emissions from the farm were estimated for agricultural land preparation, travel on unpaved roads, wind erosion, and harvest operations. Approximately 908 acres of the 1,100-acre farm would be subject to recurrent cultivation practices. Cultivation on an additional 41 acres representing mesquite plantations also would be initially conducted. Areas planted in trees would not be subject to repeated mechanical tilling.

Farm access is provided by 9.5 miles of unpaved roads that are restricted to local traffic at reduced speeds. The remainder of the farm consists of field borders, vacant land, and a few residential sites, most of which are partly vegetated. One 10-acre field at the north end of the panhandle (Field 1) may have future application for commercial development and will not be brought into agricultural production.

Land Preparation. PM_{10} emissions from tilling and land leveling were calculated using the equation below (EPA 2001). The EPA predictive equation for emission factor is based on the dry silt content of the soil and does not include a correction for soil moisture. Because fugitive dust emissions are reduced when soil moisture is higher, such as occurs during the wettest months of the year and periods following active irrigation, the equation likely overestimates PM_{10}.

$$E = c * k * s^{0.6} * p * a$$

Where:

- $E = PM_{10}$ emissions (lbs per year)
- c = constant of 4.8 lbs per acre-pass
- k = dimensionless particle size multiplier ($PM_{10} = 0.21$)
- s = percentage silt content of soil
- p = number of tillage passes per year
- a = total acreage

The average surface silt content of soil on the farm is 51 percent based on soil sampling conducted by Reclamation. Estimates of the number of passes for each crop type, projected cropping pattern, and acreages were obtained from the farm manager (Bill Worthey, personal communication, November 5, 2003). Annual PM_{10} tillage emissions were then estimated by multiplying the calculated emission factor by the total number of crop-specific acre passes related to tilling activities (Table 8). The annual PM_{10} emission is estimated to be 7.4 tons (14,764 pounds).

Table 8. Estimated Annual PM_{10} Emissions for Agricultural Tilling

Crop	Acres	Passes	Emission Factor	PM_{10} Emissions (lbs)
Alfalfa est.	114	2	10.66	2430
Alfalfa hay	417	0	10.66	0
Sweet corn	49	6	10.66	3134
Traditional squash	24	3	10.66	768
Tepary beans	115	4	10.66	4904
Pumpkins	27	3	10.66	863
Oat hay	125	2	10.66	2665
Trees	41	0	10.66	0
			Total	14,764

Approximately 300 acres would be leveled to improve the efficiency of flood irrigation. Land leveling activities would produce a short-term PM_{10} emission of 3,200 pounds (1.6 tons).

Agricultural Wind Erosion. Emission factors for agricultural wind erosion are not available from EPA; therefore, wind-blown PM_{10} emissions were estimated using emission factors developed by the University of Nevada in wind tunnel testing of desert soils in Clark County, Nevada (James et al. 2000). The testing program examined PM_{10} emissions for different land use categories (i.e., disturbed vacant lands, native desert, and stabilized vacant land) based on wind speeds of 15 miles per hour (mph) or greater (Table 9).

Table 9. Emission Factors for Wind-blown Dust.

Emission Factor Types	PM_{10} Emission Factor (ton/acre/hour) by Wind Speed (mph)		
	15 – 19.9	20 – 24.9	25 -29.9
Disturbed Vacant Land	0.00495	0.00521	0.0064
Undisturbed Native Desert	0	0	0.00257
Stabilized Land	0.00042	0.00034	0.00019

The empirical evidence from wind tunnel tests indicate that wind-derived fugitive dust emissions are more prevalent where desert soils have been destabilized by human activity or livestock. Under natural conditions, desert soils tend to form a mineral and organic crust that is somewhat resistant to wind erosion. Generally, undisturbed soil that has formed a crust has a limited reservoir of available fugitive dust and will only emit during the first hour of a high wind event (Macdougall 2002).

On most soils, relatively high threshold wind speeds are required to cause particles to become suspended in measurable airborne concentrations (Macdougall 2002). In Maricopa County, Arizona, exceedances of the PM_{10} NAAQS from wind-blown dust occurred when sustained hourly winds exceeded 15 mph. Pima County determined 15 mph to be a relevant minimum threshold wind speed for calculating PM_{10} emission totals from wind events within the NEAP action area (PDEQ 2001).

Wind-blown dust emissions from the farm were calculated for cultivated agricultural fields, fallow fields, farm roads, and miscellaneous disturbed land. For active agricultural fields, PM_{10} emissions are assumed to be negligible during periods when irrigated crops are present. Dust emissions were calculated for each land use category only for those periods when average hourly winds equaled or exceeded 15 mph. The emission estimates are based on emission factors derived from Table 10, using the following equation:

$$E = a * f * w$$

where:

$E = PM_{10}$ emissions (tons/year)
a = number of acres for the particular land category
f = wind speed-specific emission factor (tons/acre-hour)
w = number of hours of wind in stated range

Table 10 provides an acreage estimate for irrigated land within the farm. The estimate is seasonally adjusted according to a typical crop mix and irrigation regime. Post irrigation agricultural acreage was determined by subtracting total irrigated acres for each month from the total cultivated acreage.

Table 10. Estimate of Irrigated Acres by Month.

Month	Acres of Irrigated Crops							
	Alfalfa Est.	Alfalfa	Squash	Tepary Beans	Pumpkins	Sweet Corn	Oat Hay	Total
Jan							102	102
Feb							102	102
Mar	93	378	2	40		5	102	620
Apr	93	378	5	40		5	102	623
May	93	378	9	40		10		530
Jun	93	378	13	45	22	15		566
Jul	93	378	17	45	22	20		575
Aug	93	378	20	45	22	20		578
Sep	93	378	13		22	20		526
Oct							102	102
Nov	93						102	195
Dec	93						102	195

The acreage for "vacant" disturbed land was totaled for each month according to land use category (Table11). Only categories of land with no substantial plant cover were included. Roadside ditches and unused fields with minimal vegetation were listed as miscellaneous disturbed land.

Table 11. Land Use Categories.

Month	Acres of Land				
	Highly Disturbed		Stable		Undisturbed
	Cultivated - Post Irrigation	Roads/ Facilities (1)	Fallow	Field Borders/ Ditches/Dikes	Native Desert
January	783	17	10	82	18
February	783	17	10	82	18
March	108	17	10	82	18
April	104	17	10	82	18
May	212	17	10	82	18
June	144	17	10	82	18
July	128	17	10	82	18
August	125	17	10	82	18
September	247	17	10	82	18
October	783	17	10	82	18
November	692	17	10	82	18
December	692	17	10	82	18

(1) Includes farm maintenance and equipment storage area.

Annual emissions were derived by summing the acreages of all nonirrigated land use categories according to month. Acreages were multiplied by the number of hours of wind in each speed range at or above the 15 mph threshold and the appropriate emission factor. Average hourly wind speed was determined using data from the Tucson Arizona Meteorological Network (AZMET) station. No average hourly wind speed in excess of 24.9 mph was recorded by the AZMET station. Emission estimates are provided in Table 12.

Table 12. Annual Emission Estimates for Agricultural Wind Erosion.

Month	Land Type (Acres)			Wind Event (Hours)*		Total PM_{10} Emission (tons)
	Highly Disturbed	Stable	Native Desert	15 – 19.9 mph (EFD = 0.00495) (EFS = 0.00042)	20 – 24.9 mph (EFD = 0.00521) (EFS = 0.00034)	
January	800	92	18	2	1	12.2
February	800	92	18	7	1	33.2
March	125	92	18	10		6.6
April	121	92	18	8		5.1
May	229	92	18	1		1.2
June	161	92	18	2		1.7
July	145	92	18	2		1.5
August	142	92	18	2		1.5
September	264	92	18	5		6.7
October	800	92	18	2		8.0
November	709	92	18	1		3.5
December	709	92	18	9		31.9
					Total	113.1

* Based on 5-year average (1998 to 2002)
EFD=emission factor for disturbed land
EFS= emission factor for stable land
The emission factor for undisturbed native desert is 0 at wind speeds ≤ 24.9 mph.

Unpaved Roads. The EPA has developed an AP-42 equation for assessing particulate emissions for travel on unpaved roads (EPA 2003). Various ranges of source conditions from actual road tests were used in developing the equation, including mean vehicle speed (5 to 55 mph), mean number of wheels (4 to 7), and surface silt content (1.2 to 35 percent). Also factored into the equation is a mitigation expression for moisture input from precipitation. The following AP-42 equation is used to estimate PM_{10} emissions per vehicle mile traveled (VMT):

$$E_{ext} = \frac{k(s/12)^{1}(S/30)^{0.5}}{(M/0.5)^{0.2}} - C\,[(365 - p)/365]$$

where:

E_{ext} = emission factor (lbs/VMT), extrapolated for natural mitigation
k = particle size multiplier for PM_{10} (= 1.8)
s = surface material silt content (= 6.4 percent)
W = mean vehicle weight (13.4 tons)
M = surface material moisture content under dry conditions (= 1 percent)
S = mean vehicle speed (15 mph)
C = emission factor for 1980s vehicle fleet exhaust (0.00047)
p = number of days with > 0.01 inches of rain (=40)

Main farm roads and field roads would be resurfaced with 2 to 4 inches of crushed aggregate. Estimated mean percent silt content for this type of medium was derived from Table 13.2.2-1 of AP-42 Section 13.2.2 (EPA 2003). A surface material moisture content representative of Arizona was used. Vehicle miles traveled and mean vehicle weight data was obtained from the farm manager (Bill Worthey, personal communication, November 5, 2003). Total annual distance traveled by vehicles on unpaved roads was estimated to be 17,570 miles.[23] Five-year average precipitation data for 1998 to 2002 was obtained from the Tucson AZMET station (AZMET 2003).

Vehicle travel on unpaved roads was estimated to contribute 4.6 tons of PM_{10} annually.

Harvest. PM_{10} fugitive dust emission factors for harvest operations are not available from EPA. The University of California at Davis (UC Davis) has quantified harvest emission factors for three crops (cotton, wheat, and almonds) based on field emissions testing of agricultural activities. Table 13 shows the emission factors developed by UC Davis.

Table 13. Harvest Emission Factors.

Activity	**Emission Factor** (lbs PM_{10}/acre pass)
Cotton Harvest	3.4
Almond Harvest	40.8
Wheat Harvest	5.8

Using the UC Davis emission factors, the California Air Resources Board applied an adjustment factor to estimate the relative dustiness of harvesting other crops (Gaffney and Yu 2003). Although based on subjective comparisons, these adjustment factors were developed in consultation with agricultural experts with familiarity with the relative dustiness of harvesting operations. PM_{10} emissions per acre were calculated by dividing the base factor with the adjustment factor. Total PM_{10} harvest emissions are estimated to be 1.7 tons (Table 14).

Table 14. Harvest Emission Factor (EF) Assignments and Total Annual Harvest Emissions for San Xavier Farm Crops.

Crop	**Acres**	**Harvest EF Base Factor**	**Harvest EF Adjustment**	**PM_{10} Emissions/Acre (lbs)**	**Number Harvest Passes/Year**	**Annual PM_{10} Emissions (lbs)**
Alfalfa est.	114	0	1	0	28 (1)	0
Alfalfa hay	454	0	1	0	28 (1)	0
Sweet corn	49	3.4 (Cotton)	2	1.7	1	83
Traditional squash	24	0	0	0	1	0
Tepary beans	115	3.4 (Cotton)	2	1.7	2	391
Pumpkins	27	0	0	0	1	0
Oat hay	125	5.8 (Wheat)	1	5.8	4	2900
					Total	3,374

(1) Alfalfa harvest consists of four passes per cutting, seven cuts per year (personal communication Bill Worthey, Farm Manager 2004).

[23] Farm vehicle mileage use was based on an estimated average of 50 miles/day x 7 days/week x 45 weeks. Use of main farm roads by local traffic is generally restricted to the personal vehicles of homeowners who reside within the farm boundary. Privately owned vehicle mileage was estimated to be 5 miles/day x 7 days/week x 52 weeks. Travel speeds are limited due to the poor condition of some farm roads.

Total PM_{10} Emissions. The total annual PM_{10} emissions from tillage, harvest, vehicle travel, and wind are estimated to be approximately 127 tons. This represents an estimated 56-ton reduction from existing conditions. Application of irrigation water and plant cover to a larger acreage of disturbed soils and capping farm roads with an aggregate base course is responsible for the decline in emissions. Further reduction in PM_{10} emissions is possible through the use of BMPs.

Cumulative Effects

The rehabilitation project would reduce net PM_{10} emissions from the farm.

3.6.3 Mitigation

The farm proposes a wide range of adaptable BMPs for controlling dust emissions. These methods are based on principles that contain or slow airborne movement of soil from fields. Application of the following management practices would reduce wind erosion and PM_{10} emissions from tillage.

- No tillage or soil preparation would occur when the wind speed exceeds 25 mph.
- Plant residues would be left on the soil surface between crop rotations.
- Mulching would be encouraged.
- Woody vegetative wind barriers would be maintained along outer field borders.
- Adequate soil moisture would be maintained during tillage and following planting.
- An aggregate base cover would be applied to main farm and field roads.

3.7 Socioeconomic Resources

3.7.1 Affected Environment

Primary components of the District economy are government, business, and agriculture. Government (District and Federal) is a major employer providing opportunities in management, public administration, and education. Business enterprises include a 1,500-seat bingo and casino operation and the San Xavier Industrial Park with 13 tenant industries and a 23-acre foreign trade zone. Indian arts and crafts shops located in the San Xavier Plaza next to the San Xavier Mission Del Bac and livestock production contribute to the economic health of the District. Many community members also work for businesses in Tucson.

The District labor force is estimated to be 740. Based on the 2000 census, unemployment in the District was almost three times higher than in Pima County or the State of Arizona. Table 15 shows that 1999 median household, family, and per capita incomes in the District were substantially lower than similar levels in Pima County and Arizona. In addition, the percentage of households in the District receiving public assistance is over three times that of Pima County and Arizona, which is also reflected in the high percentage of families and individuals living below the poverty level.

Table 15. Economic Characteristics of the District.

Attribute	San Xavier District	Pima County	Arizona
Population	1,940	843,746	5,130,632
Labor force - unemployed	9.0%	3.2%	3.4%
Median household income	$32,853	$36,758	$40,558
Median family income	$29,543	$44,446	$46,723
Per capita income	$10,533	$19,785	$20,275
Households with public assistance income	10.3%	3.1%	2.9%
Families below poverty level	17.4%	10.5%	9.9%
Individuals below poverty level	24.9%	14.7%	13.9%

Source: 2000 Census, Bureau of Census

In recent years, farm revenues have declined as harvested acres fell. Current revenue from the sale of crops does not cover annual operating costs, requiring supplemental funds provided by Reclamation and the Nation under SAWRSA to sustain the farm. Under the lease agreement, allottees who have leased their interest in land to the San Xavier Cooperative Association are entitled to membership in the association and a share of the net profits of the farm. The absence of a net profit precludes any payment to association members and tightly constrains the number of people employed at the farm.

3.7.2 Environmental Consequences

No Action

Existing conditions would prevail into the foreseeable future.

Proposed Action

Anticipated income to the San Xavier Cooperative Association was estimated based on commercial crop budgets (Westland Resources 2003b). Information used to develop these budgets was provided by the San Xavier Farm Manager and the Arizona Field Crop Budgets developed by the University of Arizona Cooperative Extension Service for Pima County. A number of factors were used to determine the crop budgets, including estimated product prices and yields, operating and maintenance costs, machinery costs, management services, and water supply (see Appendix G). Table 16 provides an estimate of potential farm income based on cost inputs, irrigation method (surface and sprinkler), and crop mix. Factors such as changes in crop yield, crop mix, market conditions, and operating costs (including wages) will influence actual profit margins.

After rehabilitation, lands in active commercial crop production would increase to approximately 909 acres. Another 41 acres would be dedicated to tree plantations from which additional income could be generated from the sale of mesquite flour and nuts. Projected increases in agricultural production would generate an estimated $642,404 of net value product. This relates to a net annual profit per acre of approximately $707 (Table 16).

Table 16. Estimated Annual Farm Income from Commercial Production (adapted from Westland Resources 2003b).

Crop	Acres*		Net Profit		
	Surface	Sprinkler	Surface	Sprinkler	Total
Alfalfa establishment	114		($20,504)		($20,504)
Alfala hay	417	37	$283,520	$24,705	$308,225
Traditional squash	24		$59,514		$59,514
Tepary beans	115		$185,418		$185,418
Pumpkins	27		$9,878		$9,878
Sweet corn	49		$53,953		$53,953
Oat hay	125		$45,920		$45,920
Total acres	**871**	**37**			
Total net profit			**$617,699**	**$24,705**	**$642,404**
Net profit per acre			**$709**	**$668**	**$707**

( ) denotes negative return
* Tree plantations (41 acres) not included in commercial production estimate

The revival of agriculture would stimulate economic growth and provide opportunities to reduce poverty within the District. Because net income from the farm accrues to cooperative members based on their land holding within the lease, financial success of the farm would generate income for cooperative members. In addition, farm rehabilitation would provide additional employment opportunities, job training, and experience for O'odham workers. Indirect economic gains associated with an increase in the local money supply would also accrue.

Perhaps one of the most important benefits of implementing the farm rehabilitation project is to maintain the O'odham agricultural tradition desired by many community members. This effect is intangible and cannot accurately be measured.

Adverse effects of rehabilitation are associated with lost opportunities for more profitable land uses. Land that is cultivated within the farm cannot be leased for residential, industrial, or commercial use. This issue is particularly germane to allotments that front transportation corridors such as San Xavier, Valencia, and Mission roads.

Cumulative Effects

Farm profits would be incremental to other income streams within the District.

3.7.3 Mitigation

No mitigation is recommended.

3.8 Noise

3.8.1 Affected Environment

Noise in an environmental context is defined as any loud or disagreeable sound that creates an annoyance. A noise impact occurs when sound from an emission source noticeably exceeds background levels in an area. Noise-sensitive land uses (e.g., residential, educational, health care, and places of worship) have lower tolerances for increases in noise above normal ambient levels than uses that are predominately commercial or industrial.

Numerous environmental factors determine the level of perceptibility of sound at a given point of reception. These factors include: distance from the source of sound to receptor, surrounding terrain, ambient sound level, time of day, and wind direction. The characteristics of a sound (i.e., loudness and pitch) are also important factors for determining possible noise effects. Generally, at distances greater than 50 feet from a noise source, every doubling of the distance produces a 6 decibel (dBA)[24] reduction in sound. Additional noise attenuation is provided by natural topography; fabricated structures such as buildings, walls, or berms; and vegetation between the point of noise generation and noise reception.

Common descriptors of sound include the Community Noise Equivalent Level (CNEL) and equivalent steady-state noise level (L_{eq}). The CNEL reflects noise exposure over an average 24-hour period with weighting to account for increased sensitivity to noise during the evening and night. The L_{eq} expresses the equivalent (average) steady-state noise for varying levels of sound emitted over a specified period of time. According to common practice for residential communities that are not immediately adjacent to heavily traveled roads or airports, CNEL noise exposure up to 60 dBA is considered acceptable.

Most humans find a sound level of 60 to 70 dBA as beginning to create a condition of substantial noise effect (EPA 1978). The addition of a permanent noise source in a nonindustrial setting should not raise the ambient noise level above 65 dBA (EPA 1978). This would be considered the upper daytime limit in a residential setting since levels above 65 dBA preclude undisturbed speech at a distance of 3 feet (typical conversational speech generates noise levels of 52 to 66 dBA). Similar sound propagation levels were considered by the U.S. Department of Transportation (USDOT), Federal Highway Administration, in determining traffic noise impacts and abatement considerations. According to the USDOT, a traffic noise impact occurs in residential areas (including settings with parks, schools, churches, and hospitals) when L_{eq}(h) (i.e., the equivalent steady-state sound level over a period of 1 hour) approaches or exceeds 67 dBA (USDOT 1995). For purposes of this document, a project-induced increase in average daytime noise to a level higher than 65 dBA would indicate a substantial noise impact on sensitive land uses. A level higher than 60 dBA would indicate a substantial noise impact when nighttime operation of a noise source is anticipated.

The project area is primarily rural, with small agricultural fields and wide expanses of open desert beyond the farm boundary. Scattered community residences, schools, and the San Xavier Mission are located within the District approximately 400 feet from the farm boundary. A high-density residential development occurs within 100 feet of the farm outside the north end of the reservation boundary. Ambient noise levels are generally low, except near San Xavier Road, Vallencia Road, and Interstate 19. Existing sources of noise in the action area include farm equipment, vehicular traffic, and low-flying aircraft. Sensitive noise receptors potentially affected by rehabilitation activities and expanded farm operations consist of residential areas (both on and off the reservation), the San Xavier Mission, and the San Xavier Mission School.

[24] Sound pressure levels (decibels) on the A-scale of a sound meter are abbreviated dBA.

3.8.2 Environmental Consequences

No Action

Only minor increases in noise are anticipated from ongoing farm operations as irrigated agriculture is gradually expanded using supplies of CAP water. The deteriorated condition of existing irrigation systems would generally restrict agricultural production to the fields south of San Xavier Road and along the east side of the farm headquarter complex. Minor repairs to existing irrigation systems and conveyance infrastructure would allow an increase in production from 250 acres to an estimated 300 acres. No substantial impact to sensitive noise receptors would result from modest increases in agriculture.

Proposed Action

Construction. Localized temporary increases in noise would result from construction of flood protection structures, irrigation water distribution facilities, and leveling fields, including operation of earth-moving equipment, trucks, and concrete mixers. Temporary increases in construction vehicle traffic would represent a minor source of noise on farm roads and local highways.

Noise emissions resulting from construction of water conveyance systems would not affect noise-sensitive land uses. These systems would be constructed at distances greater than 500 feet from the nearest sensitive land uses. The distances involved would attenuate peak noise levels below 65 dBA at sensitive receptor locations.

Rehabilitation of farm fields would include leveling to improve drainage. Noise impacts to sensitive land uses would occur within 500 feet of equipment being used for leveling fields. Leveling activities would generate intermittent peak noise levels approaching 67 dBA at the San Xavier Mission and San Xavier Mission School and 79 dBA along the outer margins of the off-reservation Los Reales Improvement District residential area. Noise levels would vary in intensity as leveling equipment travels across the fields, dropping below 65 dBA at distances greater than 500 feet. Land leveling would occur during daylight hours when occasional loud noises are more tolerable. No one receptor is expected to be exposed to equipment noise of long duration; therefore, extended disruption of normal activities is not expected. Impact on sensitive land uses would be limited to a few hours during the leveling operation. Average daytime noise levels (L_{eq}) would be below 65 dBA. No substantial noise impact would occur.

Widening the Los Reales West and South Flood Channels would introduce sporadic peak construction noise within the range of 75 to 85 dBA along the outer margins of the Los Reales residential district east of the panhandle. Most noise would be dampened by existing block walls and other spatially interposed structures. Disruption of normal activities or sensitive land uses is not anticipated. Construction would be limited to daylight hours.

Table 17 illustrates noise levels associated with common heavy construction equipment. For comparison, highway traffic traveling at 75 miles per hour propagates mean noise levels of approximately 70 to 85 dBA at a distance of 50 feet (USDOT 1995).

Table 17. Noise from Common Construction Equipment (dBA).

Equipment	50 Feet from Source	100 Feet from Source	500 Feet from Source	1000 Feet from Source
Augered earth drill	80	74	60	53
Bulldozer	80	74	60	53
Backhoe	83-86	77-80	63-66	56-59
Grader	85	79	65	58
Concrete mixer truck	85	79	65	58
Dump truck	80	74	60	53
Chain saw	75-81	69-75	55 - 61	48-54

Source: derived from Cowan 1994 and EPA 1974

Farm Operation. Since 1970, the Nebraska Tractor Test Center has measured sound levels at the operator's station of a representative number of farm tractors. The average sound level of all new tractors in 1970 was over 98 dBA at maximum power and nearly 95 dBA at 50 percent maximum pull (OSU 2003). Most newer models of tractors today still emit noise at or above 91 dBA at maximum power. Normal cultivation practices would likely propagate noise in ranges shown in Table 17 for grader operation.

Intermittent sources of noise would ensue from farming activities when farm equipment is in operation. Noise impacts associated with farming is a function of distance from the noise-generating equipment. In general, noise impacts on sensitive land uses would be greatest when farm equipment is operating within 500 feet of the San Xavier Mission and the San Xavier Mission School (outer portions of Field 20S), and residential neighborhoods (outer portions of Fields 3D to 3K, 4A to 4C, and 12N). Noise levels would vary in intensity as the farm equipment travels across the fields, dropping below 65 dBA at distances greater than 500 feet. Average daytime noise levels would be below 65 dBA. No substantial noise impact would occur.

Worker Safety. A 1990 National Institute of Health Consensus Panel on noise stated that the average person could experience a long-term average daily exposure of 73 to 76 dBA of ambient noise without suffering hearing loss. This exposure level approximates a highly urbanized site with some background construction noise. The current Occupational Safety and Health Administration (OSHA) noise standard for the workplace is a maximum time-weighted daily exposure level of 90dBA (equivalent to 8-hour exposure to the sound of a lawn mower). However, OSHA requires that workers be placed on a hearing conservation program if they are exposed to average noise levels of 85 dBA or greater over an 8-hour work day. The National Safety Council recommends 85 dBA for 8 hours of exposure as the safe limit for farm operations. Appropriate engineering controls or personal protective equipment would be utilized to protect workers if this OSHA standard is exceeded.

The proposed agricultural development would not jeopardize health through excessive exposure to noise.

Cumulative Effects

Noise from rehabilitation activities and ongoing farm operations would be incremental to other sources of noise affecting the project area.

3.8.3 Mitigation

- Construction and tillage would be restricted to daylight hours.

- Exhaust mufflers on construction equipment and farm tractors would be maintained in good working condition.

- Appropriate engineering controls or personal protective equipment would be utilized to protect workers from excessive noise.

3.9 Indian Trust Assets

3.9.1 Affected Environment

Indian Trust Assets are legal interests in assets held in trust by the United States through the Department of 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.

All allotted land within the reservation is considered a trust asset. Approximately 59 percent of land within the District is allotted, and 41 percent is considered a resource of the Nation controlled by the District (Franzoy Corey 1988). The San Xavier farm consists almost entirely of allotted land.

3.9.2 Environmental Consequences

No Action

Existing conditions would prevail into the foreseeable future. The District's CAP water allocation that is excess to the needs of the farm would be available for other uses granted by the Arizona Water Settlements Act of 2004.

Proposed Action

The rehabilitation project is part of an overall plan to revitalize agriculture within the District and apply the water right under SAWRSA to benefit community members. Rehabilitation is also consistent with the terms and conditions of the farm lease. In order to encourage allottee input under the planning process, the District has conducted numerous community participation meetings since the project was first conceptualized in the 1980s. Project implementation would enhance the value of community land and water resources.

Cumulative Effects

No cumulative effects are anticipated.

3.9.3 Mitigation

- Flow easements and ROW would be acquired by the United States for project effects on allotted land outside the farm lease area.

3.10 Environmental Justice

3.10.1 Affected Environment

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

3.10.2 Environmental Consequences

No Action

Existing conditions would prevail into the foreseeable future.

Proposed Action

The farm rehabilitation project would facilitate effective and efficient use of land and water resources within the District to enhance economic growth, development, and self-sufficiency. In addition, the project would benefit community members by providing additional employment opportunities and increasing farm revenues. Economic opportunities provided by the project are consistent with cultural and historic land uses.

The project would also allow the District to more efficiently utilize their allocation of CAP water and enhance the adequacy and dependability of their agricultural enterprise. No residents would be relocated, and no Native American or minority populations would be exposed to disproportionately high-adverse health or environmental effects resulting from revitalization of agriculture within the District.

Cumulative Effects

No cumulative effects are anticipated.

3.10.3 Mitigation

No mitigation is recommended.

CHAPTER 4 - AGENCIES AND PERSONS CONSULTED

List of Preparers

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Other Contributors

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Scott Rogers, Hydrologist, San Xavier District
Bill Worthey, Farm Manager, San Xavier Cooperation Farm

List of Agencies and Persons Contacted

Ak-Chin Indian Community
Arizona Department of Environmental Quality
Arizona Department of Transportation
Arizona Department of Water Resources
Arizona Game and Fish Department
Arizona State Historic Preservation Office
Bureau of Indian Affairs
Bureau of Land Management
Center for Biological Diversity
City of Tucson
Gila River Indian Community
Honorable Jim Kolbe, U.S. Congressman
Honorable Jon Kyl, U.S. Senator
Honorable John McCain, U.S. Senator
Hopi Tribe
Natural Resources Conservation Service
Pima County Department of Environmental Quality
Pima County Flood Control District
San Xavier Cooperative Farm Board
Salt River Pima-Maricopa Indian Community
Sierra Club
Tohono O'odham Cultural Affairs Office
Tohono O'odham Legislative Agricultural Committee
Tohono O'odham Legislative Cultural Preservation Committee
Tohono O'odham Legislative Natural Resources Committee
U.S. Army Corps of Engineers
U.S. Fish and Wildlife Service
U.S. Geological Survey

CHAPTER 5 - RELATED ENVIRONMENTAL LAWS/DIRECTIVES

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

National Environmental Policy Act (NEPA) of 1969, as amended - NEPA requires Federal agencies to evaluate the potential environmental consequences of major Federal actions. An action becomes "Federalized" when it is implemented, wholly or partially funded, or requires authorization by a Federal agency. The intent of NEPA is to promote consideration of environmental impacts in the planning and decision-making process prior to project implementation. NEPA also encourages full public disclosure of the proposed action, accompanying alternatives, potential environmental effects, and mitigation.

This EA was prepared in accordance with the requirements of NEPA. Public involvement activities included informal meetings, notices that were posted in the project area, and information mailed to potentially affected members of the District. Two public scoping meetings were held at the San Xavier District Center in early 2004. Each scoping meeting included a formal presentation, informational displays, and an opportunity for people to discuss the project individually with Reclamation, District, and farm personnel. A total of 42 people attended the scoping meetings. No written comments were submitted to Reclamation during the scoping period. A draft EA was distributed for 30-day public review on June 17, 2005. Only one letter of comment was received by Reclamation on the draft EA (see Appendix J).

Fish and Wildlife Coordination Act (FWCA) of 1934, as amended - The FWCA provides a procedural framework for the consideration of fish and wildlife conservation measures in Federal water resource development projects. Coordination with the FWS and State wildlife management agencies are required on all Federal water development projects.

A Fish and Wildlife Coordination Act Report (CAR) was requested on December 23, 2003. The FWS prepared a final CAR on August 26, 2004 (see Appendix H).

Endangered Species Act (ESA) of 1973, as amended - The ESA provides protection for plants and animals that are currently in danger of extinction (endangered) and those that may become so in the foreseeable future (threatened). Section 7 of this law requires Federal agencies to ensure that their activities do not jeopardize the continued existence of threatened or endangered species or adversely modify designated critical habitat.

A Biological Assessment which concluded “no effect” to the lesser long-nosed bat and Pima pineapple cactus and “may affect, not likely to adversely affect” to the pygmy-owl was submitted to the FWS on December 21, 2004. In a letter dated January 31, 2005, the FWS concurred that the proposed action was not likely to adversely affect the pygmy-owl. In accordance with FWS policy not to issue concurrence letters on no effect findings, the January 31, 2005, letter was silent on Reclamation’s no effect determination regarding the Pima pineapple cactus and lesser long-nosed bat.

Migratory Bird Treaty Act (MBTA) of 1918, as amended – The MBTA is the domestic law that implements the United States' commitment to the protection of shared migratory bird resources. The MBTA prohibits the take, possession, import, export, transport, selling, or purchase of any migratory bird, their eggs, parts, or nests.

Implementation of the project would not violate provisions of the MBTA.

Clear Air Act (CAA) of 1963, as amended - The CAA requires that any Federal entity engaged in an activity that may result in the discharge of air pollutants must comply with all applicable air pollution control laws and regulations (Federal, State, or local). It also directs the attainment and maintenance of NAAQS for six different criteria pollutants including carbon monoxide, ozone, particulate matter, sulfur oxides, oxides of nitrogen, and lead.

Air quality in the project area is in attainment of NAAQS. Short-term construction emissions associated with the proposed action would have localized and minor effects on air quality. Agricultural dust emissions would be less under the proposed action than the status quo.

Clean Water Act (CWA) of 1977, as amended- The CWA strives to restore and maintain the chemical, physical, and biological integrity of the nation's waters by controlling discharge of pollutants. The basic means to achieve the goals of the CWA is through a system of water quality standards, discharge limitations, and permits. Section 404 of the CWA identifies conditions under which a permit is required for actions that result in placement of fill or dredged material into waters of the United States. In addition, a 401 water quality certification and 402 National Pollutant Discharge Elimination System (NDPES) permit are required for activities that discharge pollutants to waters of the U.S. On District land, the EPA has primacy for issuing Water Quality Certifications (or waivers) and NPDES permits.

Reclamation would obtain coverage under the Section 402 NPDES general storm water permit for construction activities. A review by the U.S. Army Corps of Engineers determined that the project is not subject to their jurisdiction under Section 404 of the CWA (see Appendix I).

National Historic Preservation Act of 1966, as amended (NHPA) – Federally funded undertakings that have the potential to affect historic properties are subject to Section 106 of the NHPA. Under this act, Federal agencies are responsible for the identification, management, and nomination to the National Register of Historic Places of cultural resources that would be affected by Federal actions. Consultation with the Advisory Council on Historic Preservation and the SHPO is required when a Federal action may affect cultural resources on, or eligible for inclusion on, the National Register.

Consultation with the SHPO and the Nation regarding effects to historic properties within the project area was completed by Reclamation in 2004. No areas of traditional cultural importance are known in the project area. Mitigation for project effects is listed in section 3.5.2.

Resource Conservation and Recovery Act (RCRA), as amended - RCRA establishes thresholds and protocols for managing and disposing of solid waste. Solid wastes that exhibit the characteristic of hazardous waste, or are listed by regulation as hazardous waste, are subject to strict accumulation, treatment, storage, and disposal controls.

The project is not expected to generate hazardous waste as defined and regulated under RCRA. To minimize the possible impact of hazardous materials (petroleum, oil, and lubricants) used during construction, all equipment would be periodically inspected for leaks. Any significant leaks would be promptly corrected. Nonhazardous solid waste would be disposed of in accordance with State and Federal regulations at an EPA-approved landfill. Spills and disposal of contaminated media would be managed in accordance with State and Federal requirements.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended – FIFRA requires all persons who apply pesticides classified as restricted use be certified or that they work under the direct supervision of a certified applicator. Aquatic applicators must demonstrate a practical knowledge of the secondary effects that can be caused by improper application rates, incorrect formulations, and faulty application of restricted pesticides. Applicators must have a practical knowledge concerning potential effects on plants, birds, beneficial insects, and other organisms that may be present in aquatic environments.

The farm would employ organic methods to control insects and weeds. No commercial insecticides or herbicides would be utilized.

Farmland Protection Policy Act (FPPA), as amended - The FPPA requires identification of proposed actions that would adversely affect any lands classified as prime and unique farmlands. The Natural Resources Conservation Service administers this act to preserve farmland.

There are no prime and unique farmlands designated by Natural Resources Conservation Service in the project area.

EO 11988 (Floodplain Management) - This Presidential directive encourages Federal agencies to avoid, where practicable alternatives exist, the short- and long-term adverse impacts associated with floodplain development. Federal agencies are required to reduce the risk of flood loss; minimize the impacts of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains in carrying out agency responsibility.

The proposed flood protection measures would protect farm and residential properties. Changes in 100-year frequency flows associated with the WBSCR would have a minor effect on uninhabited land west of the farm. Project implementation would decrease the impact of floods on human safety, health, and welfare.

EO 11990 (Wetlands) - This Order directs Federal agencies, in carrying out their land management responsibilities, to take action that will minimize the destruction, loss, or degradation of wetlands and take action to preserve and enhance the natural and beneficial values of wetlands.

The project would not affect wetlands.

EO 12898 (Environmental Justice) - This Order directs Federal agencies to identify and address, as appropriate, disproportionately high and adverse human health and environmental effects of their programs, policies, and activities on minority and low-income populations.

No high and disproportional adverse impacts on low income or minority populations as defined by EO 12898 would result. See section 3.10 for additional information.

Secretarial Order 3175 (Indian Trust Assets) - Indian Trust Assets are legal interests in assets held in trust by the U.S. Government for Indian tribes or individual Indians. Assets are anything owned that has monetary values. They can be real property, physical assets, or intangible property rights. Common examples of Trust Assets include lands, minerals, water rights, hunting rights, other natural resources, money, or claims.

Project development would enhance the value of community land and water resources. ROW and project-induced flooding affecting allotments outside the farm lease area would require compensation to the affected allottees by the United States. See section 3.9 for additional information.

CHAPTER 6 – LITERATURE CITED

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