RECLAMATION

Managing Water in the West

Revised Draft Environmental Assessment

Community Water Company of Green Valley
Central Arizona Project Water Delivery System
Pima County, Arizona

U. S. Department of the Interior
Bureau of Reclamation
Phoenix Area Office
Glendale, Arizona

April 2010

REVISED DRAFT ENVIRONMENTAL ASSESSMENT

COMMUNITY WATER COMPANY OF GREEN VALLEY
CENTRAL ARIZONA PROJECT WATER DELIVERY SYSTEM
PIMA COUNTY, ARIZONA

PREPARED FOR

U.S. BUREAU OF RECLAMATION

PREPARED BY

ERO RESOURCES CORPORATION

DENVER, COLORADO

WWW.ERORESOURCES.COM

Interior and Reclamation Mission Statements

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

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

ABBREVIATIONS AND ACRONYMS

AAC	Arizona Administrative Code
ACC	Arizona Corporation Commission
ACHP	Advisory Council on Historic Preservation
ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
AF	acre-feet
AFY	acre-feet/year
AGFD	Arizona Game and Fish Department
AL	Action Level
ANC	American Nevada Company
ARS	Arizona Revised Statutes
ASLD	Arizona State Land Department
ASM	Arizona State Museum
AZPDES	Arizona Pollutant Discharge Elimination System
BA	Biological Assessment
bgs	below ground surface
CAGRD	Central Arizona Groundwater Replenishment District
CAP	Central Arizona Project
CAWCD	Central Arizona Water Conservation District
CC&N	Certificate of Convenience & Necessity
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CNF	Coronado National Forest
CWA	Clean Water Act
CWC	Community Water Company of Green Valley
Corps	U.S. Army Corps of Engineers
DEA	Draft Environmental Assessment
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ERO	ERO Resources Corporation
ESA	Endangered Species Act of 1973, as amended
FEMA	Federal Emergency Management Area
FICO	Farmers Investment Company
FONSI	Finding of No Significant Impact
FR	Federal Register
FWCA	Fish and Wildlife Coordination Act
FWS	U.S. Fish and Wildlife Service
gpm	gallons per minute

GSF	Groundwater Savings Facility
GVDWID	Green Valley Domestic Water Improvement District
I-19	Interstate 19
ITA	Indian Trust Assets
Listed species	species listed as federally threatened or endangered under the ESA
LLNB	lesser long-nosed bat
LOI	Letter of Intent between CWC and Augusta Resource Corporation
M&I	municipal and industrial
MCL	Maximum Contaminant Level
mg/l	milligrams per liter
MPO	mine plan of operation
NAAQS	National Ambient Air Quality Standards
ND	not detected
NEPA	National Environmental Policy Act
NH	Nogales Highway
NHPA	National Historic Preservation Act
NPDES	National Pollutant Discharge Elimination System
NR	not reported
NRHP	National Register of Historic Places
ONH	Old Nogales Highway
pCi/l	picocuries per liter
PAG	Pima Association of Governments
PDEQ	Pima County Department of Environmental Quality
P.L.	Public Law
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in diameter
PM_{10}	particulate matter less than or equal to 10 microns in diameter
PMR	Pima Mine Road
PMRRP	Pima Mine Road Recharge Project
PPC	Pima pineapple cactus
ppm	parts per million
Proposed Project	CWC CAP water delivery system
Reclamation	Bureau of Reclamation
RH	Rural Homestead
Rosemont	Rosemont Copper Company
ROW	right-of-way
SCADA	Supervisory Control and Data Acquisition
SDCP	Sonoran Desert Conservation Plan
Section 7	Section 7 of the ESA
SHPO	State Historic Preservation Office
SMCL	Secondary MCL
Stantec	Stantec Consulting, Inc.

STD	Standard
STU	Standard Testing Units
TAMA	Tucson Active Management Area
TAPA	Tucson Air Planning Area
TDS	total dissolved solids
µg/l	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
µS/cm	microsemens per centimeter
USC	Upper Santa Cruz
USC/PUG	Upper Santa Cruz Providers and Users Group
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WWTP	wastewater treatment plant

Unit Conversion Guide

For the reader's convenience, the following table has been included to serve as a guide in converting measurements found in this document between U.S. measurements and metric.

CONVERSION OF U.S. TO METRIC MEASUREMENTS	
U.S. Measurement	**Metric Measurement**
Distance	
1 inch	2.54 centimeters
1 foot	0.31 meter
1 mile	1.61 kilometers
Area	
1 square foot	0.09 square meter
1 acre	0.41 hectare
CONVERSION OF METRIC TO U.S. MEASUREMENTS	
Metric Measurement	**U.S. Measurement**
Distance	
1 centimeter	0.39 inch
1 meter	3.28 feet
1 kilometer	0.62 mile
Area	
1 square meter	10.76 square feet
1 hectare	2.47 acres

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REVISED DRAFT ENVIRONMENTAL ASSESSMENT

COMMUNITY WATER COMPANY OF GREEN VALLEY
CENTRAL ARIZONA PROJECT WATER DELIVERY SYSTEM
PIMA COUNTY, ARIZONA

Preface

An initial draft Environmental Assessment (DEA) for the Community Water Company of Green Valley's (CWC) proposed construction and operation of its Central Arizona Project (CAP) Water Delivery System and Recharge Facility was made available for a public review and comment period on March 6, 2009. Subsequent to the end of the public review and comment period, the Bureau of Reclamation (Reclamation) received a letter from CWC that stated, in part, "…the cost to develop and operate the recharge facility proposed in the subject EA will not be supportable by Community Water over the long haul." CWC indicated its intention to identify an alternate location for the recharge facility associated with the CAP Water Distribution System.

After a rigorous evaluation of 10 potential recharge areas, CWC identified two alternate recharge sites, located adjacent to each other, about 1.6 miles west of the originally proposed recharge site. Both of these sites were found to be more suitable than the original recharge location. Evaluation of these two sites indicates either site would be capable of recharging up to 7,000 acre-feet per year (AFY), which is the preferred capacity initially identified in the original scoping notice to the public. The evaluation also indicated resulting impacts would be similar to those described in the original DEA.

The DEA has been revised to reflect the new recharge site alternatives, an increase in the capacity of the recharge facility (from 5,000 to 7,000 AFY), and an optional tie-in to the CAP terminus, in case CWC is not able to connect into the Pima Mine Road Recharge Project Lateral. The action alternatives presented in this revised DEA have been adjusted to accommodate these refinements to the proposed project, and are described in more detail in Section 2.0—Description of Alternatives.

With the elimination of the original recharge site, there now are no anticipated effects to Pima pineapple cactus or the lesser long-nosed bat. This is explained in more detail in Section 3.4.2.2.3—Biological Resources—Environmental Consequences—Preferred Alternative—Threatened and Endangered Species. Reclamation has also revised the DEA, where appropriate, in response to comments already received.

This revised DEA is being issued for another public review and comment period. Reclamation welcomes comments regarding the adequacy of this revised DEA and will take all public comments received, on both the initial draft and this revised draft, into consideration prior to making a decision regarding whether a Finding of No Significant Impact (FONSI) is appropriate, or an environmental impact statement (EIS) should be prepared. Comments that were previously submitted do not have to be resubmitted. All comments received on both versions of the EA, and Reclamation's responses, will be included in the final EA.

1.0 Purpose and Need

1.1 Introduction and Background

The Community Water Company of Green Valley (CWC) has submitted its final plans to the Bureau of Reclamation (Reclamation), for taking and using its Central Arizona Project (CAP) entitlement. Reclamation's proposed action is to approve CWC's plans. This Environmental Assessment (EA) has been prepared to describe and assess the environmental consequences that may result from construction and operation of CWC's proposed CAP water delivery system, which consists of a pipeline, recharge site, and related facilities (Proposed Project) to convey and store CAP water from the existing pipeline that delivers water to the Pima Mine Road Recharge Project (PMRRP) to a location near the northern edge of the CWC service area.

This revised DEA has been prepared in compliance with the National Environmental Policy Act of 1969, as amended (NEPA), the Council on Environmental Quality (CEQ) regulations implementing NEPA, and amendments of the Department of the Interior's regulations for implementing NEPA (73 Federal Register [FR] 61292; October 15, 2008). Reclamation is the lead agency responsible for preparation of this revised DEA. Cooperating agencies in the preparation of this revised DEA are the Arizona State Land Department (ASLD), the Arizona Department of Water Resources (ADWR), and the Central Arizona Water Conservation District (CAWCD). ASLD is a cooperating agency due to its expertise in and responsibility for state land and associated resources in the vicinity of the Proposed Project. ADWR is also a cooperating agency due to its expertise in and responsibility for water resources throughout Arizona. CAWCD is a cooperating agency due to its role as contractor for the CAP water service subcontracts and operator of the CAP system.

CAP was authorized as part of the Colorado River Basin Project Act of 1968 (Public Law [P.L.] 90-537). CAP's principal purpose is to furnish water for irrigation and municipal and industrial (M&I) use in central and southern Arizona through the importation of Colorado River water, thereby reducing the use of ground water[1] in the CAP service area. CAP delivers Colorado River water to Arizona water users through a system of pumping plants, aqueducts, dams, and reservoirs.

In 1982, Reclamation prepared an Environmental Impact Statement (EIS) to address the potential environmental impacts associated with the allocation of CAP water to M&I water users, non-Indian agricultural users, and Indian Tribes (Reclamation 1982). The EIS included a description of each water user's preliminary plans for the delivery and use of CAP water, and a general description of the resulting environmental impacts if that information was available at the time the EIS was prepared. On May 17, 1985, CWC entered into a CAP water service subcontract with Reclamation and the CAWCD for

[1] In this EA, "ground water" is used to refer to underground water in a technical context, "groundwater" is used in a legal context or as a proper name, as in Central Arizona Groundwater Replenishment District (CAGRD).

1,100 acre-feet/year (AFY) of CAP water. This CAP water service subcontract was later amended in 1997 when New Pueblo Water Company transferred 237 AFY to CWC. CWC also received 1,521 AFY as a result of the Arizona Water Settlements Act in 2005, making CWC's total CAP water entitlement equal to 2,858 AFY.

To contract for CAP water, each non-Indian water user given a CAP entitlement is required to enter into a three-party water service subcontract with both Reclamation and CAWCD. As part of its procedures for approving these water service subcontracts, Reclamation includes a second level of environmental review for each CAP water user. For this second level environmental review, Reclamation requires each water user to provide specific plans for taking and using its CAP water entitlement. These plans are compared against the scenarios described in the 1982 EIS to determine whether the plans are consistent with the original plans, or whether additional environmental review and documentation are needed.

1.2 Purpose and Need

Reclamation

Prior to entering into the initial subcontract in 1985, Reclamation reviewed CWC's conceptual plan for taking and using its CAP water entitlement through treatment and direct use. Reclamation determined the plan would not result in significant impacts. Because CWC did not anticipate implementing that plan in the reasonably foreseeable future, Reclamation indicated that once CWC finalized its plan for taking and using its CAP water entitlement, the plan would need to be submitted for review and possible final environmental clearances prior to commencement of construction. For purposes of this revised DEA, a final plan means that specific project components, which may have an impact on the environment, have been provided to Reclamation. In this context, a final plan does not mean that all engineering details or financing arrangements have been completed.

In April 2008, CWC provided Reclamation with a final plan for taking and using its CAP water entitlement ("Proposed Project"). The Proposed Project indicates CAP water would be recharged near the CWC service area to help offset the declining water table and provide an alternative water supply if needed because of water quality or other issues with CWC's existing wells.

Reclamation determined an EA was required because:

- A substantial amount of time has elapsed since Reclamation's original review of the conceptual plan;
- The areas to be impacted and environmental conditions have changed since the conceptual plan was submitted; and
- The final plan (Proposed Project) includes the construction and operation of a recharge facility.

At the end of the public review and comment period for the DEA in June 2009, CWC withdrew the proposed location of the recharge facility identified in the March 2009 DEA because it was too costly. Alternative sites were researched and selected in fall 2009. Details of the Proposed Project are described in Section 2.3—Proposed Action.

Project alternatives involving an adjacent recharge site, a different location for connection to the CAP system, and two smaller pipeline capacities are described in Section 2.4—Additional Action Alternatives.

Reclamation must evaluate the environmental effects of CWC's Proposed Project for taking and using its CAP entitlement, and identify environmental mitigation measures if appropriate, pursuant to the requirements of the CAP water service subcontract. Based upon this revised DEA, and careful consideration of any comments received during the public review and comment period, Reclamation will determine whether a Finding of No Significant Impact (FONSI) is appropriate, or whether an EIS must be prepared prior to approving CWC's Proposed Project.

Community Water Company

The purpose of CWC's Proposed Project is to enable CWC to deliver its CAP entitlement to its water service area. The Proposed Project is needed to provide a renewable source of M&I water to CWC, to help relieve ground water overdraft in this region consistent with the purpose of the CAP's authorizing legislation, and to provide an alternative source of water should CWC's ground water wells become unusable due to water quality issues or some other problem.

Ground water levels within the Green Valley/Sahuarita area have declined significantly over the past 50 years (ADWR 2006a, p. 34[2]). Between 1940 and 1995, ground water elevations directly west of the Farmers Investment Company (FICO) facilities declined 100 to 150 feet (Id., p. 3). The continued lowering of the water table is also confirmed in a 2007 report by Pima County that states "the water table in Green Valley/Sahuarita area has been declining in past years, and is expected to continue to decline even faster as water demands, through population growth and other factors, continue in the Green Valley area" (Pima County 2007a, p. 1). CWC currently supplies all of its demand by pumping ground water, which is treated by chlorination and reduction of arsenic. Studies conducted for CWC indicate that the population of its service area, and thus its water demand, will more than double between the current level and about 2020. The continued reduction of the water level in the Green Valley/Sahuarita area has raised concerns regarding the quantity of available ground water in the future. The finite water supply in the Green Valley/Sahuarita area and continuous lowering of the ground water table are prime reasons that CWC subcontracted for a CAP water entitlement. CWC has maintained and paid for a CAP water entitlement since 1985 to assure water availability for its members (CWC 2007a). However, CWC has not taken delivery of any CAP water to date due to the lack of a water delivery system.

[2] Page numbers are included with the citation only where specific data or analyses are referenced and where the information would be otherwise difficult to locate in a large document.

Water quality in the Green Valley/Sahuarita area, particularly for CWC wells, is also a concern, primarily due to a sulfate plume from the Sierrita Mine tailings impoundment (HGC 2008, pp. 1–8). The tailings cover approximately 3,600 acres just west of Green Valley. Freeport-McMoRan Sierrita, Inc. (Freeport-McMoRan) is the current owner of the mine and tailings impoundment. Elevated concentrations of sulfate were first discovered in the vicinity of the tailings impoundment during the 1970s. In the 1980s, the origin of the sulfate was determined to be seepage from the various mine tailings impoundments in the area. The mining company installed interceptor wells along the southeastern and eastern boundaries of its tailings impoundment to intercept the seepage and return it for use at the mine. However, the seepage has continued and the sulfate plume is moving downgradient to the east and northeast (HGC 2007, pp. 35, 36). Freeport-McMoRan is developing a mitigation plan to control the sulfate plume under a Mitigation Order from the Arizona Department of Environmental Quality (ADEQ) (ADEQ 2008). Use of two CWC production wells has been discontinued due to sulfate contamination of the ground water aquifer in the vicinity of the Sierrita Mine. These wells were replaced for CWC by Freeport-McMoRan. CWC is concerned about the possibility of future contamination of additional potable water wells.

Another consequence of the declining water level in the local aquifer has been the subsidence of the ground surface in areas of heavy pumping. Ground subsidence occurs when aquifer layers are dewatered due to cyclical or continuous lowering of the water table. When the water level in the aquifer declines, the aquifer materials compress and are no longer able to store as much water. The resulting compression of the aquifer layers lowers the ground surface and may cause changes to floodplain boundaries or lead to the creation of soil fissures. Ground subsidence has been a serious problem in parts of central Arizona such as Stanfield and Eloy, where agriculture withdrew significant ground water. During the period from February 2007 to March 2008, ADWR recorded net ground surface subsidence of almost 1.5 inches in some areas near Green Valley/Sahuarita (see Section 3.6.1.1—Ground Water Resources—Regional Aquifer).

The Proposed Project would deliver CWC's CAP entitlement to the vicinity of the CWC service area. The delivery of the CAP water would help offset the overdraft of the ground water aquifer in the Green Valley/Sahuarita area by providing a renewable water supply. Recharging water in the vicinity of the CWC service area would help maintain the aquifer levels near the point of use. Delivery of CAP water to the CWC service area also would provide an alternative water source in the event that additional CWC wells become contaminated or have other problems in the future. In addition, the concentrated withdrawal of water has created subsidence of the ground surface in the areas of the heaviest pumping. Delivering CAP water to the Green Valley/Sahuarita area for recharge in the vicinity of the pumping would help offset the decline of the water table and would help reduce the potential for ground subsidence.

1.3 Project Location

The CWC service area is in Pima County, Arizona, approximately 20 miles south of Tucson (Figure 1).[3] CWC's service area is approximately 8 square miles, extending roughly between Anamax Road on the north, the Santa Cruz River on the east, the Sierrita Mine on the west, and Mission Twin Buttes Road on the south.

The location of the pipeline, recharge site, and related facilities is described in detail in Section 2.3—Proposed Action. Most of the Proposed Project facilities would be on previously disturbed land within existing rights-of-way (ROWs).

The Proposed Project is in the Santa Cruz Valley on the edge of the Sonoran Desert. Elevations along the pipeline and recharge facilities range from about 2,800 to 3,000 feet. Several copper mines are west of the Proposed Project on the flanks of the Sierrita Mountains. Southeast of the Proposed Project is the Santa Rita Experimental Range, where research on the Sonoran Desert ecosystem has been conducted since 1903 by the U.S. Forest Service (USFS) and University of Arizona. The Experimental Range is bounded to the east by the Coronado National Forest (CNF) and the Santa Rita Mountains (Figure 1).

CWC supplies water to the northern portion of the unincorporated retirement community of Green Valley. Municipal water supplies for the adjoining areas are provided by Las Quintas Serenas Water Company to the north, Farmers Water Company to the east, and the Green Valley Domestic Water Improvement District (GVDWID) to the south. The incorporated Town of Sahuarita adjoins CWC to the north and northeast.

1.4 Public Involvement and Scoping

CWC developed an extensive public involvement program to notify its members and customers of the plans for taking and using its CAP entitlement. CWC issued a press release on its plan for the Proposed Project on July 19, 2007, and held a public meeting to describe the Proposed Project in more detail on July 25, 2007. The August 2007 Newsletter, distributed to all CWC members and customers, described the various issues and recharge alternatives being considered (CWC 2007a). CWC held a series of meetings with its members and customers to describe and discuss the Proposed Project on August 24, September 11, and October 30, 2007. On November 28, 2007, CWC published a Newsletter summarizing issues regarding the Proposed Project and urged attendance at the upcoming meeting with the Arizona Corporation Commission (ACC). The ACC invited public comment on the proposed pipeline during a Green Valley Town Hall meeting on December 5, 2007. Answers to frequently asked questions, comments, and replies since August 2007 have been posted and updated on the CWC website at: http://www.communitywater.com/.

[3] All figures follow the text of Section 6.0, Literature Cited.

The CEQ 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 Code of Federal Regulations [CFR] 1501.7). Scoping is an important part of the NEPA process that helps identify public and agency concerns, and focuses the environmental impact analysis on relevant issues.

On August 11, 2008, Reclamation sent out a scoping memorandum to about 70 interested agencies, organizations, and individuals requesting input regarding issues or concerns that should be addressed in the EA (Appendix A). Reclamation also issued a press release to nine news media outlets and posted the scoping memorandum on its website on August 11, 2008. A public scoping meeting was held in Green Valley on August 26, 2008, which was attended by approximately 70 people. Following an open house with informational displays on the Proposed Project, and a presentation by Reclamation on the Proposed Project and the NEPA process, public comments were invited. Nine people provided oral comments, which were transcribed by a court reporter. The comment period was open through September 12, 2008, and 28 written comments were received.

As discussed in more detail along with Reclamation's responses in the Scoping Report in Appendix B, the relevant issues and concerns identified during scoping that are addressed in this revised DEA include:

- The NEPA process is premature and should not be initiated at this time;
- An EIS is required rather than an EA;
- The scoping process was inadequate;
- The EA needs to consider more alternatives than just the proposed action or no action;
- Alternatives that directly address mine-related water use and needs for Rosemont Copper Company's (Rosemont) proposed mine need to be included in the EA;
- Statutory or regulatory conflicts exist with use of CWC's CAP entitlement by Rosemont; and
- Effects of the Proposed Project on the following topics should be evaluated: invasive species; climate change; potential for growth inducement; Santa Cruz River; quality of life and effects to tourism and real estate from declining water table; impacts to the existing ground water, including any effects of recharge on the existing sulfate plume contamination; and permits required to construct and operate the Proposed Project.

The DEA was issued for public review on March 9, 2009, for a 46-day public review and comment period. Reclamation received 16 comment letters on the DEA and several people offered comments at the public hearing held on March 26, 2009 in Green Valley.

1.5 Relationship to Proposed Rosemont Mine

Two of the most common public comments are 1) the Proposed Project is connected to the proposed Rosemont Mine and as a connected project, the impacts would be significant; and 2) the Proposed Project, together with the Rosemont Mine, would result in significant cumulative impacts.

Reclamation recognizes that construction of the Proposed Project is proposed to be funded by Rosemont and that CWC plans to give Rosemont priority over other customers for use of the water, the system, and recharge capacity for the first 15 to 20 years unless those uses are needed by CWC to meet delivery obligations to other portions of CWC's service area. However, as discussed further in the Scoping Report in Appendix B and below, Reclamation has determined the Proposed Project and the proposed Rosemont Mine are not connected actions under NEPA.

To evaluate whether the Proposed Project and the proposed Rosemont Mine are connected, Reclamation applied the three criteria in the NEPA regulations regarding connected actions (40 CFR 1508.25):

1. Approval of the CWC water delivery system does not automatically trigger the Rosemont Mine. Since 1985, CWC has pursued opportunities to develop a means for taking and using its CAP entitlement. Use of the CWC water delivery system is not identified in Rosemont's mine plan of operation (MPO) (Rosemont 2007) under consideration by the CNF. Reclamation's approval of the CWC water delivery system is not contingent upon CNF's approval of Rosemont's MPO, nor the operation of the mine itself. Conversely, CNF's approval of the proposed Rosemont Mine, and any conditions that might be required by CNF, are not contingent on Reclamation's decision on the CWC water delivery system.
2. As indicated in Rosemont's memorandum to CWC dated January 20, 2009 (Appendix D), Rosemont's commitment to pay for construction of the Proposed Project[4] is not contingent on CNF's approval of the MPO. Rosemont's MPO does not include the CWC water delivery system and, therefore, Reclamation does not consider CWC's water delivery system to be a prerequisite for the mine's operation.
3. The CWC water delivery system has separate utility from the proposed Rosemont Mine. Because Rosemont's commitment to fund construction of the CWC water delivery system is not contingent on mine approval by the CNF, the Proposed Project does not depend upon the proposed mine to justify its construction and

[4] The Letter of Intent between CWC and Augusta Resource Corporation (Rosemont's parent company) indicates Rosemont's agreement to fund all capital and project development for the Proposed Project, which includes, but is not limited to, engineering, legal, public relations, easements, direct project management, construction, permitting, and similar costs. This includes costs associated with preparation of this document and Reclamation's costs associated with complying with all applicable environmental rules and regulations.

operation. Neither does Rosemont depend upon construction of the Proposed Project to proceed with its mine proposal. Rosemont can meet its stated commitment to replenish water within the Tucson Active Management Area (TAMA) using other sources of CAP water and other ground water storage facilities, as has been occurring since 2007. Therefore, Reclamation believes these two actions are not interdependent parts of a larger action, nor do they depend on a larger action for their justification.

Similarly, as part of its Biological Opinion on the construction of the proposed CWC water delivery system at the original recharge location, the U.S. Fish and Wildlife Service (FWS) concluded that the proposed Rosemont Mine is not an action interrelated or interdependent to the Proposed Project for purposes of the ESA analysis (Appendix E).

Additional discussion of the relationship of the Proposed Project with the proposed Rosemont Mine is provided in Appendices B and E. Further discussion of the potential hydrological impacts of the proposed Rosemont Mine is provided in Section 3.1—Background for Cumulative Effects and Section 3.6—Ground Water Resources.

2.0 Description of Alternatives

This section describes the formulation and evaluation of alternatives. Information on the six alternatives evaluated in detail in this revised DEA is provided. Reasons for excluding a number of other alternatives from further consideration are summarized.

This revised DEA focuses on analyzing the following six alternatives:

- The No Action Alternative.
- Proposed Action – Reclamation's proposed action to approve CWC's plan (Proposed Project or Preferred Alternative) for taking and using its CAP water entitlement. Under CWC's Preferred Alternative, CWC would construct and operate a CAP water delivery system and recharge facility.
- North Parcel Recharge Site Alternative – A recharge site north of the recharge site included in the Proposed Project would be used.
- CAP Terminus Alternative – A different connection to the CAP system, at the existing CAP terminus, would be used.
- CAP Entitlements Alternative – The capacity of the pipelines would be reduced to only deliver the existing CAP entitlements in the area.
- CWC-Only Alternative – The capacity of the pipelines would be further reduced to only deliver the CWC CAP entitlement.

Depending on Reclamation's evaluation and CWC's decision, the project could include either recharge site or either connection to the CAP water supply, in combination with one of three pipeline capacities.

2.1 Formulation and Evaluation of Alternatives

A number of alternatives were considered during development of the Proposed Project and preparation of this revised DEA. The primary factors used during formulation, screening, and evaluation of alternatives were:

- CWC's need for the Proposed Project;
- Public input;
- Availability of land access and ROW; and
- Impacts on other resources.

A primary consideration in evaluating alternatives was CWC's need for the Proposed Project. As discussed in Section 1.2—Purpose and Need, declining water levels, subsidence, and potential future water quality issues or other problems result in a need to deliver the CAP entitlement to the vicinity of the CWC service area for beneficial use.

Section 1.4—Public Involvement and Scoping summarizes public input during scoping, which included a suggestion that additional alternatives be examined. In particular, an alternative developed by FICO and American Nevada Company (ANC) (the

FICO-ANC Alternative) was identified as a potential alternative to the Proposed Project and is discussed further below in Section 2.6.3—Alternatives Considered but Eliminated from Detailed Study—Alternative Recharge Sites. Also, as discussed in Section 2.6.3, FICO recently provided a Design Concept Report for CAP water delivery to FICO lands.

Availability of land access and existing ROWs was a major consideration in evaluating alternative pipeline alignments and recharge locations. Alternatives requiring new ROWs or having land access constraints were eliminated due to higher costs, infeasibility, or greater environmental impacts. Use of a previously disturbed ROW would minimize impacts on other resources (e.g., native vegetation and wildlife habitat), as well as minimize costs associated with obtaining new ROW or mitigating environmental impacts. However, it was not possible to identify a suitable recharge site that was located a significant distance from existing wells and recharge facilities.

2.2 No Action Alternative

The No Action Alternative means that Reclamation would not approve CWC's Proposed Project to deliver CAP water for recharge near its service area. Without Reclamation approval, it is not likely a pipeline would be constructed in the foreseeable future for the conveyance and recharge of the CWC CAP water. CWC would continue to rely solely on pumped ground water for delivery to its customers. Without the delivery and use of its CAP water entitlement, either directly or by recharge and recovery, CWC would not have an alternative potable water supply should its existing wells have water quality or other problems in the future. In addition, without introducing a renewable water supply to the area, ground water level decline and subsidence would occur faster than with one of the action alternatives.

Currently, the majority of the ground water supply delivered by CWC is grandfathered under the Arizona Groundwater Management Act.[5] Under the No Action Alternative, developers within the CWC service area would continue to be able to join the CAGRD, enroll their lands as member lands of CAGRD, and then pay CAGRD to replenish excess ground water delivered within the member lands.[6] CWC could supply member lands in those future developments through its ground water delivery system.

[5] Grandfathered ground water rights are based upon historic use of ground water for 5 years prior to the establishment of the Active Management Area (BLM 2001).

[6] "Excess groundwater" is that amount of groundwater pumped by a member service area or member land that exceeds the amount allowed to be pumped under the Assured Water Supply rules. CAGRD would then be responsible for replenishing (recharging), with renewable water supplies (as defined in ARS 48-3771.C.), this volume of excess groundwater within the TAMA (as well as volumes of excess groundwater pumped that are reported for all other CAGRD members within the TAMA). This must be accomplished by CAGRD within 3 years.

2.3 Proposed Action (Preferred Alternative or Proposed Project)

Reclamation's proposed action is approval of CWC's Proposed Project, referred to in this document as the Preferred Alternative or Proposed Project. Under the Preferred Alternative, CWC would construct a water delivery system to deliver its CAP entitlement to the Green Valley/Sahuarita area, consisting of a mainstem pipeline, a smaller delivery pipeline, and a recharge facility (Figure 2). As part of the Preferred Alternative, the maximum capacity of the recharge site would be able to recharge the annual CAP entitlements of both CWC and GVDWID, as well as an additional 2,200 acre-feet (AF) if other CAP water supplies or other sources of water become available, with acquisition of appropriate permits. CWC and GVDWID currently are the only water service providers in the Green Valley/Sahuarita area with permanent CAP entitlements. If GVDWID does not elect to participate in the Proposed Project, alternative CAP supplies or other renewable sources could be recharged at the site, with appropriate state approvals.

CWC has agreed to give Rosemont priority for use of CWC's 2,858 AFY of CAP water for the first 15 to 20 years of the system's operation unless it is needed by CWC. Under the Preferred Alternative, this water would be recharged at the proposed recharge site, along with additional water supplies Rosemont may obtain to utilize the maximum recharge capacity of 7,000 AFY at the site. In the long term (following the first 15 to 20 years), it is expected that CWC would continue to recharge its CAP water at the site, along with other CAP water supplies from potential participants such as GVDWID. For analysis purposes, this revised DEA assumes the full recharge capacity of the site of 7,000 AFY would be utilized for 20 years. In its original plan, CWC indicated that it desired to recharge 7,000 AFY to accommodate the various intended sources of water planned for the Proposed Project; however, this amount was reduced to 5,000 AFY in the March 2009 DEA because of the limitations of the recharge site under consideration at that time.

Below is a brief description of the major project components of the Preferred Alternative.

Pipelines

A proposed 36-inch-diameter main delivery pipeline ("main pipeline") would connect to an existing pipeline that delivers CAP water to the PMRRP as it enters that recharge facility. The PMRRP, which includes a connection with the existing CAP pipeline (PMR Lateral), came into full-scale operation in December 2001; it was developed by CAWCD in cooperation with the City of Tucson. The proposed connection would occur on the north side of Pima Mine Road (PMR) in the southeast ¼ of the southeast ¼ of Section 30, Township 16 South, Range 14 East, approximately 2 miles east of the CAP terminus. From the connection with the PMR Lateral, the pipeline would extend eastward on the north side of PMR approximately 0.4 mile to the Nogales Highway (NH). The alignment turns south along the western NH ROW for approximately 5 miles to the intersection with the Old Nogales Highway (ONH) and continues south approximately 0.9 mile along the western ROW of ONH. The main pipeline would require disturbing a maximum 60-foot-

wide area (including a 30-foot-wide temporary construction easement) along existing utility ROWs, resulting in a total disturbance of up to 46 acres during construction.

At the section line of Sections 30 and 31 of Township 17 South, Range 14 East, a delivery pipeline would be constructed to the west. The delivery pipeline would be 20 inches in diameter, continuing west 0.2 mile to the proposed recharge site. The 20-inch-diameter pipeline would require disturbing a maximum 60-foot-wide area along the pipeline alignment, resulting in a total disturbance of up to 1.5 acres during construction. A 20-inch-diameter pipeline would extend from the recharge facility approximately 0.7 mile west to the existing Well #11 treatment facility operated by CWC. The extended pipeline would disturb about 5.1 acres during construction. This segment of pipeline would be used when CWC needs to recover recharged water or take direct delivery of CAP water. Use of this pipeline segment would depend on future water demands and water quality or other considerations affecting the existing CWC wells.

The design capacity of the main pipeline was established after consultation with the Upper Santa Cruz Providers and Users Group (USC/PUG), of which CWC and GVDWID are participants. The USC/PUG is a group of water companies and major water users that are seeking to bring CAP water and other renewable water sources to the Green Valley/Sahuarita area to recharge the aquifer. CWC requested the group's input to assure that the pipeline capacity would meet the potential needs of the USC/PUG members, which is estimated to be approximately 30,000 AFY, including CWC (USC/PUG 2008). Thus, the maximum capacity for the main pipeline was established at 30,000 AFY, with up to 7,000 AFY to be delivered to the proposed CWC recharge site.

The proposed route of the main pipeline is consistent with the alignment recommended in the "Sahuarita – Green Valley Area Central Arizona Project Water Use Feasibility Analysis and Delivery System Optimization Study" (Malcolm Pirnie 1998, Figure ES-3). The selected main pipeline route and size are also consistent with the recommendations in Pima County's "Evaluation of Sustainable Water Supply Options in Green Valley," which adopted the Malcolm Pirnie preferred alignment (Pima County 2007a, Attachment A, p. 6).

The new buried ductile iron pipelines would be constructed using conventional construction methods of open-cut trenching and backfill for the majority of the route. Materials excavated from the trench would be temporarily stockpiled adjacent to the trench line and used for backfill of the trench after installation of the new pipe. Excess excavated material would be spread within the limits of the ROW in a manner that blends with the adjacent contours, and then would be stabilized and reseeded with an appropriate native seed mix.

The pipeline alignment includes two railroad crossings, and road crossings at PMR and NH. The railroad crossings would be completed by jacking and boring a casing pipe beneath the existing rail bed or pavement. The locations of the proposed jacking and

boring operations are shown on Figure 3. Road crossings would be completed with open trenches.

The water delivery pipeline from the proposed recharge basin to CWC's existing Well #11 site would cross the Santa Cruz River. This pipeline would be used when CWC elects to recover recharged water using recovery wells at the recharge site or by taking direct delivery of its CAP water and treating it. The river crossing would be completed by jacking and boring a casing pipe beneath the calculated scour depth of the flow channel at the maximum channel flow rate. This type of crossing would eliminate any disturbance of the riverbed, and would comply with U.S. Army Corps of Engineers (Corps) requirements under a Clean Water Act (CWA) nationwide Section 404 permit, if applicable. Several additional minor drainageways also would be crossed along the NH section of the pipeline. The crossing of these small drainages would be completed by conventional open trench construction and would comply with CWA Section 404, if applicable. The new pipeline would be installed below the calculated scour depth of the channels. The completed pipeline would be pressure tested to assure that there would be no significant leaks during operation of the new delivery system.

CAP Connection

The CWC water delivery system would connect to the PMR Lateral, and would be designed and installed pursuant to an agreement among CWC, CAWCD, and the City of Tucson. The CWC system would consist of a new control valve, flow meter, and associated appurtenances. The control valve, flow meter, and all of the associated equipment would be owned and maintained by CAWCD.

Rights-of-Way

The pipeline route would occupy existing ROWs along PMR, NH, and ONH (Figure 2). The 20-inch pipeline would be installed near the north section line of Section 36 of T17S, R13E and Section 31 of Township 17 South, Range 14 East (Figure 2 and Figure 4). Following construction, the permanent access road for the recharge facility would occur along the 30-foot-wide permanent easement for the 20-inch pipeline. No additional areas would be disturbed by the permanent access road.

The new ROWs along the 20-inch pipeline alignments would be approximately 30 feet wide. The existing ROWs along the main pipeline alignments are used for roadways as well as numerous other utilities including gas, telephone, cable television, fiber optic lines, electrical power lines, and existing water lines.

Construction Access and Staging

The Proposed Project would require ground access to deliver equipment and materials, and to accommodate labor crews and activities to complete construction of the pipelines and recharge facility. Construction access for the main pipeline is readily available from the existing public roadways adjacent to the alignment. Road closures or traffic restrictions are not anticipated. Pipe and other materials can be temporarily placed within the ROWs as the construction progresses. Areas where installation of the pipeline has

been completed would be backfilled and regraded as a continuous part of the construction. Access roads for the construction and future maintenance of the 20-inch line would be completed as part of the construction sequence. Pipe and other materials would be delivered and temporarily stored within the new easements as well as temporary construction easements located on previously disturbed areas. The access roads completed for construction of the 20-inch pipeline also would be used to bring equipment and materials for construction of the recharge basins.

Construction staging areas, temporary offices, and areas for storing construction materials would require 2 to 3 acres of land. Several privately owned large, open, previously disturbed areas adjacent to the Proposed Project pipeline could serve as staging areas. Figure 3 shows two possible locations that would be suitable for staging and storage of materials. Equipment and material storage areas are normally secured by the contractor as a part of the construction services. The selected contractor would negotiate with local property owners to secure a site for staging operations and storage of materials. The contractor would negotiate the use of these areas as part of the bid package; however, use of any other areas by the contractor not already identified in Figure 3 would require prior approval by Reclamation.

Booster Station Construction

An in-line pump booster station would likely be needed to deliver water to the proposed recharge facility. This booster station would be located along the pipeline segment adjacent to the NH or ONH. It is anticipated the booster station would be constructed on previously disturbed land on and adjacent to the pipeline ROW within a 300-foot by 165-foot footprint. The entire booster station would be enclosed within a concrete masonry unit wall that would be a minimum of 8 feet high. The booster station would be installed with a Supervisory Control and Data Acquisition (SCADA) system to control the operation and send data to remote locations. The new SCADA system would be compatible with the operating systems used by the CAP operators. If engineering design indicates the booster station needs to be located on an area with native vegetation, environmental clearances will be conducted on the new site prior to construction.

If it becomes necessary in the future to deliver a flow of 30,000 AFY as part of an expanded system, one or more additional booster stations would be required. Any booster stations required to deliver additional water would be constructed by the entities requesting water service and using the CWC water delivery system, and any necessary environmental compliance would be completed by those entities.

Recharge Basin Construction

Following the decision in June 2009 to find a more suitable recharge site than the one identified in the March 2009 DEA, CWC developed site selection criteria to screen and evaluate potential locations, and a ranking system to determine the most acceptable locations. Initial recharge site selection criteria required potential properties to be a minimum of 20 acres, located within 2 miles of the terminus of the proposed CWC main pipeline, and as close to the CWC service area as possible. Based on various land

attributes, 10 parcels containing one or more potential recharge sites were identified within 2 miles of the proposed pipeline terminus. These sites were further evaluated based on site selection criteria consisting of the following parameters:

- Ownership and potential for acquisition;
- Proximity to the CWC service area, existing recharge sites and wells, three-phase power, and known environmental issues;
- Surface soils, geology, and topography;
- Subsurface geology, and depth to bedrock and ground water; and
- Land acquisition and maintenance costs.

Ranking the parcels was based on the parameters listed above. Parcels were ranked relative to each other based on a scale of: 1-unfavorable, 2-satisfactory, and 3-favorable/ideal. Double weights were applied to the parameters associated with surface and subsurface permeability, which are critical to recharge feasibility. Weighted average rankings were calculated to determine the most favorable site (highest score). The two alternative recharge sites, the South Parcel and North Parcel recharge sites, shown on Figure 4 ranked the highest among potential recharge locations based primarily on favorable locations relative to CWC and the main pipeline, topography, soils, geology, construction costs, and environmental considerations.

The South Parcel Recharge Site (South Parcel) ranked highest and is included in the Preferred Alternative. The South Parcel is considered the most favorable site because it is larger and is farther away from the active channel of the Santa Cruz River. ASLD owns the land. This proposed recharge site is in the west ½ of the northeast ¼ of the northeast ¼ of Section 36, Township 17 South, Range 13 East. The total impacted acreage would be about 21 acres, of which approximately 3.1 acres along the northeast parcel boundary would be used for storage of equipment, vehicles, and accumulation of the fine material scraped from the bottom of the recharge basins during periodic cleaning.

Four recharge basins are proposed on the South Parcel, covering 17.9 acres. The recharge basins would be operated about 300 days per year, or possibly more, depending on the maintenance requirements of the CAP system and recharge facility. Alluvium suitable for recharge of CAP water has been located on-site at an average depth of approximately 2.5 feet. The alluvial layers below 2.5 feet contain coarse-textured material from 3 to 57 feet thick, which overlay an approximately 10-foot-thick fine-grained layer. The underlying coarse-grained layer has a capacity to recharge up to 8 feet of water per day; however, certain factors may limit the long-term recharge potential to approximately 2 to 3 feet per day.

The overburden to be removed for recharge basin construction would be used on-site to construct the recharge basin berms, or hauled off to an appropriate, permitted fill location. The berms around the recharge basins would be approximately 5 feet above the original ground surface and constructed with 2:1 side slopes. The outer slopes would be stabilized against high floodwaters using riprap purchased or excavated from the site.

CAP water would be delivered to the recharge basins by pipes. Concrete distribution boxes would be constructed to reduce the velocity of the inflow and control the flow to the recharge basins through irrigation gates. The basins would be operated on a continuous basis; however, they would be allowed to dry for up to 60 days every year in coordination with the operation of the CAP system. The drying cycles would be used to inspect the basin surfaces and complete any necessary maintenance including scarifying or ripping the basin surfaces with equipment to reduce clogging. Small amounts of accumulated fine material and algae that could affect recharge efficiency would be removed periodically from the surface of the recharge basins using a small front-end loader or similar equipment.

Several monitoring wells may need to be installed, as required by ADWR, to construct and operate an underground storage facility. Existing wells in the vicinity of the Proposed Project would be considered first for monitoring wells. The total area of impact, including access to new wells, if any, is estimated to be 0.5 acre or less. Disturbance to cultural resources and native vegetation would be avoided to the degree practicable.

The recharge basins would be fenced with site-appropriate materials; signs would notify individuals that the property is private and no trespassing is allowed. The perimeter fencing would not restrict passage of small mammals. Chain-link fencing would be used around the control structures and other points that require restricted access.

2.4 Additional Action Alternatives

Project alternatives involving an adjacent recharge site, a different location for connection to the CAP system, and two smaller pipeline capacities are described in this section.

2.4.1 North Parcel Recharge Site Alternative (added in revised DEA)

The North Parcel Recharge Site (North Parcel) ranked second highest of the 10 potential recharge locations evaluated since June 2009. It is not the preferred recharge location because it is smaller than the South Parcel, closer to the active channel of the Santa Cruz River, and has piles of construction debris that would need to be removed. However, the North Parcel remains a suitable location for recharge if the South Parcel is not available. The North Parcel is owned by Pima County and is in the west ½ of the southeast ¼ of the southeast ¼ of Section 25, Township 17 South, Range 13 East (Figure 4). The total area impacted by the Proposed Project would be about 18.8 acres, of which approximately 3.1 acres, east of a large swale between the recharge site and the ONH, would be used for storage of equipment, vehicles, and accumulation of the fine material scraped from the bottom of the recharge basins during periodic cleaning.

Four to five recharge basins are assumed to be located on the North Parcel. Alluvium suitable for recharge of CAP water has been located on-site at an average depth of approximately 3.5 feet. The alluvial layers below 3.5 feet contain coarse-textured material from 3 to 58 feet thick, which overlay an approximately 6-foot-thick fine-grained layer.

Piles of construction debris are located throughout the parcel. The debris piles would be removed and properly disposed of prior to recharge basin construction. Depending on the material encountered, some of the debris may be used as riprap along the berms as protection against high floodwaters.

Construction and operation of the North Parcel would be identical to that of the South Parcel. Also, the North Parcel would have the same provisions for monitoring as the South Parcel.

2.4.2 CAP Terminus Alternative (added in revised DEA)

If CWC is unable to connect to the CAP system at the PMR Lateral, the main pipeline would connect to the CAP terminus, which is approximately 0.1 mile south of PMR on the west side of Interstate 19 (I-19) (Figure 2). From the CAP terminus, the pipeline alignment would extend approximately 0.1 mile north along the west side of I-19, turn east approximately 300 feet south of PMR, continue approximately 1.2 miles east, then jog approximately 350 feet north and continue east along the north side of PMR within the existing road ROW for approximately 1.2 miles to the NH. At the NH, the pipeline would continue south along the same alignments as the Preferred Alternative. Crossings of I-19, the railroad, and the Santa Cruz River would be completed by jacking and boring a casing pipe beneath the surface (Figure 3). This segment of pipeline would disturb up to 18.5 acres, in addition to the estimated 46 acres impacted by the Preferred Alternative. Approximately 50 percent, or about 9.3 acres of the additional land needed for this alternative has been previously disturbed by construction of I-19, PMR, and existing utilities.

The connection to the existing CAP pipeline at the terminus would be completed with a new 54-inch-diameter fabricated steel elbow that would be followed by a 54-inch by 36-inch fabricated steel reducer. These new fittings would be connected directly to the existing 54-inch tee at the end of the existing CAP pipeline. These fittings would be buried adjacent to the existing terminus vault. The main pipeline would be extended to a new concrete vault that would house a new 36-inch-diameter flow meter, as specified by the CAP operations staff. The CAP operations staff has specified the design requirements for the vault and all of the appurtenant equipment. The vault would be equipped with ventilation fans, lights, access hatches, safety climb devices, and a SCADA system compatible with the existing equipment. CAP would own and maintain the flow meter and all of the associated equipment.

2.4.3 CAP Entitlements and CWC-Only Alternatives

If no participants are available to pay the cost of the larger mainstem pipeline, other alternatives available to CWC would be a smaller system with pipelines that are smaller than the proposed 36-inch pipe and a smaller recharge facility. In all other respects, these alternatives would have the same ROWs and location of the booster station and recharge facility as the Preferred Alternative. To address this possibility, the CAP Entitlements and

CWC-Only alternatives, which involve delivery of smaller quantities of water than the Proposed Project, are evaluated in this revised DEA.

The CAP Entitlements Alternative is identical to the Preferred Alternative, except the delivery pipeline would be 18 inches in diameter for the entire length rather than a combination of 36-inch and 20-inch diameters. The ROWs and location of the booster station and recharge facility would be similar to the Preferred Alternative, although the size of the recharge facility would be reduced by about 30 percent in proportion to the volume of water to be recharged. This alternative would be limited to the capacity to deliver the entitlements of the existing CAP water subcontractors in the Green Valley/Sahuarita area, which are CWC (2,858 AFY) and GVDWID (1,900 AFY).

The CWC-Only Alternative is similar to the Preferred Alternative except the size of the facilities would only be sufficient to deliver CWC's CAP entitlement of 2,858 AFY. The delivery pipeline would be 14 inches in diameter for the entire length rather than a combination of 36-inch and 20-inch diameters. The ROWs needed for this alternative, as well as the location and exterior dimensions of the booster station, would be the same as the Preferred Alternative. The size of the recharge facility would be approximately 55 percent smaller because a maximum of approximately 3,000 AFY would be recharged rather than 7,000 AFY.

2.5 Project Financing

The following description of project financing applies to each of the action alternatives. CWC is a private water company, as defined in Arizona Revised Statutes (ARS) § 45-402 (30), and a public service corporation, as defined by Arizona Constitution Article 15, § 2. As such, CWC is subject to the regulatory jurisdiction of both the ADWR and ACC in providing water utility service. CWC is in the business of producing water for delivery and sale to customers within its service area and has authority to withdraw and distribute ground water from within the TAMA ground water basin (ARS § 45-491). CWC's public service corporation service area is defined by a Certificate of Convenience & Necessity (CC&N) approved by the ACC.

Under the Letter of Intent (LOI) dated July 12, 2007, between CWC and Augusta Resource Corporation, the parent company of Rosemont, it was anticipated that Rosemont would fund construction of the Proposed Project. This proposed arrangement was confirmed in letters from Rosemont to CWC on January 20, 2009 and from CWC to Reclamation on May 15, 2009 (Appendix D). CWC would own and operate the water delivery system. CWC would deliver its CAP water to the recharge basin for use by its customers. For a period of 15 to 20 years, Rosemont would have priority over other customers for that water, the system, and recharge capacity, unless they are needed by CWC to meet delivery obligations to other portions of CWC's service area.

Negotiations between CWC and Rosemont (Parties) are ongoing to finalize an agreement (Agreement) through which the details of the arrangement would be memorialized. The Parties anticipate that the Agreement will require approval by the

ACC under Arizona Administrative Code (AAC) R14-2-406. Currently, the Parties envision Rosemont would become a customer of CWC, subject to ACC and other approvals, and would provide an advance or contribution in aid of construction to CWC so the necessary infrastructure can be built to move water from the existing CAP system to a recharge site (underground storage facility) or other location where the water is of use to the customer, without financial burden on CWC's existing customers (Appendix D). The Parties also envision that Rosemont would pay the full cost of the infrastructure, a portion of which may be eventually refunded to Rosemont by CWC, depending on the nature of the transaction as finally approved. Once the infrastructure is in place, Rosemont anticipates purchasing nonpotable CAP water from CWC under an approved tariff by the ACC [AAC R14-2-401(30); R14-2-409(D)].

As envisioned by the Parties, CWC proposes to incorporate this facility into its ACC CC&N and it would become an extension of CWC's operating distribution system and therefore a part of CWC's service area under ARS § 45-493(A)(2). The underground storage facility would need to be permitted by ADWR under ARS § 45-811.01. Once the facility is permitted, CWC would perform water storage services. Rosemont, as a customer of CWC, would be required to obtain a water storage permit from ADWR under ARS § 45-831.01 to store CAP water at this facility [ARS § 45-831.01(B)(2); ARS § 49-243(H)].

The Agreement between CWC and Rosemont has not been finalized, and the specific contractual and legal requirements related to the arrangements, whereby CWC would request delivery of its CAP entitlement under such an Agreement, have not been reviewed by Reclamation or CAWCD. Nevertheless, based upon CAWCD and Reclamation's understanding of the proposed water provider/customer relationship that would need to be approved by the ACC as described above, Reclamation has concluded that no additional action would be required on Reclamation's part. While additional discussion between CWC and CAWCD, in coordination with ADWR, may be needed, the outcome of these discussions would not alter the range of environmental impacts described in this EA.

If CWC's CAP water is not used as envisioned in the LOI or Agreement, the use of other supplies likely would be increased, such as CAP excess pool water or CAP tribal leases. Thus, the Preferred Alternative would still recharge up to 7,000 AFY at the recharge site and the impacts would be as described in Section 3.0—Affected Environment and Environmental Consequences. If recharge averages less than 7,000 AFY, ground water replenishment and other impacts would be less than those described in Section 3.6.2—Ground Water Resources—Environmental Consequences.

As discussed above, GVDWID also holds a CAP M&I priority subcontract in the general vicinity of the proposed infrastructure. Currently, there are no agreements or tentative agreements in place concerning the delivery or use of this CAP water within the proposed CWC water delivery system, but there is available capacity to transmit this water to locations near the GVDWID service area. If the Agreement and related tariffs are approved by the ACC, this capacity would be available to transport GVDWID's CAP

water entitlement upon payment of the applicable tariffs. The water may be stored in underground storage facilities (if properly permitted as described for the Proposed Project) or delivered for direct use to, or storage by, a GVDWID customer at the discretion of GVDWID.

2.6 Alternatives Considered but Eliminated from Detailed Study

The following alternatives were considered, but were eliminated from further consideration in the EA for the reasons summarized below.

2.6.1 Direct Use of CAP Water

Direct delivery and treatment of CWC's CAP water entitlement was evaluated as an alternative. Direct use would require more extensive treatment of the water to reduce turbidity, total dissolved solids (TDS), and other constituents. The cost of constructing and operating a treatment facility and disposal of the resultant waste stream would exceed CWC's current ability to finance a CAP water delivery system. However, it is anticipated that this alternative will be implemented in the future when appropriate.

2.6.2 Alternative Pipeline Routes

Alternative pipeline routes were considered as possible alignments including: La Canada, Sahuarita Road, El Toro Road, and combinations of other existing and new ROWs. Most of these potential routes would have greater impacts on residential and commercial areas than the proposed alignment while offering little opportunity for access to possible recharge sites. Some of these routes also were studied in the 1998 Malcolm Pirnie report and were not recommended for consideration in that study (Malcolm Pirnie 1998, pp. ES-13 – ES-15).

2.6.3 Alternative Recharge Sites

A variety of alternative recharge sites were evaluated as discussed below.

Recharge to the Santa Cruz River or Tributaries

A managed recharge project was considered, in which CWC's CAP entitlement would be delivered to the Santa Cruz River or its tributaries in the Green Valley/Sahuarita area. An initial feasibility investigation was completed. This alternative was eliminated from consideration because recharge in the bed of the Santa Cruz River or its tributaries could adversely impact other existing recharge sites by raising the water table in their vicinity. Other issues related to the use of natural waterways for recharge include the cost of rebuilding portions of the recharge facilities if major flood events cause damage, and a reduction in natural recharge from flood events due to an already wetted channel and higher water levels under the stream channel.

Recharge on Various Parcels near the CWC Service Area

Eight parcels were evaluated after the initial recharge location was deemed unsuitable. The parcels were ranked below the preferred South Parcel and the alternative North Parcel that are being considered for the Proposed Action.

Recharge at Recharge Facilities in the Marana Area

Existing and proposed recharge facilities in the Marana area, approximately 40 miles north (downgradient) of Green Valley, may be available for recharge of the CWC water allotment. Recharge at one or more of those facilities would allow withdrawal of water from a recovery well near the CWC service area. This alternative was not considered further because it does not provide for recharge near the CWC service area. The Marana area would provide no benefit to the Green Valley/Sahuarita aquifer, and would provide no opportunity for delivery and direct use by CWC if water quality or other problems occur with the existing CWC wells.

Recharge at Pima Mine Road CAP Recharge Facility

The PMRRP, approximately 7 miles north of the CWC service area, may be available for recharge of the CWC water allotment. Recharge at the PMRRP would allow withdrawal of water from a recovery well in or near the CWC service area. This alternative was not considered further because it does not provide for recharge near the CWC service area. The PMRRP would provide only limited benefit to the Green Valley/Sahuarita aquifer, and would provide no opportunity for CWC to deliver and directly use its CAP entitlement if water quality or other issues occur.

Use of the FICO Groundwater Savings Facility

Use of the CAP water for irrigation within the existing FICO Groundwater Savings Facility (GSF) could be a cost-effective and environmentally benign alternative for delivery and indirect recharge of the CWC CAP water. The GSF would reduce current ground water pumping in an area identified by ADWR as having the most significant subsidence problems in the Green Valley/Sahuarita area by substituting CAP water for irrigation pumping. As discussed in Section 1.2—Purpose and Need, subsidence can cause changes to floodplain boundaries, and uneven subsidence has been associated with surface fissuring elsewhere in Arizona. However, by itself, recharge at the FICO GSF does not meet CWC's need for the Proposed Project to recharge and recover the CWC CAP entitlement near the CWC service area, with the option to take direct delivery of CAP water if necessary.

Initially, this alternative was eliminated from further consideration due to a request to Reclamation by Richard Walden, President of FICO, that it be removed from further consideration (B. Ellis, pers. comm. 2008). Because FICO is the owner of the GSF, Reclamation agreed to Mr. Walden's request. On November 11, 2009, Mr. Walden submitted a Design Criteria Report for delivery of CAP water to the GSF, which would serve FICO lands between PMR and Sahuarita Road. Although the intent of submitting the Design Criteria Report is not clear, as noted above, the FICO GSF is not a viable

alternative to the Proposed Project because the center of the FICO study area for the Design Criteria Report is approximately 5 miles north of the CWC service area.

FICO/ANC Water Delivery Proposal

FICO and ANC developed a proposed CAP water delivery system, which would incorporate the use of FICO's GSF for recharge (FICO 2008a). The FICO-ANC system would consist of three phases (Figure 5)[7]:

1. Phase I would be construction of a 36-inch pipeline from the CAP terminus or PMR Lateral along the same alignment as the Proposed Project to Sahuarita Road, where a turnout would interconnect with FICO's GSF (irrigation system) with a capacity of 5,000 AFY during the irrigation season.
2. Phase II would extend the 36-inch pipeline farther south to Continental Road, with several turnouts to interconnect with additional sections of FICO's GSF and potentially other recharge projects or water users.
3. Phase III would extend the pipeline further south to the Canoa recharge basins, about 4.7 miles south of the Phase II terminus.

The FICO-ANC proposal anticipates various sources of water being delivered through the system including FICO's non-Indian agricultural pool CAP water (3,600 AFY but declining over time), CAGRD water supplies (1,500 AFY and likely to increase over time), CWC and GVDWID CAP entitlements, ASLD CAP entitlements, and other potential water sources (Id.). Funding for Phase I would be provided by FICO and an affiliate of ANC, and construction would occur between 2011 and 2016, subject to housing market conditions (FICO 2008b). The cost, funding, timing, and features of Phases II and III are not known at this time due to ongoing discussions with potential participants in those phases (Id.).

A portion of Phase II of the FICO-ANC alternative, plus construction of facilities to recharge the CWC CAP entitlement near the CWC service area, would need to occur to meet the need for the Proposed Project. The cost, funding, timing, and features of Phase II are uncertain. In addition, CWC reviewed the information provided by FICO regarding the FICO-ANC alternative, and concluded that the FICO-ANC alternative did not meet CWC's financial and schedule requirements. Therefore, this alternative was eliminated from further consideration.

[7] Figure 5 was developed from a map provided by FICO dated October 15, 2008. The preferred CWC recharge site is also shown on Figure 5.

3.0 Affected Environment and Environmental Consequences

In this section, the affected environment of the area potentially impacted by the Proposed Project (referred to as the "Project area" or "impact area," which varies by resource) and likely environmental consequences are described for each resource potentially impacted by the Preferred Alternative and the other action alternatives. The consequences of the No Action Alternative also are described for each of the resources as a basis for comparison. In addition, the cumulative impacts of the action alternatives are identified. Section 3.9—Resources Considered But Not Affected summarizes the reasons that other resources, such as recreation, were considered for analysis but determined not likely to be affected.

3.1 Background for Cumulative Effects

Potential effects of the Proposed Project would occur in the context of other development actions that have occurred and will occur in the impact area. Cumulative effects, or impacts, are the effects on the environment that result from the incremental effects of the Proposed Project when added to the effects of other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such actions (40 CFR 1508.7). Cumulative effects can result from individually minor, but collectively significant, actions taking place over time.

For purposes of this analysis, the geographic impact area for analyzing cumulative effects for the Proposed Project for most resources was established as the area within which measurable ground water elevation changes are anticipated to occur as a result of recharging a maximum of 7,000 AFY for the 20-year project period (referred to in the cumulative impacts discussion as the "ground water area of impact"). This is an oblong area extending from the recharge facility in a radius of approximately 10 miles north, 6 miles south, and 5 miles to the east and west (see Section 3.6.2—Ground Water Resources—Environmental Consequences). This geographic impact area contains the entire proposed pipeline alignment and the area within which all land-disturbing Project construction impacts would occur. Although smaller areas might be more appropriate for land use, and biological and cultural resources, Reclamation chose to use this broader geographic area as a conservative approach for analyzing cumulative impacts.[8]

Cumulative effects to various resources are possible for each of the action alternatives. The description of the affected environment in each subsection below provides the existing conditions of resources within the Project area that are the result of past and present actions. Notable past and present actions in the impact area of the Proposed Project include construction of roads and utility corridors, mining, and the development of residential communities and associated facilities.

[8] Depending upon the resource, the impacts may also vary temporally. The geographic impact areas for air quality, surface water, and socioeconomic resources, which also vary temporally, are identified in their respective sections.

"Reasonably foreseeable future actions" are defined as actions that are not speculative—they have been approved, are included in short- to medium-term planning and budget documents prepared by government agencies or other entities, or are likely to occur given trends (Environmental Protection Agency [EPA] 1999).

3.1.1 Reasonably Foreseeable Actions

Potential future actions were identified through public and agency scoping, input from cooperating agencies, and available information on known projects or actions under consideration. Actions that meet all of the following criteria were considered reasonably foreseeable and were included in the cumulative impacts analysis:

- The impacts of the future action would occur within the same geographic area (impact area) and same time frame as the impacts of the Proposed Project or alternatives.
- The future action would affect the same environmental resources as the Proposed Project or alternatives.
- There is a reasonable expectation the future action would occur; the future action is not speculative.
- There is sufficient information available to define the future action and assess cumulative impacts.

(EPA 1999; CEQ 1997)

Reasonably foreseeable future actions meeting all of the above criteria, located within the ground water impact area, consist of road construction and housing projects. The following description of reasonably foreseeable actions provides context for the discussion of cumulative impacts included in this section for each resource category, as appropriate. One major new road is planned in the Project area; Quail Crossing Boulevard would be connected to Duval Mine Road south of the proposed recharge facility (Sahuarita 2009).

Quail Creek, a planned community southeast of Sahuarita and south of the recharge site consists of two components. Quail Creek is planning to add 5,000 age-restricted homes. The Stone House portion of Quail Creek would add 222 non-age-restricted custom homes. The existing Quail Creek development has a new clubhouse and plans to add more commercial and retail businesses (Sahuarita 2008a).

Sahuarita's current Master Plan of Development includes several new housing sites within and adjacent to the town. Rancho Sahuarita would have both age-restricted and non-age-restricted components. The Rancho Sahuarita development is expected to add housing for about 11,000 families as well as commercial and recreational opportunities (Sahuarita 2008a).

Mission Peaks is a proposed master-planned community west of Sahuarita. Up to 15,000 homes would be built along with commercial areas and community facilities. The Mission Peaks development plans include a wastewater treatment plant (WWTP) and use

of reclaimed water to irrigate drought-tolerant landscaping (ANC 2008). This housing development has obtained a General Plan Amendment from the Town of Sahuarita (Franchine 2008; Sahuarita 2008b). In addition, ADWR has issued a designation of assured water supply to the Rancho Sahuarita Water Company, which would provide water service to this development (ADWR 2008a).

A third planned community is Madera Highlands. It will be located on the southernmost edge of the Sahuarita town limits. Madera Highlands would add homes for 617 families. The project plans include athletic fields, botanical gardens, an outdoor amphitheater, and various other recreational opportunities. This community would not be age-restricted (Sahuarita 2008a).

Another reasonably foreseeable activity in the impact area is ground water withdrawal to remediate a sulfate plume from the Sierrita Mine operated by Freeport-McMoRan. The preferred remediation action of Freeport-McMoRan consists of an aggressive ground water pumping program to stabilize the plume and remove high sulfate ground water within the plume (HGC 2008). More details on the Sierrita Mine remediation plan are provided in Section 3.6.2.5—Ground Water Resources—CAP Entitlements Alternative.

Reclamation is aware of the high level of public interest concerning the potential hydrologic impacts of Rosemont's production wells, which are within the ground water area of impact surrounding the recharge basins. Reclamation's ground water modeling of the long-term operation of the recharge facility required making assumptions with regard to future potential pumping by others. Because of the level of public interest in the proposed Rosemont Mine's production well pumping, modeling for the Proposed Project considered the effect of the Preferred Alternative's proposed recharge under two different scenarios—with and without future pumping by Rosemont. These two scenarios are described in Section 3.6.2.5—CAP Entitlements Alternative.

3.1.2 Actions Not Considered Reasonably Foreseeable for Cumulative Impact Analysis Purposes

Potential future actions considered but determined not to be reasonably foreseeable for purposes of the cumulative impact analysis are summarized below. Based on the best available information, these and similar actions did not meet the criteria for inclusion in the cumulative impact analysis as reasonably foreseeable actions because they occur outside of the impact area, are speculative, and/or do not have sufficient information available to conduct a meaningful analysis of cumulative impacts.

A number of housing projects are proposed in the region outside of the impact area for the Preferred Alternative. For example, south of the impact area is the proposed Las Mesas de Santa Cruz development north of Tubac. ADWR recently approved a water rights transfer from irrigation to municipal use, which supports an assured water supply for this master-planned community with 2,630 residential units plus commercial and office development (Las Mesas 2008). In late 2008, however, the County Board of

Supervisors' approval of this development was overturned by a citizen-generated referendum (Davis 2008).

3.1.3 Other Future Actions Not Considered for Cumulative Impact Analysis Purposes

Reclamation has concluded it is not appropriate to consider the proposed Rosemont Mine project for cumulative analysis purposes. The proposed Rosemont Mine is approximately 10 to 12 miles from the Proposed Project and is in a separate watershed. Because of its distance from the Project area, and because construction of the Proposed Project would be completed prior to any mining, there is no potential for impacts to common resources, with the exception of ground water. For example, impacts that need to occur coincidentally to result in a cumulative effect, such as windblown dust resulting from local construction projects or socioeconomic impacts related to construction work, would not occur since the CWC project would be completed prior to any mining. Proposed ground water pumping by Rosemont is considered in the cumulative impact discussion in Section 3.6.2.5—Ground Water Resources—CAP Entitlements Alternative because Rosemont's proposed production wells are in the CWC project area, and the timing of Rosemont's proposed withdrawals and CWC's recharge would overlap, thereby creating the potential for cumulative impacts. Impacts related to implementation of the proposed Rosemont Mine, including direct, indirect, and cumulative impacts, will be addressed in the CNF EIS on Rosemont's MPO. The cumulative impacts discussion in the CNF EIS will take into consideration any past, present or reasonably foreseeable future actions relative to the Proposed Project, if appropriate.

3.2 Air Quality

The Project area for evaluation of air quality impacts is Pima County and, in particular, the Tucson Air Planning Area (TAPA) because regional air quality might be affected by the Proposed Project. Pima County is divided into three designated air planning areas. Two are in eastern Pima County and include the Rillito Planning Area and the TAPA, and the third area is in western Pima County. The Proposed Project is within the TAPA, which was established in the late 1980s to address nonattainment of National Ambient Air Quality Standards (NAAQS) for carbon monoxide (RECON 2006, pp. 3–43).

3.2.1 Affected Environment

The NAAQS resulted from the Clean Air Act of 1970, as amended in 1977 and 1990 (EPA 2008). The standards are designed to protect public health and indicate the maximum levels of pollution allowable, including a margin of error. The standards relate to six primary air pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM_{10} and $PM_{2.5}$), ozone (O_3), and sulfur dioxide (SO_2). The State of Arizona's air quality standards are the same as those developed by the federal government. Pollutant levels for primary standards (human health) and secondary

standards (human welfare, e.g., visibility) have been established by the EPA as shown in Table 1.

Table 1. National Ambient Air Quality Standards.

	Primary Standards		Secondary Standards	
Pollutant	**Level**	**Averaging Time**	**Level**	**Averaging Time**
Carbon Monoxide	9 ppm (10 mg/m^3)	Eight-hour[1]	None	
	35 ppm (40 mg/m^3)	One-hour[1]		
Lead	1.5 µg/m^3	Quarterly Average	Same as Primary	
Nitrogen Dioxide	0.053 ppm (100 µg/m^3)	Annual (Arithmetic Mean)	Same as Primary	
Particulate Matter (PM_{10})	150 µg/m^3	24-hour[2]	Same as Primary	
Particulate Matter ($PM_{2.5}$)	15 µg/m^3	Annual[3] (arithmetic mean)	Same as Primary	
	35 µg/m^3	24-hour[4]	Same as Primary	
Ozone	0.075 ppm (2008 STD)	Eight-hour[5]	Same as Primary	
	0.08 ppm (1997 STD)	Eight-hour[6]	Same as Primary	
	0.12 ppm	One-hour[7] (applies only in limited areas)	Same as Primary	
Sulfur Dioxide	0.03 ppm	Annual (arithmetic mean)	0.5 ppm (1300 µg/m^3)	3-hour[1]
	0.14 ppm	24-hour[1]		

[1] Not to be exceeded more than once per year.
[2] Not to be exceeded more than once per year on average over three years.
[3] To attain this standard, the three-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15 µg/m^3.
[4] To attain this standard, the three-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3 (effective December 17, 2006).
[5] To attain this standard, the three-year average of the fourth highest daily maximum eight-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm (effective May 27, 2008)
[6] To attain this standard, the three-year average of the fourth highest daily maximum eight-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm. The 1997 standard—and the implementation rules for that standard—would remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.
[7] The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than or equal to 1. As of June 15, 2005, EPA revoked the one-hour ozone standard in all areas except the eight-hour ozone nonattainment Early Action Compact Areas.
STD – Standard.
ppm – parts per million.
Source: EPA 2008.

In 1996, a carbon monoxide limited maintenance plan was submitted to the EPA. The Plan was amended in 1999. In 2000, the area was redesignated as being in attainment for carbon monoxide (RECON 2006, pp. 3–43). The Tucson area, including Sahuarita and Green Valley, is in attainment for all of the criteria pollutants.

The Pima County Comprehensive Land Use Plan (Pima County 2003) includes plans for maintaining air quality and ensuring that occurrences such as range and forest fires, land disturbance, unpaved roads, and other land uses do not compromise the existing levels of attainment for the six criteria pollutants.

Both meteorology and climate affect air quality. Pollution levels increase in the winter when temperature inversions can trap pollutants during calm weather. The layer of pollution trapped near the ground will eventually rise as the sun heats the ground, which allows dispersal of the trapped pollutants (RECON 2006, pp. 3–45).

Projections regarding future air quality for specific pollutants within Pima County are provided below.

Ground-Level Ozone

While no violations of ozone have occurred in Pima County since 1982, there is a possibility of exceedance in the future (RECON 2006, pp. 3–46). Ozone levels tend to follow increases in carbon monoxide, which occur with increased vehicular activity. The photochemical reactions resulting from heat and sunshine raise levels of ozone during the summer. Recently, Pima County has been close to exceeding NAAQS limits, so there is at least a moderate likelihood of exceedance in the future. The trend in ground-level ozone in Pima County from 2000 to 2007 was steady or slightly declining (Pima County 2008a).

Carbon Monoxide

As mentioned above, Pima County was previously in nonattainment for carbon monoxide levels. Carbon monoxide is a colorless and odorless gas produced by vehicle emissions. The area around Tucson has elevated readings of carbon monoxide during the winter months when temperature inversions occur. Carbon monoxide levels are predictably higher at busy intersections. As a result of advances in technology producing cleaner burning vehicles, carbon monoxide levels have decreased during the past 15 years. Projections for nonattainment of carbon monoxide levels are low for the predictable future, despite the predicted population increase in the Tucson area.

Particulate Matter

There have been no exceedances of PM_{10} in Pima County since 1999. Problems related to PM_{10} are common in the arid Southwest because dirt roads, fallow agricultural fields, and construction sites often are sources of airborne dust. Studies have indicated a range of health effects resulting from PM_{10} and $PM_{2.5}$ including asthma, bronchitis, and premature death. In the event of elevated PM_{10} levels, the Pima County Department of Environmental Quality (PDEQ) issues Particulate Matter Pollution Advisories. The trend

for PM_{10} and $PM_{2.5}$ in Pima County from 2000–2007 was a reduction of about one-third (Pima County 2008a).

Sulfur Dioxide and Nitrogen Dioxide

Levels of both SO_2 and NO_2 have been well below the NAAQS and the likelihood of future exceedances is low.

Lead

As a result of decreasing levels of lead in the late 1990s, the EPA discontinued the requirements for monitoring ambient levels of lead in most of the country, including Pima County (RECON 2006, pp. 3–47).

PDEQ has 23 air quality monitoring stations throughout Pima County. One monitoring station is adjacent to the Pima County Government Center in Green Valley. The station has been monitoring PM_{10} since 1989 and was established to monitor the particulates from the ASARCO (now Freeport-McMoRan) and Cypress Sierrita mines and tailings ponds. The station is approximately 2 miles southwest of the proposed recharge facility. A summary of 2007 air quality values from the Green Valley monitoring site is shown in Table 2.

As shown in Table 2, readings for ozone, PM_{10} and $PM_{2.5}$ are below the NAAQS thresholds (Table 1) at the Green Valley monitoring station.

Table 2. Green Valley Air Quality Data.

Ozone One-Hour Average Summary Values for 2007 (in ppm)				
Monitor	**1st Max Eight-Hour Value**	**2nd Max Eight-Hour Value**	**3rd Max Eight-Hour Value**	**4th Max Eight-Hour Value**
Ozone (ppm) [1]	0.033	0.085	0.074	98

Particulate Matter (PM_{10} and $PM_{2.5}$) Summary Values for 2007 (in micrograms per cubic meter [µg/m^3])			
Monitor	**Annual Average[2,3]**	**1st Max 24-Hour Value[4]**	**2nd Max 24-Hour Value**
Particulate Matter (PM_{10})	20.4	123	77
Particulate Matter ($PM_{2.5}$)	4.33	14.5	13.0

[1] NAAQS is the three-year average of the fourth highest daily maximum eight-hour average ozone concentrations measured at each monitor within an area over each year that must not exceed 0.075 ppm (effective May 27, 2008); three years of data following the new standard will not be available until May 2011.
[2] NAAQS annual average for PM_{10} was revoked in September 2006.
[3] NAAQS annual average for $PM_{2.5}$ is 15 µg/m^3.
[4] NAAQS 24-hour average for PM_{10} is 150 µg/m^3 and for $PM_{2.5}$ is 35 µg/m^3.
Source: Pima County 2008b.

3.2.2 Environmental Consequences

3.2.2.1 No Action Alternative

The No Action Alternative would not alter the air quality in the Project area. Because the CWC water delivery system would not be constructed under this alternative, the ambient air quality conditions would remain unchanged.

3.2.2.2 Preferred Alternative

The Preferred Alternative would result in the emission of relatively minor amounts of pollutants caused by operation of vehicles and construction equipment over the construction period of approximately 6.5 months. Based on the size, type, and number of vehicles and equipment expected to be used to build the Proposed Project, potential emissions during construction would be approximately 1.3 tons of hydrocarbons, 7.1 tons of carbon monoxide, 13.3 tons of nitrogen oxides, and 4.1 tons of sulfur dioxide (Welch 2010). While not quantified, ozone levels during the construction period could increase because they tend to follow carbon monoxide levels, as discussed above under Section 3.2.1—Affected Environment.

Construction activities may result in a slight localized increase of particulate matter from land disturbance, fugitive dust, and operation of construction equipment. Pima County Code (Title 17) requires dust-control measures be implemented during construction. According to PDEQ, a Pima County Activity Permit is required prior to land disturbance associated with construction of the pipeline, booster station, and recharge basin (Pima County 2008c). CWC would obtain the necessary Pima County permit prior to construction, and the construction firms would be required to implement dust control by adhering to permit requirements. Construction firms also would be required to maintain construction vehicles and equipment to minimize emissions. The use of dust suppression would limit PM_{10} emissions to approximately 8.4 tons during construction of the Proposed Project (Welch 2010).

Construction of the Proposed Project would result in a short-term minor increase in air pollution. The contribution of project-related emissions during a 6.5-month construction period compared to the emissions countywide for the same period would range from 0.01 percent (carbon monoxide) to just under 0.3 percent (sulfur dioxide). This contribution is not anticipated to result in exceedances of air quality standards (Welch 2010). There also would be temporary emissions of air pollutants from periodic scarifying of the recharge basins to maintain infiltration rates. These activities are expected to occur over a period of one or two weeks each year; the emissions would be nominal and only a fraction of those created during construction of the Proposed Project. These activities also are not anticipated to result in exceedances of air quality standards. No adverse air quality impacts would result from operation of the pipeline or recharge facility following construction.

3.2.2.3 North Parcel Recharge Site Alternative

Under this alternative, overall air emissions would be about the same as the Preferred Alternative except there would be an increase of approximately 0.4 tons of PM_{10} emissions due to the slightly greater amount of fugitive dust from more earthwork at the North Parcel (Welch 2010).

3.2.2.4 CAP Terminus Alternative

The CAP Terminus Alternative would result in 13 to 14 percent more gaseous air pollutant emissions than the Preferred Alternative due to construction of an additional 2 miles of pipeline. Potential emissions during construction would be approximately 1.5 tons of hydrocarbons, 8.1 tons of carbon monoxide, 15.1 tons of nitrogen oxides, and 4.7 tons of sulfur dioxide (Welch 2010). There would also be an increase of approximately 0.7 tons of PM_{10} emissions compared to the Preferred Alternative (Id.). The increase in emissions from the CAP Terminus Alternative would be short-term and minor compared to countywide emissions.

3.2.2.5 CAP Entitlements Alternative

The minor adverse air quality impacts of the CAP Entitlements Alternative would be slightly less than the impacts of the Preferred Alternative because the amount of vehicle and equipment use would be reduced because of the smaller recharge facility.

3.2.2.6 CWC-Only Alternative

The minor adverse air quality impacts of the CWC-Only Alternative would be less than the impacts of the Preferred Alternative because excavating the smaller recharge facility would require less equipment use. The vehicle and equipment use for pipeline construction would be similar to the Preferred Alternative.

3.2.3 Cumulative Effects

As described in Section 3.1—Background for Cumulative Effects, anticipated projects in the impact area include several new housing developments and a new road. These actions would result in an increase of vehicle emissions and construction-related fugitive dust in the impact area. Construction of the Proposed Project would temporarily add minor emissions of air pollutants in the immediate vicinity of the Proposed Project; however, the Proposed Project has the potential to contribute only slightly to cumulative air quality impacts for the duration of construction. Timing of construction of the Proposed Project in relation to the other anticipated projects is not known; if the projects do not occur at the same time, there would be no additive, or cumulative, impacts. The Proposed Project's emissions of minute quantities of greenhouse gases during construction would have a negligible cumulative effect on the global processes that contribute to climate change, when added to those types of emissions from other natural and human-caused sources.

Construction of the project with the North Parcel would result in about the same cumulative air quality impacts as the Proposed Project. Construction of the CAP Terminus Alternative, in addition to the other components of the Proposed Project, would result in slightly greater short-term emissions of air pollutants than the Proposed Project in the immediate vicinity of the construction activities. However, like the Proposed Project, this alternative has the potential to contribute only slightly to cumulative air quality impacts, including the emission of greenhouse gases, during the construction period. Timing of construction of this alternative in relation to other anticipated projects is not known; if they do not occur at the same time, there would be no cumulative impacts. Compared to the Proposed Project, the CAP Entitlements and CWC-Only alternatives would have fewer air quality cumulative effects due to the construction of smaller recharge basins.

3.3 Land Use

For evaluation of land use impacts, the Project area is the Town of Sahuarita because that is where direct Project construction effects would occur. The Project area for analysis of cumulative impacts to land use is the ground water area of impact surrounding the proposed recharge facility.

3.3.1 Affected Environment

The Town of Sahuarita was incorporated in 1994 and covers more than 29 square miles. In December 2002, the Town adopted a General Plan (Sahuarita 2002). The Land Use Element consists of both maps and policies regarding land uses planned for specific areas. To augment the planning process, the Town defined the "sphere of influence," which increased the planning area to 38.5 square miles. The pipeline portion of the Proposed Project is either within the Sahuarita Town limits, or its "sphere of influence" (Id., p. 7). Table 3 lists the existing land use percentages in various categories under the Sahuarita General Plan.

Table 3. Sahuarita Land Use (2002).

Land Use Category	Percent of Area*
Residential	6.5
Commercial	0.3
Industrial	1.4
Parks and Open Space	0.3
Golf Course	1.8
Public, State Trust, and Institutional	11.6
Rights-of-Way	1.7
Utilities and Mines	3.8
Vacant	20.5
Farm and Ranch	52.3

*Does not total exactly 100 percent due to rounding.
Source: Sahuarita 2002 (p. 6).

Of the total sphere of influence in the Sahuarita Land Use Plan, 16.8 percent is State Trust Land and 83.2 percent of the land is privately, institutionally, or municipally owned. There are no federal lands within the Plan area. Most of the future growth within the Town is anticipated to be within master planned communities (Sahuarita 2002, p. 9).

The Town has identified three specific areas within its corporate boundaries for future commercial growth. One area for developing commerce is near Duval Mine Road and I-19. The second area is at the intersection of I-19 and Sahuarita Road. The third growth area is designated for mixed use adjacent to PMR and I-19 (Id., p. 25). In addition, the town adopted a General Plan Amendment in October 2008 that categorizes some State Trust Land directly east of the established sphere of influence along Sahuarita Road as a "designated growth area," which is effective upon annexation into the Town (Sahuarita 2008b).

Although the area of the 100-year floodplain near the Santa Cruz River is seen as future developable land, the likelihood of development occurring within the foreseeable future is low. The possibility of floods in this area creates a development constraint that is likely to slow growth in this area (Id., p. 16).

The pipeline would be constructed primarily through existing ROWs on private land within the Town limits. The portion of the pipeline corridor extending from the PMR Lateral to ONH, then south to the end of the proposed main pipeline would be on land currently designated within the 100-year floodplain. The area along both sides of the NH is the subject of a Special Planning Area designation by the Town of Sahuarita (Id., Figure 1A). Future land use both east and west of the NH is projected as an Employment category for most of the distance north of Sahuarita Road. The land surrounding the intersection of Sahuarita Road and NH is designated Commercial. The land south of the intersection to the end of the proposed main pipeline is designated Medium or High Density Residential. A narrow linear parcel of land northwest of where the 20-inch delivery pipeline heads west is designated Resource Conservation due to its proximity to the Santa Cruz River (Id., Figure 1A). The area surrounding Well #11 is designated a mixture of Commercial and Residential uses (Id., Figure 1).

The new ROW west of the ONH along the 20-inch pipeline alignment includes the Santa Cruz River channel and sparsely vegetated, mostly disturbed land. The remainder of the 20-inch pipeline ROW would cross previously disturbed areas.

The majority of the main and delivery pipeline routes, as well as the recharge locations, are currently zoned Rural Homestead (RH). According to the Official Zoning Map of the Town of Sahuarita, a thin strip of land along the NH north and south of Sahuarita Road is designated General Industrial (CI-2) (Sahuarita n.d.).

The Sahuarita General Plan contains a section on Recreation and Open Space (Sahuarita 2002, pp. 44–50). As provided in the General Plan, a draft Parks, Recreation, Trails and Open Space Plan was completed in 2007 (Sahuarita 2007). The General Plan describes the existing and proposed trail system within the Town of Sahuarita boundaries

and sphere of influence (Sahuarita 2002, Figure 3). Several trails planned for the future by the National Park Service (NPS) would cross the pipeline corridor. The existing De Anza National Historic Trail (De Anza Trail) connects early mission sites and Spanish settlements of the 1700s, primarily as an auto tour route with points of interest along the way (NPS 2008). The De Anza Trail is administered by local governments and the NPS in partnership with agencies, private landowners, and nonprofit organizations. A portion of the De Anza Trail corridor falls within the Project area.

Another relevant plan in the region that would have an effect on future land use is the Sonoran Desert Conservation Plan (SDCP) (Pima County 2008d). The SDCP identifies the area near the Santa Cruz River as a significant wildlife corridor (Pima County 2008d).

3.3.2 Environmental Consequences

3.3.2.1 No Action Alternative

The No Action Alternative would not change the land use patterns in the vicinity of the Proposed Project. Because this alternative would not result in the construction of Project facilities, land use conditions on the proposed pipeline alignment and recharge facilities would remain unchanged. Housing developments within the CWC service area would continue to use the CAGRD to meet their future water needs.

3.3.2.2 Preferred Alternative

The proposed pipeline would be constructed primarily within existing ROWs that have been previously disturbed. Land use would not change following pipeline installation. Installation of the pipeline, booster station, and recharge facility are compatible with existing Sahuarita land use plans and zoning. The proposed booster station would be constructed in an area zoned for a compatible land use, Resource Industrial. The booster station would be enclosed in concrete masonry unit block walls of a type to coordinate with the adjacent walls in the area.

The segment of the future proposed pipeline extending from the recharge basin west to Well #11 would cross the De Anza Trail. Some minor temporary disruption to recreational use of the trail system could occur during construction or repair of the proposed pipeline extension; however, such a disruption would be negligible because trail users could skirt the construction or repair zone.

Placement of the proposed pipeline within portions of the Santa Cruz 100-year floodplain would have no long-term impacts to the floodplain because the pipeline would be buried. The majority of the proposed recharge facility would be below the original ground surface and surrounded by a berm. From the surrounding area, much of the facility would not be visible.

Development of the proposed CWC water delivery system would comply with state and federal laws and regulations regarding waste management and would consider:

1) hazardous waste, landfill, and superfund sites; and 2) water reduction and pollution prevention methods.

Temporary traffic delays would be caused at road crossings during open-trench construction of the main and delivery pipelines.

3.3.2.3 North Parcel Recharge Site Alternative

Land use impacts under the North Parcel alternative would be the same as the Preferred Alternative.

3.3.2.4 CAP Terminus Alternative

Land use impacts under the CAP Terminus Alternative would be similar to the Preferred Alternative. Construction of an additional 2 miles of pipeline under the CAP Terminus Alternative would primarily occur in and adjacent to areas previously disturbed for construction of PMR and various utilities. Land use along the additional segment of pipeline would not change due to pipeline installation.

Installation of the additional segment of pipeline would be compatible with existing Sahuarita land use plans and zoning. The additional section of pipeline would be installed in an area zoned Rural Homestead or Rural Residential with a Mixed Use land use designation under the Sahuarita General Plan.

The additional pipeline segment would cross one section of the trail associated with the De Anza Trail and would be adjacent to and cross proposed sections of the county trail system. Some minor temporary disruption to recreational use of the trail system could occur during construction or repair of this proposed pipeline extension; however, such a disruption would be negligible because trail users could skirt the construction or repair zone.

Pipeline construction within portions of the Santa Cruz 100-year floodplain would have no long-term impacts to the floodplain because the pipeline would be buried.

In addition to the temporary traffic delays under the Preferred Alternative (Section 3.3.2.2—Land Use—Environmental Consequences), temporary traffic delays would occur where the main pipeline from the CAP Terminus would cross PMR near the junction with Rancho Sahuarita Boulevard (see Figure 2).

3.3.2.5 CAP Entitlements Alternative

The effect to land use for the CAP Entitlements Alternative would be nearly identical to the impacts of the Preferred Alternative because the location of new facilities and area of disturbance would be the same under both alternatives.

3.3.2.6 CWC-Only Alternative

The land use impacts of the CWC-Only Alternative would be similar to the impacts of the Preferred Alternative because the only change would be the reduced size of the recharge facility.

3.3.3 Cumulative Effects

As described in Section 3.1—Background for Cumulative Effects, a number of road and housing projects are expected to be constructed in the Project area. These actions would result in changes in existing land use in the vicinity of the Proposed Project. The Preferred Alternative and action alternatives would not change land use patterns where the new underground pipeline would be located within existing utility corridors. The remaining pipeline alignments and addition of a small booster station would be compatible with existing land use plans and zoning. The recharge facility would be compatible with development on adjacent properties because the facility would be similar to existing recharge facilities about ½ mile south of the proposed recharge sites. Any maintenance activities at the recharge facility would be similar to existing operations at the Staker & Parson facility, but would only occur for one to two weeks per year and at much less intensity.

Under the North Parcel alternative, construction of the project would result in about the same cumulative land use impacts as the Proposed Project. Construction of the CAP Terminus Alternative, in addition to the other components of the Proposed Project with either the North or the South parcel, would result in minimal additional change in existing land use in the vicinity of the Proposed Project. The additional underground pipeline construction would be compatible with existing land use plans and zoning. Compared to the Proposed Project, construction of the CAP Entitlements and CWC-Only alternatives would have nearly the same land use cumulative effects because the only change would be smaller recharge basins.

3.4 Biological Resources

The Project area for evaluation of biological resource impacts consists of the pipeline corridors, the proposed recharge facility, and the CWC service area because that where the Proposed Project construction, recharge, and water use effects would occur. For analysis of cumulative impacts to biological resources, the Project area is the ground water area of impact surrounding the proposed recharge facility.

3.4.1 Affected Environment

3.4.1.1 Vegetation

The Project area encompasses three primary habitat types: semidesert grasslands, Sonoran desertscrub, and riparian habitats. Descriptions of the vegetation communities in the Project area are provided below and follow Brown (1994). Note: Pima County uses a variation of Brown's (1994) biotic communities where some of the names are different

and the vegetation mapping is more refined (Novak Environmental, Inc. 2001). A list of flora that may occur in the Project area is in Appendix C.

Semidesert Grasslands

The Semidesert Grassland community is a perennial grass-scrub-dominated landscape between Sonoran Desertscrub at lower elevations and Evergreen Woodland, Chaparral, or Plains Grassland at higher elevations (Brown 1994, p. 123). Most Semidesert Grasslands receive average annual precipitation between 9.5 and 17.5 inches, of which about 50 percent occurs from April to September. Perennial grass production is dependent primarily on the predictability and amount of precipitation during this period (Id., p. 123). Many Semidesert Grasslands have been invaded by woody plants, leaf succulents, and cacti. This is believed to be caused by livestock grazing and increased aridity from decreased rains and increasing temperatures (Turner 1974, map).

Species typical of the Semidesert Grassland habitat include catclaw acacia (*Acacia greggii*), foothill palo verde (*Parkensonia microphylla*), mesquite (*Prosopis velutina*), columnar cacti such as the saguaro (*Cereus giganteus*), fishhook barrel cactus (*Ferocactus wislizenii*), cholla (*Opuntia* spp.), prickly pear (*Opuntia* spp.), pincushion cacti (*Mammillaria* spp.), hedgehog (*Echinocereus engelmannii*), and burroweed (*Isocoma tenuisecta*). Typical grass species include needle grama (*Bouteloua aristidoides*), bush muhly (*Muhlenbergia porteri*), and three awn (*Aristida* spp.).

Within the Proposed Project area, Semidesert Grassland habitat occurs along the southern portion of the pipeline alignment, the proposed recharge facility, and the undisturbed portions of the North Parcel. The South (Preferred) Parcel was used for agricultural purposes in the 1940s or 1950s, and is currently used for grazing. Vegetation cover is sparse (visually estimated at 10 percent to 15 percent during the site visit) and consists of mesquite, desert broom (*Baccharis sarothroides*), and burrowed (*Isocoma tenuisecta*).

Arizona Upland Subdivision of the Sonoran Desertscrub

The Arizona Upland Subdivision of the Sonoran Desertscrub is also known as the Arizona Desert or Paloverde Cacti Desert. Approximately 90 percent of the Arizona Upland Subdivision is on slopes, broken ground, and multidissected sloping planes (Brown 1994, p. 200). Average annual precipitation ranges between 7 and 16 inches. Summer rainfall accounts for 30 to 60 percent of the annual total. Winter precipitation ranges from 10 to 40 percent of the annual total.

The vegetation of the Arizona Upland Subdivision most often takes on the appearance of a scrubland or low woodland of leguminous trees with intervening spaces held by one to several open layers of shrubs and perennial succulents and columnar cacti (Brown 1994, p. 194). Vegetation within the subdivision includes its characteristic trees: foothill palo verde, blue palo verde (*Parkensonia florida*), mesquite, and catclaw acacia. Cacti in this subdivision include several species of cholla, saguaro, and pincushion, to name a few.

The pipeline alignment from the PMRRP to approximately Sahuarita Road consists of Sonoran Desertscrub habitat. Vegetation along existing road ROWs is sparse and includes mesquite, catclaw acacia, blue palo verde, fishhook barrel cactus, annual grasses, and forbs. The CAP Terminus Alternative also occurs within this habitat type. Portions of the CAP Terminus alignment have been used for construction of utility (electric and water) distribution lines. However, vegetation density is higher along portions of the alignment on the south side of PMR.

Riparian Communities

The Project area contains small patches of habitat classified as Important Riparian Areas (Stantec Consulting, Inc. [Stantec] 2008, p. 5.3; Pima County 2005, p. 3). Important Riparian Areas occur along major river systems and provide critical watershed and water resource management functions, as well as a framework for landscape lineages and biological corridors. Important Riparian Areas are valued for their water availability, vegetation density, and biological productivity compared to adjacent uplands. Pima County has classified the Santa Cruz River as an Important Riparian Area. In addition to the Santa Cruz River, a strip of habitat running along the east edge of the South Parcel, and a band of habitat between the recharge basins and the storage area within the North Parcel are all classified as Important Riparian Areas.

Xeroriparian habitat is generally associated with an ephemeral water supply. Ephemeral systems are normally dry, only flowing in response to storm events. These communities typically contain plant species also found in the upland habitats, but they are typically larger and/or occur at higher densities than adjacent uplands. Pima County has four classifications of Xeroriparian habitat (A, B, C, and D) based on the amount of total vegetative volume; Xeroriparian A has the greatest volume.

Disturbed Habitats

Most of the pipeline alignment along PMR, NH, ONH, and ONH west to Well #11 occur within previously disturbed areas and/or dedicated ROWs. The percentage of vegetative cover varies throughout the Project area. Species found within the disturbed areas include mesquite, acacia (*Acacia* spp.), foothill palo verde, annual grasses, Russian thistle (*Salsola iberica*), and forbs.

CWC Service Area

The vegetative communities within the CWC service area were not field verified. However, according to the Brown and Lowe (1994) map, the CWC service area falls within the habitat types previously described. According to the Sahuarita General Plan (Sahuarita 2002), approximately 73 percent of the CWC service area is described as vacant, farm, or ranch lands. The actual percentage of native habitat within this grouping is unknown. Likewise, the exact breakdown of habitat types within the vacant, farm, or ranch lands is unknown, although the Arizona Upland Subdivision appears to be the predominate vegetative community.

3.4.1.2 Wildlife

Common bird species that may occur in the Project area include curve-billed thrasher (*Toxostoma curvirostre*), mourning dove (*Zenaida macroura*), Say's Phoebe (*Sayornis saya*), Gila woodpecker (*Melanerpes uropygialis*), verdin (*Auriparus flaviceps*), rufous-winged sparrow (*Aimophila carpalis*), and black-throated sparrow (*Amphispiza bilineata*). In addition to resident species, the Sonoran Desert provides wintering and migratory habitat for various bird species including the white-crowned sparrow (*Zonotrichia leucophris*) and Brewer's sparrow (*Spizella breweri*), as well as raptors such as the northern harrier (*Circus cyaneus*).

The Sonoran Desert also exhibits a wide diversity of mammal species. Three rabbit species occur throughout this region: the desert cottontail (*Sylvilagus audubonii*), black-tailed jackrabbit (*Lepus californicus*), and antelope jackrabbit (*Lepus alleni*). Other typical desert mammals include the highly desert-adapted Merriam's kangaroo rat (*Dipodomy merriami*), ubiquitous white-throated woodrat (*Neotoma albigula*), coyote (*Canis latrans*), and collared peccary (*Pecari tajacu*).

Common lizards in the Project area include the tiger whiptail (*Aspidoscelis tigris*), side-blotched lizard (*Uta stansburiana*), and poisonous Gila monster (*Heloderma suspectum*). The variety of small mammals provides an abundant prey source for snakes in the area including the red racer (*Masticophis flagellum picues*), western diamondback rattlesnake (*Crotalus atrox*), and gophersnake (*Pituophis catenifer*).

A list of fauna expected to occur in the Project area is provided in Appendix C.

3.4.1.3 Threatened and Endangered Species

Table 4 summarizes the federally listed species (listed species) and designated and proposed critical habitat identified by the FWS as potentially occurring in Pima County (FWS 2008).

Impacts to federally listed aquatic species associated with importation of nonnative fish species into the Santa Cruz Basin via the CAP were considered under the "Reinitiated Biological Opinion on the Transportation and Delivery of CAP Water to the Gila River Basin in Arizona and New Mexico and its Potential to Introduce and Spread Non-indigenous Aquatic Species" dated May 15, 2008. Impacts to listed aquatic species are not discussed further because they were addressed in the 2008 Biological Opinion. Two listed species have suitable habitat in the Project area, and may be affected by the Preferred Alternative. Those species are discussed below.

Table 4. Federally Listed, Proposed, and Candidate Species, and Designated or Proposed Critical Habitats.

Common Name	Scientific Name	Federal Status	Habitat	Determination of Presence of Suitable Habitat in Project Area
MAMMALS				
Jaguar	*Panthera onca*	Endangered	Found in Sonoran desertscrub up through subalpine conifer forest	Arizona population extirpated;. possible Mexican transients
Lesser Long-nosed Bat	*Leptonycteris curasoae verbabuenae*	Endangered	Desert scrub habitat with agave and columnar cacti present as food plants	Suitable habitat within the Project area
Ocelot	*Leopardus (Felis) pardalis*	Endangered	Humid tropical and subtropical forests, savannahs, and semiarid thornscrub	Vegetation lacks density to support species
Sonoran Pronghorn	*Antilocapra americana sonoriensis*	Endangered	Broad intermountain alluvial valleys with creosote-bursage and palo verde-mixed cacti associations	Outside of known range
BIRDS				
Masked Bobwhite	*Colinus virginianus ridgewayi*	Endangered	Desert grasslands with diversity of dense native grasses, forbs, and brush	Outside of current population range
Mexican Spotted Owl	*Strix occidentalis lucida*	Threatened	Nests in canyons and dense forests with multilayered foliage structure	Outside of current elevation range
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	Endangered	Cottonwood/willow and tamarisk vegetation communities along rivers and streams	No suitable habitat present
Yellow-billed Cuckoo	*Coccyzus americanus*	Candidate	Nests in relatively dense riparian habitat, willow, cottonwood, and salt cedar	No suitable habitat present

Common Name	Scientific Name	Federal Status	Habitat	Determination of Presence of Suitable Habitat in Project Area
FISH				
Desert Pupfish	*Cyprinodon macularius macularius*	Endangered	Shallow springs, small streams, and marshes; tolerates saline and warm water	Perennial flows absent in this reach of the river
Gila Chub	*Gila intermedia*	Endangered	Pools, springs, cienegas, and streams	Perennial flows absent in this reach of the river
Gila Topminnow	*Poeciliopsis occidentalis*	Endangered	Small streams, springs, cienegas, and vegetated shallows	Perennial flows absent in this reach of the river
AMPHIBIANS AND REPTILES				
Chiricahua Leopard Frog	*Lithobates (Rana) chicahuensis*	Threatened	Streams, rivers, backwaters, ponds, and stock tanks that are mostly free from introduced fish, crayfish, and bullfrogs	No permanent water source on or near the Project area
Sonoyta Mud Turtle	*Kinosternon sonoriense longifemorale*	Candidate	Ponds and streams	No permanent water source on or near the Project area
PLANTS				
Huachuca Water Umble	*Lilaeopsis schaffneriana* ssp. *recurva*	Endangered	Cienegas, perennial low gradient streams, and wetlands	Outside of current range
Kearney Blue Star	*Amsonia kearneyana*	Endangered	West-facing drainages in the Baboquivari Mountains	Outside of current range
Nichol Turk's Head Cactus	*Echinocactus horizonthalonius* var. *nicholii*	Endangered	Sonoran Desertscrub	Outside of current range
Acuna Cactus	*Echinomasatus erectocentrus* var. *acunensis*	Candidate	Well-drained knolls and ridges in Sonoran Desertscrub	No suitable habitat present
Pima Pineapple Cactus	*Corypantha scheeri* var. *robustispina*	Endangered	Sonoran Desertscrub or Semidesert Grassland communities	Suitable habitat in the Project area

Lesser Long-Nosed Bat

The lesser long-nosed bat (LLNB) was listed as endangered on September 30, 1988 (53 FR 38456). It is a medium-sized bat, yellowish brown or pale gray on top with cinnamon brown on lower parts (FWS 2001). The LLNB has an elongated nose, a small triangular leaf on the end of its snout, and a minute tail. The LLNB migrates north to

Arizona in the summer to give birth and raise young; it returns to Mexico to breed during winter months. The LLNB cannot withstand prolonged exposure to cold temperatures (Dalton 1996).

The current range of the LLNB includes central Arizona to southwest New Mexico, extending to El Salvador (AFGD 2003). Its habitat is described as desertscrub with agaves, saguaros, and organ pipe cactus. The LLNB is a seasonal resident of southeastern Arizona in Cochise, Pima, Pinal, Maricopa, Santa Cruz, and Graham counties. Daytime and maternity roosts are in caves and abandoned mines.

Known threats to the LLNB include urban development, loss of food resources through bootleg harvesting of agaves, catastrophic fire, and a new threat of illegal border crossings associated with enforcement actions, and possibly new wind farms (FWS 2007a, p. 9).

The LLNB feeds on nectar from agaves and columnar cacti, such as saguaros. There is a mutualistic relationship between the LLNB and its forage species (FWS 2007a, p. 13). Reports show that the LLNB will repeatedly travel long distances to forage when resources are scarce (Bogan 2007). However, foraging studies have also shown that the LLNB will fly long distances to forage even when forage resources are available closer to the roosting site (FWS 1994, p. 15). Because *Leptonycteris* bats forage over such a wide area, large roosts require extensive stands of cacti or agaves for food (FWS 2007a, p. 14). This emphasizes the importance of maintaining food resources close to roost sites.

There are LLNB roosts in the Santa Rita and Rincon mountains. The nearest recorded maternity roost to the Project area is 21 miles to the northeast. A colony is 13 miles to the southeast (S. Schwartz, Arizona Game and Fish Department [AGFD], pers. comm. 2008). Both of these sites are within the 40-mile foraging radius of LLNB, as determined by the FWS (S. Richardson, FWS, pers. comm. 2008).

There are no roost sites or foraging habitat in the Project construction zone. Foraging habitat may be adjacent to portions of the pipeline alignment.

Pima Pineapple Cactus

The Pima pineapple cactus (PPC) was listed as endangered on September 23, 1993 (58 FR 49875). The range of PPC is limited to Pima and Santa Cruz counties of Arizona and northern Sonora, Mexico. The PPC current range extends from the Baboquivari Mountains east to the western foothills of the Santa Rita Mountains (FWS 2000). The northern limit of the range is near Tucson (FWS 2000). The PPC is described as a 4- to 18-inch dome-shaped cactus with yellow silky flowers that blooms in early July, when summer rains begin, and continues flowering through August. Clusters of six to 15 spines (with a central, usually hooked, spine) appear on finger-like projections called tubercles. PPC prefer open areas on flat ridgetops of the Semidesert Grassland or the Sonoran Desertscrub habitat dominated by white-thorn acacia (*Acacia constricta*), mesquite, thread snakeweed (*Gutierrezia microcephala*), triangle bursage (*Ambrosia deltoidea*), and

various cacti and grasses (AGFD 2001). The PPC also can be found in alluvial basins or on hillsides. This species seems to prefer deep alluvial soils (silty to rocky) of granitic origin (Ecosphere 1992, p. 11). The PPC is most often found on south- or east-facing slopes between 2,500 feet and 3,800 feet in elevation (Ecosphere 1992, p. 11).

Known threats to this species include habitat loss associated with off-road vehicle use, road construction, agriculture, mining, habitat degradation due to livestock grazing, alteration of habitat due to aggressive nonnative grasses, and illegal collection (AGFD 2001). It is believed that residential and commercial development and its infrastructure are the greatest threat to PPC (FWS 2007b, p. 10). Continued growth in Green Valley and Sahuarita has resulted in increased developmental pressure on PPC habitat.

Invasive species have the potential to alter the ecosystem of the plant community by forming monotypic stands that do not allow for regeneration of native species and creating a much heavier fuel load with higher fire intensities. This change in composition can lead to a permanent change in the plant community by allowing fires to burn hotter and more frequently than would occur in the natural vegetation. Certain species, such as the PPC, that are not fire adapted can be lost as a result of such fires.

The Preferred Alternative occurs within suitable PPC habitat. PPC surveys were completed on all proposed pipeline alignments and the recharge site in accordance with the FWS-recommended survey protocol. No PPC were observed in the Proposed Project area during the surveys.

3.4.2 Environmental Consequences

3.4.2.1 No Action Alternative

The No Action Alternative would not alter the vegetation patterns, wildlife populations, or threatened and endangered species in the vicinity of the Proposed Project. Because the No Action Alternative would not result in construction, the biological resources would remain unchanged.

3.4.2.2 Preferred Alternative

3.4.2.2.1 Vegetation

The pipeline would be constructed primarily in Semidesert Grassland and Sonoran Desertscrub habitat. Impacts to these vegetation communities would be minimized by locating the pipeline within existing easements to the degree practicable. Approximately 55.6 acres of previously disturbed habitat would be affected by pipeline construction. Construction of the recharge site would disturb about 21 acres of previously disturbed Semidesert Grassland habitat. Despite increased losses due to development, Semidesert Grassland and Sonoran Desertscrub habitat remain abundant in southeastern Arizona. The loss of about 76.6 acres of these two types of habitat would not be considered adverse based upon the acreage remaining in the region.

The Important Riparian Areas along the Santa Cruz River would be avoided by boring the proposed future pipeline to Well #11 under the river and associated riparian areas. Construction of the pipeline to the recharge site through a narrow band of Important Riparian Area along the eastern edge of the recharge site would result in the loss of approximately 0.05 acre of habitat. This acreage loss could be further reduced if the pipeline alignment follows the existing road corridor.

All areas disturbed by construction that are not required for permanent facilities would be revegetated with an appropriate native seed mix following construction, or as otherwise required by the entity providing the ROW. Best management practices would be used during construction to minimize the introduction and spread of noxious weeds. Ongoing weed control would be implemented during and after construction to minimize the colonization of disturbed areas by nonnative grasses that may degrade potential PPC habitat (see Section 3.4.2.2.3—Threatened and Endangered Species).

3.4.2.2.2 Wildlife

Mammal, bird, and reptile species common to the region would be temporarily displaced during pipeline construction, and there would be loss of some individuals; however, wildlife use of this habitat is limited because of the proximity to major roads along most of the pipeline route. Revegetation of areas disturbed during construction that are not needed for permanent facilities would restore vegetative cover along the pipeline corridor. Construction of the recharge site would result in the loss of 21 acres of habitat for reptiles, small mammals, and birds. However, due to the degraded nature of the site, these impacts would be minor. Use of the area by large native mammals is likely limited, although the adjacent Santa Cruz River provides a large mammal movement corridor. Impacts to migratory birds would be avoided by performing construction work outside the breeding season or conducting clearance surveys prior to construction. If an active nest is found during clearance surveys, the nest would be avoided until after the breeding season. A temporary construction barbed wire fence would be installed, if needed, to protect migratory bird nests and restrict public access, but permit wildlife movement.

3.4.2.2.3 Threatened and Endangered Species

Lesser Long-Nosed Bat

No saguaro cacti or suitable LLNB habitat would be impacted along the pipeline route, booster station location, proposed contractor use areas, or recharge facility. On February 10, 2010, Reclamation provided a revised biological assessment (BA) to the FWS on potential impacts to the LLNB as a result of project modifications. Reclamation concluded that the revised Proposed Project would have no effect on the LLNB.

Pima Pineapple Cactus

The introduction and spread of invasive plant species within PPC habitat have the potential to alter the plant community by crowding out native species and replacing them with species that provide a heavier fuel load and higher fire potential. These changes in vegetative composition permit fires to burn hotter and more frequently than what naturally

occurs with the native vegetation. As a result, the potential for fire-related mortality of PPC is increased.

Several weed control measures would be used to minimize potential adverse effects to PPC habitat that may be present on lands bordering the recharge site and other Proposed Project areas. Construction equipment would be washed with high-pressure cleaning instruments to remove potential weed sources before moving into a construction area. Additionally, active construction sites would be closed to vehicles that are not involved with construction, and public access to the recharge site would be restricted. Construction areas would be monitored for noxious weeds during construction and would be treated as needed during, and for 2 years following, construction. Noxious weeds would be treated with glyphosate herbicide. Areas disturbed by construction would be revegetated with salvaged native cacti species where feasible. Additionally, a native seed mix appropriate for the area would be applied to disturbed areas after construction to help prevent weed invasion.

Stantec Consulting, Inc. conducted PPC surveys along the entire pipeline alignment between May 22, 2008 and June 22, 2008. Reclamation conducted PPC surveys at the South Parcel on August 28, 2009. No PPC were observed in the Project area. On February 10, 2010, Reclamation submitted a revised BA to the FWS on potential impacts to the PPC as a result of the Project modifications. Reclamation concluded that the Proposed Project would have no effect on the PPC.

3.4.2.3 North Parcel Recharge Site Alternative

The only difference between the Preferred Alternative and the North Parcel Alternative is the location of the recharge facility. Consequently, impacts to biological resources under this alternative would be similar to the Preferred Alternative. There are no saguaros (and therefore no LLNB habitat) on the North Parcel. PPC surveys were conducted on August 28, 2009, and no PPC were observed during the survey. On February 10, 2010, Reclamation submitted a revised BA to the FWS concerning Project modifications. A discussion of the potential impacts to federally listed species from this alternative was included due to the potential for this recharge alternative to be selected. Reclamation concluded that use of the North Parcel would have no effect on the LLNB or PPC.

3.4.2.4 CAP Terminus Alternative

The biological resource impacts under the CAP Terminus Alternative would be similar to the Preferred Alternative. The construction of an additional 2 miles of pipeline under the CAP Terminus Alternative would primarily occur in and adjacent to areas that have been previously disturbed for construction of PMR and various utilities. The only difference in impacts from the Preferred Alternative is associated with the additional 2 miles of pipeline along PMR.

A small patch of Xeroriparian C habitat occurs along PMR between I-19 and Rancho Sahuarita Boulevard. Xeroriparian C habitat ranks third out of the four Xeroriparian

subclasses (A, B, C, and D) with respect to total vegetation volume. Approximately 0.5 acre of Xeroriparian C habitat would be disturbed by pipeline construction.

Revegetation and weed control measures for the additional 2-mile pipeline segment would be the same as for the Preferred Alternative. Impacts to migratory birds would be avoided by performing construction work outside the breeding season or conducting clearance surveys prior to construction. If an active nest is found during clearance surveys, the nest would be avoided until after the breeding season to the extent practicable.

A site visit on January 11, 2010 resulted in documentation of approximately 74 saguaros (less than 10 feet tall and no arms) and six saguaros (greater than 10 feet tall with arms) in or adjacent to the 2-mile pipeline extension area. The loss of six mature saguaros would have an insignificant effect on foraging habitat for the LLNB. However, the loss of up to 74 small saguaros would constitute a loss of future foraging resources. On February 10, 2010, Reclamation submitted a revised BA to the FWS concerning Project modifications. A discussion of the potential impacts to federally listed species from this alternative was included due to the potential to use this alternative connection to the CAP water supply. If this alternative is selected, CWC commits to transplanting all saguaros, as provided in Section 3.4.4—Biological Resource Mitigation Commitments. Based on this commitment, Reclamation concluded that implementation of the CAP Terminus Alternative would have no effect on the LLNB.

Twelve PPC were located during surveys conducted by Stantec (May 22, 2008 to June 22, 2008) and Reclamation (January 11, 2010) along this 2-mile alignment. One additional PPC was located during a January 25, 2010 site visit with FWS. Eleven of the 13 cacti occur within 150 feet of the proposed alignment.

Informal consultation (site visit and discussion) with FWS was conducted on January 25, 2010. A discussion of the potential impacts to federally listed species from this alternative was included in the February 10, 2010 memorandum to FWS in case this alternative is selected. If the CAP Terminus Alternative is selected, the pipeline alignment would be relocated to avoid the existing PPC and provide for a minimum buffer of 72 feet to the nearest cactus. FWS concurred with the need for installation of protective fencing and an on-site monitor during construction. Based on CWC's commitment to: (1) relocate a portion of the pipeline to avoid the cacti; (2) provide an on-site monitor during construction; and (3) install temporary fencing between the construction site and the PPC, Reclamation concluded that implementation of the CAP Terminus Alternative would have no effect on the PPC.

3.4.2.5 CAP Entitlements Alternative

A smaller amount of habitat would be impacted by this alternative compared to the Preferred Alternative; thus, the impacts to biological resources would be smaller. There would be no impacts to the federally endangered LLNB and PPC because the new facilities and area of disturbance essentially would be the same under both alternatives.

The CAP Entitlement Alternative would implement the same mitigation measures as the Preferred Alternative.

3.4.2.6 CWC-Only Alternative

Compared to the Preferred Alternative, the CWC-Only Alternative would have slightly less impact on biological resources because the recharge basin would be about 40 percent smaller. No threatened or endangered species would be affected. Mitigation measures would be the same as the Preferred Alternative.

3.4.3 Cumulative Effects

As described in Section 3.1—Background for Cumulative Effects, a number of road and housing projects are expected to occur within the impact area of the Proposed Project. These actions may result in future loss or degradation of vegetation, wildlife habitat, and LLNB foraging habitat. The Proposed Project's contribution to cumulative impacts to vegetation, wildlife, and LLNB foraging habitat (taking into consideration the planned mitigation measures) would be small, especially with respect to planned developments. Reasonably foreseeable actions by nonfederal entities are expected to result in continued loss and further fragmentation of PPC habitat.

Construction of the project in the North Parcel would result in substantially the same cumulative biological resource impacts as the Proposed Project. Construction of the CAP Terminus Alternative, in addition to the other components of the Proposed Project, with either the North or South parcels would result in a small amount of additional cumulative impacts to vegetation, wildlife, and LLNB foraging habitat due to the extended length of underground pipeline. Compared to the Proposed Project, the CAP Entitlements and CWC-Only alternatives would have slightly fewer biological resource cumulative effects due to the construction of smaller recharge basins.

Consideration of cumulative effects and future federal actions under the Endangered Species Act of 1973, as amended (ESA) is specifically dictated by that Act. Pursuant to the ESA, consideration of cumulative effects does not include any future federal actions. The CNF will be required to prepare a BA to determine whether the proposed Rosemont Mine would affect any federally listed or proposed species, or designated or proposed critical habitat. The CNF's BA will be required to include this Proposed Project as part of the baseline for determining the Rosemont Mine's potential effect to any federally protected species or critical habitat as part of the CNF's compliance with the ESA.

3.4.4 Biological Resource Mitigation Commitments

1. All areas disturbed by construction that are not needed for permanent facilities would be revegetated with an appropriate native seed mix.
2. Impacts to migratory bird species would be avoided by constructing outside the breeding season, or conducting clearance surveys prior to construction. If an active nest is found during clearance surveys, the nest would be avoided until after the breeding season.

3. If any previously unidentified federally listed species are discovered, construction activities would stop in the immediate area and Reclamation personnel would be notified.
4. All equipment would be power-washed to remove invasive weed seeds prior to being brought into the construction area.
5. Growth of noxious weeds would be monitored and treated as needed during construction and for 2 years following construction.
6. Public access into the construction zone and the recharge facility would be restricted.
7. Use of any areas (disturbed or undisturbed) by the contractor that are not already identified in Figure 2, Figure 3, and Figure 4 would require environmental clearances by Reclamation prior to use for this Project. Should the contractor propose to use any area that is adjacent to, or includes native vegetation, surveys for federally listed species would be conducted by a professional biologist. If PPC are located, Reclamation will reinitiate Section 7 consultation, if required under 50 CFR 402.16.
8. If the CAP Terminus Alternative is selected, then all saguaro cacti (determined by a horticulturalist specializing in cacti to be capable of being safely relocated) impacted by construction would be relocated outside of the construction ROW. The saguaro would be transplanted as close to the removal location as possible by a qualified, experienced contractor in compliance with ARS § 3-900-934 (Arizona Native Plant Law).
9. If the CAP Terminus Alternative is selected, the pipeline would be relocated (as depicted in the February 10, 2010 memorandum to FWS) to avoid PPC.
10. If the CAP Terminus Alternative is selected, CWC would provide an on-site monitor during construction of the realigned portions of the pipeline.
11. If the CAP Terminus Alternative is selected, CWC would install temporary protective fencing between the construction activities and the PPC.

3.5 Cultural Resources

The Project area for evaluation of cultural resource impacts is the corridor within ½ mile of the Proposed Project facilities. The Project area for analysis of cumulative impacts to cultural resources is the ground water area of impact surrounding the proposed recharge facility.

3.5.1 Affected Environment

3.5.1.1 Area Context

The Project area is within the Santa Cruz River valley, which has a long prehistory and history. The general region has seen human activity for more than 10,000 years,

evidenced by the discovery of mammoth remains and Paleoindian projectile points in the Santa Cruz watershed. Between Tucson and Green Valley, many areas of moderate to high cultural resource density are found. Site types range from sherd and lithic scatters to major prehistoric and historic villages and towns. At lower elevations near the river, prehistoric site density is high and includes numerous sites dated from the Archaic period to the present. Hohokam sites are common and range from small lithic and sherd scatters to large villages. At higher elevations away from the river, numerous prehistoric trails, campsites, petroglyphs, and other resource procurement sites are evident. Well-known sites between Tucson and Green Valley include the Valencia site, Julian Wash, St. Mary's, and Punta de Agua. O'odham sites from the Protohistoric period are also common. The area also has a number of historic sites connected to Native American, Spanish, Mexican, and Anglo occupations. Important sites such as the San Xavier Mission, Agua Caliente Ranch, and others contribute to the full range of sites representing every historic context including mining, commerce, farming, transportation, and ranching. Near the terraces and floodplain of the Santa Cruz River, the potential for buried cultural deposits is high.

3.5.1.2 Cultural History

Paleoindian Period (9500 to 6000 B.C.)

The earliest human occupation of the Americas is generally attributed to the Paleoindian period, which, in southern Arizona, is represented by the Clovis, Folsom, and San Dieguito traditions. Paleoindian groups are generally characterized as a pre-agricultural, highly mobile hunter-gatherer society that was well adapted to the Late Pleistocene environment (Cordell 1984, pp. 138–142; Martin and Plog 1973, p. 44). These groups, however, probably relied most heavily on small game and gathering wild plant resources.

Clovis people (ca. 9000 to 8000 B.C.) are thought to have used large territories to hunt megafauna, such as bison and mammoth, which became extinct at the end of the last Ice Age. This tradition is characterized by the diagnostic "Clovis" projectile point with its finely made fluted faces and ground distal end. Although some of the most famous Clovis sites are found in southern Arizona, they are rare. Only a few surface Clovis projectile points have been recovered in the Tucson Basin (Bronitsky and Merritt 1986, p. 95) representing the only Paleoindian remains found in the Tucson area. No remains have been identified as Folsom or San Dieguito in the Tucson Basin. This scarcity of Paleoindian remains in general may be because late Pleistocene deposits are deeply buried by recent alluvium.

Archaic Period (7500 B.C. to A.D. 200)

Much like the previous Paleoindian tradition, the Archaic period was originally described as a largely nonsedentary and widespread hunting-gathering culture. Relatively recent excavations at sites within the Santa Cruz River floodplain in Tucson show that the end of the Archaic period is characterized by a shift to a more sedentary lifestyle with a gradual commitment to agriculture. High mobility and a subsistence strategy based on

hunting and gathering characterize Early Archaic period groups. Middle Archaic groups had smaller territories, relied on large and small game, and used a range of wild plants. Many researchers now prefer the term "Early Agricultural" for the Late Archaic period to reflect the adoption of cultivation and increased sedentism, at least along major waterways (Moses and Luchetta 2008, p. 10).

Hohokam (A.D. 200 to 1450)

The Hohokam culture is present in southeastern Arizona beginning around A.D. 200, as evidenced by the large number of sites recorded in the Phoenix and Tucson basins. The Hohokam were sedentary agriculturalists who constructed pithouses, produced plain and decorated pottery, and created numerous other crafts of shell, stone, and clay. The Hohokam also constructed extensive irrigation canal systems along the major river valleys. The Hohokam cultural sequence was established during the late 1930s using the various decorated pottery types excavated at Snaketown, a large village along the Gila River north of the Tucson Basin. This chronology was modified for the Tucson Basin and was later refined to reflect newly collected data (Moses and Luchetta 2008, p. 11).

Early interpretations of the origins of the Hohokam were debated – whether they represented an intrusive migration from the south or an indigenous, in-situ development. Most archaeologists presently accept a model of indigenous origins for the Hohokam. This model is supported by recent excavations at Early Ceramic (A.D. 200 to 450) sites along the Santa Cruz River that include features common in Early Agricultural/Late Archaic occupations, such as pithouses, storage pits, and ditch agriculture, that are characteristic of the later Hohokam occupation.

Pioneer Period (A.D. 450 to 750). Pioneer period Hohokam sites are not well represented in the region, although recent excavations at Valencia Vieja (Wallace 2003) have provided much information about this early period. Controversy still exists among archaeologists with regard to the nature of the early Pioneer period materials in the area. Recent excavations have documented an Early Ceramic period occupation characterized by small pithouse villages and plain ware pottery in the Tucson Basin by A.D. 200. Red ware pottery and more substantial architecture have been found at several sites dating to A.D. 450. However, more data are needed from Early Ceramic period sites to clarify the nature of their occupations and their relationship to the Late Archaic/Early Agricultural period.

Colonial Period – Cañada del Oro (A.D. 750 to 850) and Rillito (A.D. 850 to 950) Phases. By the Colonial period, Hohokam populations were growing and the cultivation of maize, beans, squash, and cotton was widely practiced. Large village sites were established, primarily along major drainages. At least three communities in the Tucson Basin, including the Romero Ruin community in Catalina State Park, are known to have had ballcourts during the Cañada del Oro phase. These features probably served as focal points for ceremonial or recreational activities and community integration. This period witnessed the emergence of the Tucson Basin red-on-brown decorated ceramics, which are distinct from the red-on-buff pottery found in the Phoenix area.

Sedentary Period – Rincon Phase (A.D. 950 to 1150). The Sedentary period witnessed the greatest expansion in settlement patterns with communities establishing villages along secondary drainages. Evidence of the practice of nonriverine agriculture is present in the form of rock pile fields, terraces, and check dams. Large "primary villages," such as portions of the Punta de Agua site, are present along the floodplain of the Santa Cruz and Rillito rivers during early Rincon times. The late Rincon period is characterized by a more dispersed pattern of small agricultural hamlets. Intrusive artifacts in the Sedentary period show evidence of increased trade with other cultural groups. Ceramics from the Sedentary period exhibit a change from the Colonial period. Vessel construction changed, and the painted designs were often thicker and heavier (Moses and Luchetta 2008, p. 11).

Classic Period – Tanque Verde A.D. 1150 to 1300) and Tucson (A.D. 1300 to 1450) Phases. Major changes took place in the Hohokam culture during the Classic period. Many large village sites that had been occupied since the Pioneer period were abandoned. New styles of architecture were developed, such as adobe-walled surface houses often arranged in walled compounds. Ballcourts were no longer used, and platform mounds emerged as the predominant form of public/ceremonial architecture. Interment was added to cremation as a mortuary practice. Extensive nonriverine agricultural features are found at Classic period sites throughout the Tucson Basin.

Ceramic assemblages from this period show a shift from interior to exterior designs on bowls, and a trend toward more rectilinear designs. Changing trade patterns are observed in the reduction of buff wares from the Phoenix Basin and an increase in polychrome pottery from the Tonto Basin.

Protohistoric Period (A.D. 1540 to 1700)

The Protohistoric refers to the period between the first European influence and actual European presence in an area. In southern Arizona, Spanish influence increased as Spanish missionaries and communities moved into what is now northern Mexico and New Mexico, but the first recorded extended Spanish presence did not occur until the 1690s. Before this, Spanish influence was largely represented by the introduction of trade goods, such as glass beads, some domesticates, and some population movements. During times of initial contact, the Spanish encountered several established O'odham groups within the region, including the Akimel O'odham (Pima), the Tohono O'odham (Papago), the Hia Ced O'odham (Sand Papago) and, most importantly, the Sobaipuri. Although the Spanish recognized these as separate groups, they are now considered four specific groups within the O'odham culture. The sites dating from this period are characterized by a perceived reduction in cultural complexity, and areas that were villages in prehistoric times appear as small clusters of cobble-based oval huts. The larger clusters included house structures, food storage structures, ramadas, and cooking windbreaks. Toward the end of the Protohistoric period, other site types included rock circles, corrals, and Rancheria-type settlements. Pottery was thin-walled plainware, with some black-on-buff and stuccoed wares.

The first recorded European contact in the area occurred in the 1690s by a Jesuit missionary named Eusebio Francisco Kino and his military escort (Moses and Luchetta 2008, p. 12). Father Kino referred to the native O'Odham inhabitants as Sobaipuris. Sobaipuri settlements were located along the Santa Cruz and San Pedro rivers, with the largest settlement found near the present-day San Xavier community. By the end of the century, Kino established a rudimentary church and the beginnings of a permanent mission at San Xavier and other Upper Santa Cruz (USC) villages.

Historic Period (A.D. 1700 to Present)

After the initial Spanish contact in the 1690s, little European influence occurred until the mid-1700s. At that time, Spanish interests were concentrated south of the Project area in the USC Valley, where a Spanish presidio had been erected at Tubac in 1752, not far from the mission at Tumacacori. In 1757, the first missionary settlement of San Agustin was established near present-day Tucson. Subsequent population growth along the Santa Cruz River led to a concomitant increase in the level of Apache raiding in the area. In response to the Apache threat and increased Spanish interest, a fortified mission at San Agustin was built in the early 1770s (Harte 1980, p. 6).

In 1775, to further increase Spanish control in the Tucson area, the Tubac Presidio was abandoned and the garrison temporarily moved to the new San Xavier del Bac mission. A new presidio, named San Agustin de Tucson, was constructed and garrisoned in the area of present-day downtown Tucson. By 1783, the Presidio was fully developed. The Spanish retained a presence in Tucson until 1821, when Mexico won its independence from Spain and claimed her territories (Moses and Luchetta 2008, pp. 12, 13).

Near the Proposed Project area is the San Ignacio de la Canoa land grant. This grant covered more than 17,000 acres and was granted to Tomas and Ignacio Ortiz in 1821. Spanish rule ended that same year, but Mexican settlers lived throughout the area. Hostilities with local Indians ended the Ortiz's ranching operations and little was done with the ranch until it was purchased in the late 1800s for cattle ranching.

During the period of Mexican control, there was little economic growth in the area. In 1853, the area came under the control of the United States as a result of the Gadsden Purchase. Growth in the region continued to be slow until the start of the Civil War, when an increase in the demand for precious metals caused a mining boom in the newly organized Arizona territory (Id., p. 12). The surge in economic activity again was accompanied by an increase in Apache raiding. The Southern Pacific Railroad reached Tucson in 1880 and brought people and resources to the area, stimulating ranching and mining activities. In the 1880s and early 1900s, several small ranches run by Mexican families were established in the eastern portion of the Tucson Basin; and shortly afterward, Anglo-American homesteaders moved into the area (Id., p. 13). In the 1920s, the Great Depression limited economic growth. Recovery from the Great Depression was extremely rapid in the region, evidenced by the large population increase. Since the early part of the twentieth century, this region has been used for agricultural and mining purposes.

3.5.1.3 Project Research

Prior to conducting fieldwork in the Project area, a Class I records review was performed at the Arizona State Museum (ASM) in Tucson, the State Historic Preservation Office (SHPO) in Phoenix, and on the ASM's online database AZSite. This research was conducted to analyze the extent of archaeological work and to determine whether any previously recorded sites were present in or within ½ mile of the Proposed Project facilities. This records review identified 43 previously completed archaeological surveys (AZSite 2008), 16 of which covered areas within the limits of the Project construction corridor (Table 5). Three of these surveys covered most of the Project corridor. Archaeological Consulting Services (ACS) of Tempe surveyed the entire 6-mile long portion of the Project corridor between PMR to its intersection with the potential El Corto Road alignment during the Tucson-Nogales Fiber Optics Right of Way Survey (ASM project number 1995-72.ASM, Adams and Hoffman 1995; AZSite 2008). Archaeological Research Services (AR Services) surveyed this same area in 2000 during the Tucson Maintenance B-19 Survey (ASM project number 2000-823.ASM, Wright 2000; AZSite 2008). Finally, SWCA Environmental Consultants (SWCA) surveyed a portion of the ROW in 1997 (1997-257.ASM, Tucker 1995; AZSite 2008). Harris Environmental Group (Harris) surveyed a portion of Sahuarita Road in 2007 (Luchetta and Shaw 2007; AZSite 2008). Although the results from this survey have not yet been updated in the AZSite or ASM records, several new sites were recorded and previously recorded sites were reassessed.

Table 5. Previous Surveys within the Project Corridor.

ASM Project Number	Project Name	Recording Agency	Reference
1964-8	I-19, Tucson to Nogales	ASM	No reference
1980-106	Green Valley State Land	ASM	No reference
1983-96	San Xavier Survey	CES	Hanna et al. 1987
1988-177	TAP Reach 6 Terminus	ASM	Euler 1988
1988-240	Sahuarita Corridor	P.A.S.T.	Stephen 1988
1992-77	Pima Mine Road	SWCA	Rea 1992
1995-72	Tucson-Nogales Fiber Optic	ACS	Adams and Hoffman 1995
1995-82	Green Valley TEP Lines	P.A.S.T.	Stephen 1995
1997-257	Pantano/Vail to Bicknell	SWCA	Tucker 1995
2000-650	Cox Cable Installation	Tierra	Fratt and Olsson 2000
2000-823	Tucson Maintenance B-19	AR Services	Wright 2000
2003-188	State Land near Green Valley	Tierra	Thurtle 2002
2003-581	Nogales Highway Assessment	DesArch	Ruble 2003
2004-629	Pima Mine Road	Tierra	Doak 2004
2004-275	Rancho Sahuarita	SWCA	Harrison and Hesse 2003
No #	Sahuarita Road	Harris	Luchetta and Shaw 2007

Note: P.A.S.T. – Professional Archaeological Services and Technologies; Tierra – Tierra Right-of-Way Services; DesArch – Desert Archaeology; and CES – Cultural and Environmental Services.

On September 17, 2008, fieldwork was conducted to complete an intensive Phase III survey of the initially proposed pipeline corridor for the Proposed Project. No new cultural sites were identified, but seven previously recorded sites were reassessed, and a cultural resources report was completed on September 24, 2008 (Moses and Luchetta 2008). Subsequent to the elimination of the initial recharge location option, two new recharge location alternatives were surveyed on August 28, 2009. No new cultural resources were identified, nor were previously identified historic properties found within the survey boundaries (Donaldson 2009). A third field session on January 11 and 15, 2010 covered an additional alternate pipeline ROW along PMR (for the CAP Terminus Alternative), and a small storage parcel located near the North Parcel. No new archaeological sites were identified along PMR; a recent historic site was identified in the small parcel associated with the North Parcel (Donaldson 2010).

Records indicate that seven archaeological sites have been recorded within the Project corridor (Table 6).

Table 6. Previously Recorded Sites within the Project Corridor.

Site Number	Description and Cultural Affiliation	Size in Meters	NRHP Eligibility
AZ BB:13:407(ASM)	Historic artifact/trash scatter and features	46 by 55	Recommended not eligible by recorder
AZ EE:1:409(ASM)	Sahuarita Road/Twin Buttes Road	NA	Not considered eligible by recorder
AZ BB:13:679(ASM)	Tucson & Nogales Railroad	NA	Portions within Project corridor not considered eligible by recorder
AZ EE:1:78(ASM)	Original town limits of Sahuarita	NA	Recommended eligible by recorder
AZ EE:1:300(ASM)	Twin Buttes Railroad	NA	Not considered eligible by recorder
AZ EE:1:350(ASM)	Historic artifact/trash scatter and berms	NA	Not considered eligible by recorder
AZ I:3:10(ASM)	U.S. Highway 89	NA	Portions within Project corridor not considered eligible by recorder

The previously recorded sites are:

AZ BB:13:407(ASM) – Historic period artifact scatter with feature foundations. Site recording during the initial survey in August 1992, as well as during the current survey, has effectively exhausted the research potential at this site. The Preferred Alternative design to begin the proposed pipeline near the PMRRP effectively removes this site from the Project footprint. The site is recommended as not eligible to the National Register of Historic Places (NRHP).

AZ EE:1:409(ASM) – Sahuarita Road. This Historic period road was originally recorded in 2007. The portion of the site near the Project corridor consists of Sahuarita Road east of U.S. 89. The site has been impacted by modern grading and construction and, therefore, it is considered not eligible to the NRHP.

AZ BB:13:679(ASM) – Tucson & Nogales Railroad line. Sections of this property have been recommended eligible to the NRHP. Although this spur line was initially built in 1882, the portion within the current Project corridor is recommended not eligible because it has been repeatedly upgraded and no longer retains any of its original components.

AZ EE:1:78(ASM) – Original town limits of Sahuarita. This site was reevaluated in 2007 by Harris and recommended eligible to the NRHP under criteria A and C (AZSite 2008). The reassessment conducted for this Proposed Project concurred with this recommendation. Should the current undertaking impact any of the features, additional research should be conducted. Proposed Project plans indicate that known historic features would be avoided and impacts would be limited to the previously disturbed ROW.

AZ EE:1:300(ASM) –Twin Buttes Railroad line. The original recording agency recommended this property, originally built around 1905, as not eligible because it has been upgraded and no longer retains any of its original components. The section of this property to be affected by the Proposed Project has been determined to be not eligible.

AZ EE:1:350(ASM) – Historic period artifact scatter. This site was recommended not eligible to the NRHP when it was originally recorded by Tierra Right-of-Way Services in August 2002 (AZSite 2008). The reassessment conducted for this Proposed Project is in concurrence with this recommendation. The site lacks integrity and as such, the recent survey recordation has effectively exhausted the research potential at this site.

AZ I:3:10(ASM) – U.S. Highway 89 (Interstate 19). Various segments of the highway have been investigated over the years with both eligible and ineligible recommendations. The portion within the current Project corridor is recommended not eligible to the NRHP because it has been upgraded and maintained over the years and no longer retains any historic integrity.

One previously unknown site was discovered within the Project corridor during the current surveys. The new site is described as:

CWC-1 (temporary number): *Historic period foundations and trash scatter*. This site was recorded during the 2010 survey of a possible storage parcel near the North Parcel. The site includes the concrete slab foundations of a recently razed residence and associated outbuilding with a trash scatter consisting of mostly broken glass and scattered metal fragments. Site recordation has exhausted the research potential of the site. The site is recommended as not eligible to the NRHP.

Construction of the Proposed Project would have little impact within the CWC service area itself, estimated to be about 8 square miles between Anamax Road and Mission Twin Buttes Road to the south. Six previously recorded archaeological sites are located within the service area: five represent Hohokam-era artifact scatters and one is a possible Archaic artifact scatter with two fire pits. Many of these sites have been disturbed by road construction and erosion.

3.5.1.4 Laws, Ordinances, Regulations, and Standards

Because the Proposed Project has a federal nexus, it is subject to compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA), as implemented through 36 CFR 800. Section 106 is the most detailed and explicitly defined authority applicable to the Proposed Project with regard to cultural resources. It requires federal agencies to consider the effects of their actions, including approval, permitting, and technical assistance, on properties that are eligible for, or included in, the NRHP. Historical sites, objects, districts, historic structures, and cultural landscapes that are eligible for listing in the NRHP are referred to as "historic properties." Section 106 also requires the federal agency to afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on the agency's efforts to consider historic properties. The implementing regulations for Section 106 describe a process of inventory, evaluation, and consultation that satisfies the federal agency's requirements. The criteria used for determining the eligibility of cultural resources are found at 36 CFR 60.4.

In November 2008, Reclamation initiated consultation with three tribes regarding the Proposed Project: the Hopi Tribe, Pascua Yaqui Tribe, and Tohono O'odham Nation. In September 2009, the same tribes were contacted regarding the survey of the two proposed recharge alternatives. In January 2010, these three tribes also were contacted regarding a third survey associated with the pipeline alternatives along PMR and a small storage parcel near the North Parcel. A summary of the Proposed Project and the findings of the Class I and Class III surveys were provided to each tribe, along with a request to respond with any concerns the communities may have. To date, the Hopi Tribe has responded that no properties significant to the tribe would be affected.

On December 18, 2008, the SHPO concurred with the finding of *no adverse effect to historic properties* for the initial pipeline survey (Moses and Luchetta 2008). Similarly, SHPO concurred with the finding of *no effect to historic properties* for the recharge alternative survey (Donaldson 2009) on September 10, 2009. The SHPO also was consulted regarding the findings of *no effect to historic properties* for the survey associated with alternate pipeline routes along PMR and an additional small land parcel near the North Parcel (Donaldson 2010). On March 16, 2010, the SHPO concurred with the findings of *no effect to historic properties* associated with the third survey, which was associated with the alternative pipeline routes along PMR and an additional small land parcel near the North Parcel.

3.5.1.5 Standards and Guidance

Federal and state governments offer guidance for the conduct of historic preservation activities. The Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation (NPS 1983) establishes standards for the gathering and treatment of data related to cultural resources. Guidance is also offered for compliance with Section 106 through the ACHP, and Section 110 Guidelines are available through the office of the Secretary of the Interior.

Cultural resources identified as part of this effort were assessed in terms of a property's potential eligibility for inclusion on the NRHP. Three key elements for determining site eligibility for listing in the NRHP are that the property has integrity, that it possesses historical significance, and that significance be derived from an understanding of historic context. In order for a site to possess integrity and be historically significant, it must meet one of the National Register criteria listed below.

> "The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and
>
> (a) That are associated with events that have made a significant contribution to the broad patterns of our history; or
> (b) That are associated with the lives of persons significant in our past; or
> (c) That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
> (d) That has yielded, or may be likely to yield, information important in prehistory or history.

In other words, a site's significance is dependent on its integrity—its retention of its essential form and construction, and its continued presence in the setting it was intended to occupy—and on its cultural significance, whether readily apparent or hidden in its potential to yield information" (NPS 1982; NPS 1986).

3.5.2 Environmental Consequences

3.5.2.1 No Action Alternative

The No Action Alternative would not alter the cultural resources of the Project area. There would be no effect on cultural resources because no construction would occur. Cultural resources would continue to be affected by natural erosional forces, as well as any cultural alterations not associated with this Project.

3.5.2.2 Preferred Alternative

All lands required for components of the Proposed Project, including pipeline construction, recharge facility construction, storage areas, and access roads have undergone cultural resource survey. The Proposed Project would be constructed primarily on previously disturbed land. No previously unrecorded cultural resource sites were discovered during the survey conducted for the Preferred Alternative. All but one of the historic properties that may be impacted by the Preferred Alternative have been determined not eligible for the NRHP. The Proposed Project will pass through the boundaries of the historic Town of Sahuarita (AZ EE: 1:78(ASM)), which has been recommended eligible to the NRHP. However, construction activities would avoid known historic features and would be limited to the previously disturbed ROW. As a result, the Preferred Alternative would have no adverse effect to historic properties, as defined in the NHPA. No other cultural resources occur in the area of planned disturbance and none would be affected by the Proposed Project.

3.5.2.3 North Parcel Recharge Site Alternative

Selection of the North Parcel and its associated storage area would have similar impacts to the Preferred Alternative because the delivery system would be identical. All lands included in the North Parcel have undergone cultural resource surveys. While use of the North Parcel would not impact any cultural resources, the associated storage area contains a recent Historic-era site comprised of concrete slab foundations and associated trash scatter. Due to the lack of integrity and failure to meet the NRHP eligibility criteria, the site is deemed ineligible for the NRHP. Selection of the North Parcel would therefore have no effect on historic properties.

Because unknown cultural resources, human remains and/or funerary objects, paleontological, or other artifacts that are at least 50 years old could be discovered during construction, the same notification and mitigation measures specified in Section 3.5.4—Cultural Resources Mitigation would be employed upon the discovery of cultural or historical resources.

3.5.2.4 CAP Terminus Alternative

The cultural resource impacts under the CAP Terminus Alternative would be similar to the Preferred Alternative. The construction of an additional 2 miles of pipeline under the CAP Terminus Alternative would primarily occur in and adjacent to areas that have been previously disturbed for construction of PMR and various utilities. The additional lands required for pipeline construction under this alternative have undergone cultural resource surveys. No previously unrecorded cultural resource sites were discovered during the survey of the CAP Terminus project components. The single historic site previously identified in the general area of the CAP Terminus Alternative (AZ BB:13:407(ASM)) has been determined ineligible for the NRHP. The CAP Terminus Alternative would therefore have no adverse effect to historic properties, as defined in the NHPA, and no other known cultural resources would be affected.

Because unknown cultural resources, human remains and/or funerary objects, paleontological, or other artifacts that are at least 50 years old could be discovered during construction, the same notification and mitigation measures specified in Section 3.5.4—Cultural Resources Mitigation would be employed upon the discovery of cultural or historical resources.

3.5.2.5 CAP Entitlements Alternative

The Project facilities for this alternative would essentially have the same "footprint" as the Preferred Alternative. Thus, the potential impacts and mitigation measures would be the same as those for the Preferred Alternative.

3.5.2.6 CWC-Only Alternative

The recharge basins for the CWC-Only Alternative would be 40 percent smaller; therefore, the potential for discovering unknown cultural resources would be slightly less than the Preferred Alternative. No known cultural resources would be impacted under this alternative; mitigation measures for the Preferred Alternative also would be applicable to this alternative.

3.5.3 Cumulative Effects

As described in Section 3.1—Background for Cumulative Effects, a number of road and housing projects are expected to occur in the Project area. These actions may result in cultural resource impacts within the impact area. However, the Proposed Project and action alternatives would not contribute to cumulative effects on cultural resources in the region since the Proposed Project has no adverse effect on historic properties.

Likewise, construction of the North Parcel, CAP Terminus, CAP Entitlements, or CWC-Only alternative, in addition to the other components of the Proposed Project, would not contribute to cumulative effects on cultural resources in the region because there would be no adverse effects on historic properties for either of those alternatives.

3.5.4 Cultural Resources Mitigation

Although no new archaeological sites were located along the surveyed pipeline ROW, one isolated ceramic concentration just north of the Preferred Alternative ROW, while appearing to represent recently introduced materials, may represent the presence of buried cultural deposits not apparent on the surface. It is recommended that the approximately 180-foot stretch of pipeline excavation in the area of this concentration be monitored to ensure that, although unlikely to occur, any buried cultural deposits or features that are present are recorded and assigned a site number.

Because unknown cultural resources could be discovered during construction, the following measures would be employed upon the unforeseen discovery of cultural resources:

- If artifacts, archaeological soils, or unusual amounts of bone or shell are uncovered during construction activities, all work in the area would be stopped and a qualified archeologist would be contacted immediately for on-site consultation.
- If a new cultural resources site is discovered during construction, and determined to be significant, a qualified archaeologist would prepare and implement a mitigation plan in accordance with state and federal regulations.
- If cultural resources are recovered during Project construction, a qualified archaeologist would arrange for the curation at a qualified curation facility of any archaeological materials collected.
- If any of the proposed work is redefined to impact standing structures, a qualified historic architect shall evaluate the structures for potential significance.

Should human remains and/or funerary objects, paleontological, or other artifacts that are at least 50 years old be uncovered during construction, ARS § 41-841 and § 41-844 require that all work be stopped in the area of the discovery and that the Director of the ASM be immediately notified. Action must then be taken to prevent further disturbance on such remains. The director of the ASM would have 10 working days to respond to any request to proceed with ground-disturbing activities.

3.6 Ground Water Resources

For purposes of the ground water analysis, the Project area is defined as the proposed artificial recharge site and the portion of the aquifer affected by the proposed recharge from the Preferred Alternative, which is an area within a radius of about 6 to 8 miles from the recharge site (see Section 3.6.2—Environmental Consequences). Construction and use of the pipeline and proposed booster sites are not anticipated to significantly impact the hydrogeologic environment.

3.6.1 Affected Environment

3.6.1.1 Regional Aquifer

The Project area is within the southern portion of the approximate 4,000-square-mile TAMA.[9] The statutory goal of the TAMA is to reduce ground water overdraft and attain safe yield of ground water supplies by 2025. Safe yield is defined by ADWR (ADWR 2006a) as "a ground water management goal which attempts to achieve, and therefore maintain, a long-term balance between the amount of ground water withdrawn in an active management area and the annual amount of natural and artificial recharge in the active

[9] The entire area on Figure 1 is within the TAMA. A location map of the TAMA can be found on ADWR's website at: http://www.azwater.gov/dwr/WaterManagement/Content/AMAs/TucsonAMA/TAMA_documents/TAMA_map_large.pdf.

management area." The amount of ground water stored within the TAMA is estimated at 12.7 million AF (ADWR 1999).

The Green Valley/Sahuarita area is within the USC Subbasin of the TAMA. The USC Subbasin is a large alluvial valley that slopes to the north and northwest. Within the Green Valley/Sahuarita area of the USC Subbasin, the Sierrita Mountain Range bounds the basin to the west and the Santa Rita Mountain Range bounds the basin to the east. The mountain ranges are generally composed of Precambrian through Tertiary age granitic, metamorphic, volcanic, and consolidated sedimentary rock. The basin fill deposits are composed of volcanic deposits and unconsolidated to consolidated sediments consisting of a complex sequence of alternating layers and lenses of gravel, sand, silt, and clay.

Previous investigations have divided the basin-fill sediments within the USC Subbasin into the Upper Basin-Fill and Lower Basin-Fill units based on their general hydrogeologic characteristics. The saturated portions of the Upper and Lower Basin-Fill sediments form the Tucson Basin Aquifer. The Upper and Lower Basin-Fill sediments have been further subdivided into the following stratigraphic units from youngest to oldest: Younger Alluvium; Fort Lowell Formation; Upper, Middle, and Lower Tinaja Beds; and the Pantano Formation. The saturated portions of the Younger Alluvium along with the Fort Lowell Formation and Upper Tinaja Beds form the most productive unit in the aquifer (ADWR 2006a). The thickness of the basin-fill deposits within the USC Subbasin ranges from a thin veneer along the mountain fronts to as much as 11,200 feet (ADWR 2006a). The maximum thickness of the Younger Alluvium along the Santa Cruz River is about 80 feet (Malcolm Pirnie 1998).

Depth to ground water within the Green Valley/Sahuarita area ranges from 50 to 250 feet below ground surface (bgs) near the Santa Cruz River to more than 500 feet bgs in the Sierrita Mountain foothills (Pima Association of Governments [PAG] 2002). The ground water flow direction within the Green Valley/Sahuarita area is away from the mountain ranges toward the axis of the basin. Along the axis of the basin, the ground water flow direction is parallel to the Santa Cruz River from south to north. The Tucson Basin Aquifer has experienced long-term water level declines and some related subsidence due to cumulative overdrafts associated with agricultural, industrial, mining, and public water supply usage. From 1940 to 1995, ground water level declines have ranged from 50 to 150 feet within the Green Valley/Sahuarita area (ADWR 2006a).

Declining ground water levels have led to compaction of the subsurface sediments, resulting in land subsidence in many Arizona basins. As part of activities to better define and monitor subsidence, ADWR has begun to compile land subsidence data and develop land subsidence maps for the TAMA. Figure 6 displays the 2007-2008 subsidence in the Green Valley/Sahuarita area. Based on 1.1 years of monitoring from February 23, 2007 to March 14, 2008, parts of the Green Valley/Sahuarita area had up to approximately 1.4 inches of subsidence (ADWR 2008b).

The primary source of Tucson Basin Aquifer recharge consists of precipitation associated with mountain-front recharge and stream infiltration, with minor amounts associated with artificial recharge, infiltration of released effluent, ground water underflow, and deep percolation of excess irrigation water. The primary source of ground water removal from the Tucson Basin Aquifer is pumping; minor amounts of ground water removal are associated with evapotranspiration and underflow.

3.6.1.2 Ground Water Quality

Ground water quality within the Green Valley/Sahuarita area is generally good with relatively few exceedances of primary drinking water standards (PAG 2002). Exceptions include elevated levels of nitrate and arsenic. Based on the PAG (2002) review of water quality data from 85 wells within the USC Subbasin sampled between February 1997 and February 2002, nitrate concentrations exceeding the primary drinking water standard of 10 milligrams per liter (mg/l) were noted in discontinuous areas mostly near and east of the Santa Cruz River. PAG (2002) noted no readily apparent pattern exists in the geographic distribution of arsenic concentrations exceeding the primary drinking water standard of 10 micrograms per liter (µg/l). A summary of the data reported by PAG (2002) is listed in Table 7.

Table 7. PAG (2002) Summary of Ground Water Quality within the Upper Santa Cruz Subbasin.

Parameter	Standard	Units	Detected Range	Mean	Number of Wells Reviewed Exceeding Standard	Number of Wells Reviewed
Arsenic	10[1] (MCL)	µg/l	ND-46	NA[2]	10	49
Nitrate (as Nitrogen)[3]	10 (MCL)	mg/l	ND-20	4.4[4]	7	77[5]
Hardness	No STD	mg/l	27-1317	283	No STD	67
Sulfate	250 (SMCL)	mg/l	3.5-1100	230	13	72[6]
TDS	500 (SMCL)	mg/l	170-2000	580	30	65

[1] Prior to January 23, 2006, MCL for arsenic was 50 mg/l.
[2] Mean not calculated due to numerous nondetect values and varying minimum detection levels.
[3] Thirteen sample results reported as Nitrite plus Nitrate, but standard is the same as Nitrate (as Nitrogen).
[4] Calculation of mean included one nondetect treated as zero.
[5] Reported in summary table as 76, but according to Appendix C, total number of samples reviewed was 77.
[6] Reported in summary table as 70, but according to Appendix C, total number of samples reviewed was 72.
MCL – Maximum Contaminant Level (EPA Primary Standard); ND – Not Detected; SMCL – Secondary MCL; STD – Standard; TDS – Total Dissolved Solids.
µg/l – micrograms per liter equivalent to parts per billion; mg/l – milligrams per liter equivalent to parts per million.

Secondary Maximum Contaminant Level (SMCL) ground water standards are typically exceeded for TDS and sulfate in wells sampled near and downgradient of the Sierrita Mine Tailings Pond. Possible mitigation options for the mine-related sulfate

plume (see Section 1.2—Purpose and Need) have been investigated and the selected remedy will be implemented under a Mitigation Order between Freeport-McMoRan and the ADEQ (ADEQ 2008). The Mitigation Order is discussed further under Section 3.6.3—Cumulative Effects.

CWC serves approximately 22,000 people with treated ground water extracted from the Tucson Basin Aquifer. The ground water is made potable by chlorination and through treatment facilities designed to reduce arsenic concentrations. Use of two CWC production wells has been discontinued due to sulfate contamination of the ground water aquifer in the vicinity of the Sierrita Mine. These wells were replaced for CWC by Freeport-McMoRan. Table 8 summarizes the water quality monitoring reported by CWC between 2004 and 2008 for their water distribution system. The CWC wells are all located within the CWC service area (Figure 1).

Table 8. Summary of Ground Water Quality Parameters Reported by CWC.

Parameter	Standard	Units	2008 Detected Range	2007 Detected Range	2006 Detected Range	2005 Detected Range	2004 Detected Range
Coliform	Presence	-	No	No	No	No	No
Lead	15 (AL)	µg/l	NR	NR	NR	0-29	NR
Copper	1.30 (AL)	mg/l	NR	NR	NR	0.02-0.25	NR
Arsenic	10[1] (MCL)	µg/l	2-10	4-10	<0.2-14	7-13	7-14
Barium	2 (MCL)	mg/l	<0.01-0.09	<0.01-0.09	<0.01-0.04	<0.01-0.04	0.01-0.04
Fluoride	4.0 (MCL)	mg/l	0.28-0.9	0.28-0.9	0.4-0.7	0.4-0.7	0.5-0.6
Cyanide	0.2 (MCL)	mg/l	NR	NR	<0.01-0.02	<0.01-0.02	<0.01-0.02
Nitrate (as Nitrogen)	10 (MCL)	mg/l	0.38-1.76	<1.00-1.94	0.57-2.05	0.4-2.0	0.50-2.00
Gross Alpha	15 (MCL)	pCi/l	5.4-6.5	5.1-8.1	NR	NR	NR
Radium 226	5 (MCL)	pCi/l	<0.4	<0.3	NR	NR	NR
Aluminum	0.05 to 0.2 (SMCL)	mg/l	<0.20-0.23	<0.20-0.23	<0.20-0.23	<0.20-0.23	<0.02-0.23
Molybdenum	No STD	mg/l	NR	NR	NR	NR	<0.04
pH	6.5 to 8.5 (SMCL)	STU	NR	6.9-7.9	7.17-7.40	7.17-7.40	7.17-7.32
Chloride	250 (SMCL)	mg/l	10.7-50.9	10.7-50.9	10.7-50.9	10.7-50.9	10.7-58.1
Hardness	No STD	mg/l	75-347	75-347	75-460	75-460	104-532
Iron	0.3 (SMCL)	mg/l	<0.02-0.23	<0.02-0.23	<0.02-0.23	<0.02-0.23	<0.02-0.23
Magnesium	No STD	mg/l	2-17	2-17	3-17	3-17	4-21
Manganese	0.05 (SMCL)	mg/l	NR	NR	NR	NR	<0.02
Silver	0.1 (SMCL)	mg/l	NR	NR	NR	NR	<0.04
Sodium	No STD	mg/l	44-50	44-50	30-61	30-61	32-72

Parameter	Standard	Units	2008 Detected Range	2007 Detected Range	2006 Detected Range	2005 Detected Range	2004 Detected Range
Sulfate	250 (SMCL)	mg/l	45.9-52.6	45.9-52.6	32.7-132	25-470[2]	44-510[2]
TDS	500 (SMCL)	mg/l	211-218	211-218	204-385	216-623[2]	209-771[2]
Zinc	5 (SMCL)	mg/l	NR	NR	NR	NR	<0.02

[1] Prior to January 23, 2006, MCL for arsenic was 50 µg/l.
[2] High reading associated with contamination of wells from Freeport-McMoRan sulfate plume; the two wells that that became contaminated are no longer in use.
AL – Action Level; MCL – Maximum Contaminant Level (EPA Primary Standard); NR – Not Reported; SMCL – Secondary MCL; STD – Standard; STU – Standard Testing Units; TDS – Total Dissolved Solids. µg/l – micrograms per liter equivalent to parts per billion; mg/l – milligrams per liter equivalent to parts per million; pCi/l – picocuries per liter.
Sources: CWC 2005, 2006, 2007b, 2008a, 2009.

Under the Proposed Project, CAP water would be piped into the Green Valley/Sahuarita area and artificially recharged in a portion of the aquifer to help offset the ground water withdrawals associated with CWC's water supply activities. CAP water is a mixture of water from the Colorado, Bill Williams, and Agua Fria rivers with the Colorado River being the principal source. CAWCD monitors CAP water quality on a monthly and quarterly basis at six sites along the CAP aqueduct by regularly scheduled collection of grab samples and real-time water quality data from installed sensors. The closest CAP monitoring location to the Proposed Project is the San Xavier Pumping Plant near the terminus of the aqueduct. Table 9 provides a summary of the 2008 CAP water quality data (which is similar to 2007 data) reported for the San Xavier Pumping Plant. In general, CAP water contains a greater level of dissolved salts such as bicarbonate, calcium, chloride, magnesium, sodium, and sulfate, when compared to the ground water within the Green Valley/Sahuarita area.

Table 9. Summary of CAP Water Quality Parameters, San Xavier Pumping Plant.

Parameter	Standard	Units	2008 Detected Range
pH	6.5 to 8.5 (SMCL)	STU	7.7-8.7
Dissolved Oxygen	No STD	mg/l	7.9-11.0
Specific Conductance	No STD	µS/cm	1000-1090
Alkalinity (as $CaCO_3$)	No STD	mg/l	80-170
Arsenic	10[1] (MCL)	mg/l	1.8-2.7
Barium	2 (MCL)	mg/l	0.13-0.163
Calcium	No STD	mg/l	71-82
Chloride	250 (SMCL)	mg/l	68-78
Copper	1.30 (AL)	mg/l	ND-0.0022
Iron	0.3 (SMCL)	mg/l	ND-0.13
Magnesium	No STD	mg/l	29-31
Manganese	0.05 (SMCL)	mg/l	3.3-9.3

Parameter	Standard	Units	2008 Detected Range
Nitrate (as Nitrogen)	10 (MCL)	mg/l	ND-0.68
Perchlorate	No STD	µg/l	ND
Sodium	No STD	mg/l	93-100
Sulfate	250 (SMCL)	mg/l	100-280
TDS	500 (SMCL)	mg/l	602-722

[1] Prior to January 23, 2006, MCL for arsenic was 50 µg/l.
MCL – Maximum Contaminant Level (EPA Primary Standard); ND – Not Detected; SMCL – Secondary MCL; STD – Standard; STU – Standard Testing Units; TDS – Total Dissolved Solids; µg/l – micrograms per liter equivalent to parts per billion; mg/l – milligrams per liter equivalent to parts per million; µS/cm – microsemens per centimeter.
Source: CAP 2009.

Although not detected in the CAP quarterly samples collected at San Xavier Pumping Plant, low perchlorate concentrations of up to 9.7 mg/l in CAP water were detected in June 1999 (CAP 2009). Based on ongoing remediation efforts in the Las Vegas Valley, Nevada, where perchlorate contamination of Colorado River water occurred, concentrations of perchlorate in CAP water are expected to gradually decrease over time (CAP 2009).

3.6.1.3 Water Use

In 2005, total water use in the TAMA was approximately 350,000 AF, of which 185,000 AF were for municipal purposes (55 percent), almost 110,000 AF were for agriculture (30 percent), about 35,000 AF were for metal mining (10 percent), and approximately 20,000 AF (5 percent) were for other industrial uses (ADWR 2006b). Within the USC Subbasin, 2006 water usage was reported by the USC/PUG from data collected by ADWR (Hedden et al. 2008). Table 10 provides the 2006 water usage (in AF) and percent of usage, along with the projected water usage (in AF) and percent of usage in 2010, 2020, and 2030 reported by USC/PUG.

Table 10. Summary of Upper Santa Cruz Subbasin Water Usage.

Major Users and Providers	2006		2010		2020		2030	
FICO	29,800	39%	29,800	37%	26,800	30%	20,800	23%
Freeport-McMoRan	26,700	35%	28,000	35%	28,000	31%	28,000	31%
ASARCO	7,900	10%	8,000	10%	8,000	8.8%	8,000	8.9%
Golf Courses	4,375	5.7%	4,375	5.5%	4,375	4.8%	4,375	4.9%
Water Providers	7,245	9.4%	8,975	11%	12,715	14%	14,095	16%
Sand/Gravel	475	0.6%	550	0.7%	750	0.8%	750	0.8%
Homeowner Wells	330	0.4%	365	0.5%	500	0.6%	660	0.7%
Potential Major Users		0.0%	200	0.2%	9,325	10%	13,515	15%
Total Usage	76,825		80,265		90,465		90,195	

All quantities in units of AF.
Source: Hedden et al. 2008.

CWC's service area is approximately 8 square miles, extending roughly between Anamax Road on the north, the Santa Cruz River on the east, Freeport-McMoRan mines on the west, and Continental Road on the south (Figure 1). In 2007, CWC pumped 2,795 AF of water for its users; in 2006, CWC pumped 3,006 AF. There were 11,854 total users as of December 31, 2007, up 251 users from the same time in 2006. Residential uses account for 78 percent of the total water sales, commercial usage accounts for 19 percent, and the other 3 percent is used for water supply maintenance such as flush and cleaning the system (CWC 2008b). CWC anticipates its water demand to double to about 6,100 AFY by 2020 as a result of additional population growth, which would approximate full build-out of the existing service area (Stantec 2006).

3.6.1.4 Existing Recharge Projects

Currently, 11 ground water recharge projects are operating within the TAMA. Of the 11 permitted recharge projects, three recharge facilities occur within the Green Valley/Sahuarita area: Town of Sahuarita WWTP, Robson Ranch Quail Creek, and PMR. A fourth recharge project, San Xavier Arroyos Project, is ongoing; however, the full-scale project has not yet been implemented. The water source for the Town of Sahuarita WWTP recharge facility is treated effluent water, and the facility is permitted to recharge up to 896 AFY. The water source for the Robson Ranch Quail Creek recharge facility is treated effluent water from the Green Valley WWTP, and the facility is permitted to recharge up to 2,240 AFY. The water source for the PMRRP is CAP water, and the facility is permitted to recharge up to 30,000 AFY. The water source for the San Xavier Arroyos Project is CAP water. In 2007 (the most recent year for which data are available), the Sahuarita WWTP recharged 50 AF, the Robson Ranch Quail Creek recharged 1,590 AF, the PMR facility recharged 21,506 AF, and the San Xavier Arroyos Project recharged 1,200 AF (Montgomery and Associates 2009a).

3.6.2 Environmental Consequences

This section describes the estimated ground water impact area, mounding, and potential water quality impacts from operation of the proposed CWC ground water recharge facility. As mentioned earlier in Section 1.5—Relationship to Proposed Rosemont Mine, concern regarding the Proposed Project's relationship to the proposed Rosemont Mine, if any, was raised during the public scoping process. To address this concern, ground water level changes for the No Action, Preferred, and North Parcel alternatives were modeled for a 20-year analysis period using two assumptions—one in which proposed Rosemont Mine-related ground water pumping does not occur and one in which Rosemont Mine-related ground water pumping does occur. Ground water changes were modeled using the ADWR TAMA MODFLOW-2000 model, which was updated by Montgomery and Associates (2010). Model updates for this project by Montgomery and Associates included refinements of the model components in the Project and Rosemont pumping areas, addition of the Proposed Project recharge facility alternatives, and addition of the proposed Rosemont Mine pumping (Montgomery and Associates 2010). The results of the modeled changes that assume Rosemont Mine-related ground water pumping occurs are discussed in Section 3.6.2.5—CAP Entitlements Alternative.

The description of the ground water impacts included in this revised DEA are summarized from a detailed evaluation of the hydrogeologic feasibility and impacts of the ground water recharge facility that was conducted as part of development of the Proposed Project design (GSA 2010; Montgomery and Associates 2010). Additional details concerning the facility feasibility and modeling results will be provided to ADWR as part of the permit application process for the proposed CWC recharge facility.

The descriptions of potential ground water impacts anticipated to occur under the No Action Alternative, the Preferred Alternative, and the North Parcel Alternative assume Rosemont Mine-related ground water pumping does not occur, and is based on the following considerations.

No Action Alternative (Case 1): The Preferred Alternative is not constructed. CWC's CAP water is not recharged in the vicinity of the Green Valley/Sahuarita area. As discussed in Section 3.6.1.3—Water Use, ground water pumping in the Project area would continue to increase to serve new developments. The new developments would likely become member lands of CAGRD and would be served ground water by a water provider; CAGRD is responsible for replenishing this ground water use by recharging within the TAMA.

Preferred Alternative (Case 2): The proposed pipeline and recharge facility are constructed. Upon obtaining the appropriate water storage permit(s), CWC would store up to 7,000 AFY at this facility for 15 to 20 years. In the long term, it is anticipated the water storage permit would be extended, and CWC would continue to recharge its 2,858 AFY of CAP water and use the storage credits to offset ground water pumping associated with delivery of water within its service area. At this time, it is unknown whether recovery well(s) would be located within CWC's current water service area or within the 20-acre recharge facility. Because water recovery is not contemplated for 15 to 20 years, no specific plan has been developed and no ground water modeling scenarios were conducted. Also, as noted in Section 2.6.1—Alternatives Considered but Eliminated from Detailed Study—Direct Use of CAP Water, CWC may reinvestigate the option of treating and using CAP water directly if necessary in the future.

North Parcel Recharge Site Alternative (Case 3): The proposed pipeline and recharge facility are constructed as specified in the Preferred Alternative, but the recharge basins and associated general storage area would be located approximately 1,500 feet to the north within the neighboring parcel currently owned by Pima County.

3.6.2.1 No Action Alternative

The No Action Alternative would not alter or offset the declining ground water table levels in the Green Valley/Sahuarita portion of the TAMA. CWC would continue to rely solely on pumping local ground water for delivery to its customers. Without the delivery and use of its CAP water, either directly or by recharge and recovery, CWC would not have an alternative potable water supply should its existing wells become contaminated or have other problems in the future. In addition, if there are no actions to change the current

conditions, ground water overdraft within the Project area would continue unabated and would result in increasingly greater ground surface subsidence and aquifer compaction, installation of deeper wells to replace dry wells, and additional costs for pumping ground water from lower elevations. Under the No Action Alternative, the depth to water beneath the preferred recharge site would decline by approximately 145 feet from 2005 levels to a depth of about 336 feet by the end of 2031 (Montgomery 2010).

New developments built within the CWC service area would join CAGRD. It is anticipated that CWC would continue to pump ground water to serve these member lands, and CAGRD would replenish the ground water used by these member lands at existing recharge basins within the TAMA. However, because much of CAGRD's recharge is likely to occur in the lower Santa Cruz Basin, there would be no benefit to the local aquifer nor would an alternative water supply source be available in the event of well contamination.

3.6.2.2 Preferred Alternative

3.6.2.2.1 Regional Aquifer

Under the Preferred Alternative, recharge of CAP water would begin following ADWR permit approval and construction of the CWC storage facility. After 20 years of recharging 7,000 AFY,[10] the extent of the ground water mound (defined as the 1-foot ground water level change) is estimated to be about 9.8 miles north, 6.4 miles south, 4.5 miles west, and 5.5 miles east of the recharge facility (Figure 7). The maximum projected ground water level rise for the Preferred Alternative is beneath the Project facility and is estimated to be 186 feet compared to the No Action Alternative. The minimum depth to ground water beneath the recharge facility is estimated to be 124.5 feet in 2017. After 2017, the projected ground water level beneath the recharge facility decreases due to increased pumping and decreased recharge unrelated to the Project. The final depth to water is estimated to be 149.8 feet at the end of 2031 (Montgomery and Associates 2010).

The Preferred Alternative would result in elevated ground water levels in an approximate radial pattern, slightly elongated downgradient to the north in response to regional ground water flow direction. Ground water recharge from the Proposed Project would reduce the rate of regional ground water elevation decline and potentially reduce associated land subsidence within the northern portion of CWC's service area, southern portion of Sahuarita, and parts of the FICO land area.

Potential impacts to the Staker Parson Gravel Pit, approximately 1,300 feet east of the recharge site, were evaluated by estimating the depth to ground water at the western edge of the gravel pit. At the gravel pit edge, the minimum depth to ground water is estimated to be 175.3 feet at the end of 2021. After 2021, the projected ground water level beneath the gravel pit edge decreases with a final depth to water of 208.6 feet at the end of 2031 (Montgomery and Associates 2010). The current and future estimated depths of the

[10] This is the maximum amount of recharge proposed. If less water is recharged, the resulting impacts would be less than described in Section 3.6.2.2.

gravel pits at the end of currently planned mining are not known. ADWR will require monitoring of ground water conditions relative to the gravel pits as one of its permit requirements.

The main pipeline would have capacity to transport additional renewable water supplies to the USC Subbasin, should water providers and users within the USC Subbasin build the necessary infrastructure and obtain supplies. Transport and use of these additional renewable water supplies, either directly or through recharge, would further assist in reducing overdraft within the USC Subbasin and ameliorating other negative effects resulting from ground water pumping. These users and providers would need to obtain all required state and local permits associated with use of water delivered through this system.

3.6.2.2.2 Water Quality

As recharge occurs, ground water quality directly beneath and radiating out from the recharge facility would approximate that of CAP water. As local ground water is displaced with CAP water, there would be an increase in the concentration of sulfate and TDS, and a general change from calcium-bicarbonate dominant water to calcium-sulfate dominant water. In 2008, sulfate and TDS concentrations in CAP water averaged 252 mg/l and 653 mg/l, respectively, which exceeded the secondary water quality standards of 250 and 500 mg/l, respectively. Local ground water quality near the facility for sulfate and TDS is typically 2.5 and 2 times less than the secondary standards, respectively. CAP water also exceeded the SMCL for manganese, whereas CWC ground water results were either not reported or negligible. Other constituents that are generally higher for CAP water than for CWC pumped ground water include magnesium (no standard), chloride, pH, and barium; however, the CAP water complies with the applicable standards. CAP water is typically lower than CWC water in copper, arsenic, and nitrate (as nitrogen). CAP water quality is acceptable for municipal use, as evidenced by the large amounts used by municipalities within all three counties in central Arizona served with CAP water (Maricopa, Pinal, and Pima).[11] Elevated ground water levels that result from recharging also assist in small reductions in pumping costs. Construction of the proposed CWC water delivery system would comply with applicable federal and state water quality requirements, which would address most potential water quality impacts.

Based on modeling results, the projected extent of CAP water migration at the end of 2031 would be about 1 mile north and south, and 0.7 mile west and east of the recharge facility (Figure 8). Under the Preferred Alternative, the projected extent of CAP water migration at the end of 2031 is anticipated to potentially affect approximately 27 water-use wells. According to the ADWR database, nine wells are listed for domestic water use, five wells are listed for industrial water use, four wells are listed as unused, and nine wells are listed for irrigation use (Montgomery and Associates 2010). The number of impacted wells is approximate based on modeling assumptions and well locations provided in the database. Impacted wells were not evaluated vertically due to uncertainties in how deeply

[11] See 2008 CAP deliveries at: http://www.cap-az.com/deliveries/index.cfm.

the CAP water will infiltrate the aquifer. The number of impacted wells to the north would likely increase with time as recharged CAP water continues to move in a northerly flow direction.

3.6.2.2.3 Water Use

The Preferred Alternative is not expected to result in an increase in water usage within the USC Subbasin as compared to anticipated usage under the No Action Alternative. Areas within the CWC service area are developing, and would continue to develop, by joining CAGRD as a means of obtaining an assured water supply in the absence of the Proposed Project, which would allow CWC to take and use its CAP entitlement. As discussed in Section 2.6.1—Alternatives Considered but Eliminated from Detailed Study—Direct Use of CAP Water, direct use of CAP water by CWC has been eliminated as an alternative at the present time.

3.6.2.3 North Parcel Recharge Site Alternative

Impacts to the regional aquifer, water quality, and water use under the North Parcel Alternative are estimated to be similar to the Preferred Alternative. Changes in model results are reflective of the movement of the recharge location about 1,500 feet to the north and the resulting change in distances relative to nearby pumping wells. A comparison of the model results discussed below for the North Parcel Alternative to the Preferred Alternative indicates the North Parcel has slightly smaller water-related environmental impacts.

- Based on modeling results, the 1-foot ground water level change resulting from the recharge of CAP water is estimated to affect an area that is slightly larger than that affected by use of the South Parcel, extending about 10 miles north, 6.3 miles south, 4.5 miles west, and 5.7 miles east of the CWC recharge facility. The maximum projected ground water level rise for the North Parcel beneath the recharge facility is estimated to be 158 feet compared to the No Action Alternative. The minimum ground water depth beneath the recharge facility is estimated to be 152.5 feet at the beginning of 2021. After 2021, the projected ground water level beneath the recharge facility decreases with a final depth to water of 178.8 feet at the end of 2031 (Montgomery and Associates 2010). By comparison, the projected depth to ground water beneath the recharge facility would be about 336 feet at the end of 2031 under the No Action Alternative.
- At the Staker Parson Gravel Pit edge, the minimum ground water depth is estimated to be 182.8 feet at the end of 2021. After 2021, the projected ground water level beneath the gravel pit edge decreases with a final depth to water of 208.6 feet at the end of 2031 (Montgomery and Associates 2010).
- Based on modeling results, the projected extent of CAP water migration at the end of 2031 would be about 1 mile north, and 0.6 mile south, west, and east of the recharge facility.

- Under the North Parcel, the projected extent of CAP water migration at the end of 2031 is anticipated to potentially affect approximately 23 water-use wells. According to the ADWR database, seven wells are listed for domestic water use, four wells are listed for industrial water use, four wells are listed as unused, and eight wells are listed for irrigation use (Montgomery and Associates 2010).

3.6.2.4 CAP Terminus Alternative

Under the CAP Terminus Alternative, only the starting location of the pipeline extension would change compared to the other action alternatives. Therefore, impacts to the regional aquifer, water quality, and water use under the CAP Terminus Alternative would be the same as the Preferred Alternative or the North Parcel.

3.6.2.5 CAP Entitlements Alternative

The maximum impacts to the regional aquifer and ground water quality under the CAP Entitlements Alternative would be about 30 percent smaller than the Preferred Alternative because of the reduced amount of recharge. Water use in the area would be the same as the Preferred Alternative. Because the capacity of the main pipeline would be limited to approximately 5,000 AFY, the total amount currently allocated to CAP water subcontractors in the Green Valley area, there would not be a future opportunity for USC/PUG participants without existing CAP entitlements to connect to the Proposed Project. Thus, under this alternative, there would be no opportunity to partially offset existing ground water pumping along the Upper Santa Cruz River by conveying renewable water supplies further south through CWC's Proposed Project.

3.6.2.6 CWC-Only Alternative

Impacts to the regional aquifer and water quality due to the decreased CAP water conveyance and recharge capacity of this alternative would be about 55 percent smaller than the impacts of the Preferred Alternative because of the reduced amount of recharge. Water use in the area would be the same as the Preferred Alternative. Because the main pipeline would only have the capacity to deliver CWC's CAP entitlement, there would not be a future opportunity for GVDWID or other USC/PUG participants to connect to the Proposed Project and convey renewable water supplies to offset existing ground water pumping.

3.6.3 Cumulative Effects

A number of road and housing projects are expected to be constructed in the Project area (see Section 3.1—Background for Cumulative Effects), which will result in increasing water usage and the addition of ground water supply wells to meet demands. As discussed in Section 3.6.1.3—Affected Environment—Water Use, total water usage in the USC Subbasin is predicted to increase from 76,825 AF in 2006 to 90,195 AF in 2030, with water providers accounting for 14,095 AF (15.6 percent) of the total use in 2030 compared to 7,245 AF (9.4 percent) in 2006. Because of uncertainty as to future well

locations and quantities, specific locations and amounts of pumping by many of these new developments were not incorporated into the recharge facility modeling. However, future ground water withdrawals incorporated in the TAMA model are described in Montgomery and Associates (2009a) and include 10,983 AFY for new residential developments to begin in 2010 and reach the maximum withdrawal in 2037 for the Green Valley/Sahuarita area. Also, given the Freeport-McMoRan sulfate plume, available well locations capable of withdrawing potable water may be limited within the CWC service area to the northern and eastern extents, if mitigation measures proposed by Freeport-McMoRan are unsuccessful in remediating the current plume in a timely manner. As a result, future pumping for reasonably foreseeable demands is likely to result in a greater withdrawal of ground water in the Project area, and some of the pumping may be closer to the recharge facility than modeled. Additional ground water pumping in the impact area would confine the impact of CAP water recharge at the proposed recharge facility to a smaller area in terms of mound height and projected extent of CAP water migration (compare Figure 7 with Figure 9, and Figure 8 with Figure 10, as discussed below in this section), but would result in a greater vertical depth of infiltration.

Another reasonably foreseeable activity in the impact area is ground water withdrawal under a Mitigation Order issued by ADEQ to Freeport-McMoRan. Presently, the Sierrita Mine preferred sulfate remediation action (Sierrita Mine Alternative 5), discussed in the Freeport-McMoRan feasibility study for addressing the sulfate plume, consists of an aggressive ground water pumping program using plume stabilization pumping and mass removal pumping within the plume to reduce the extent and sulfate mass of the downgradient plume (HGC 2008). The objective of Sierrita Mine Alternative 5 is to pump all of the water that can be used at the Sierrita Mine from the downgradient plume in order to accelerate the removal of sulfate mass from the plume during the lifetime of the mine (HGC 2008). Implementation of the Sierrita Mine Alternative 5 would begin following approval by ADEQ, with increased ground water pumping for plume remediation beginning 24 to 36 months later, assuming the necessary land acquisition required by Alternative 5 has been completed. The Sierrita Mine Alternative 5 assumes a total ground water pumping rate of 17,236 gallons per minute (gpm) from 2010 to 2035 (HGC 2008). In comparison, the TAMA model assumed a pumping rate of about 5,029 gpm for the predictive period, which is based on 2007 data for the interceptor wellfield (Montgomery and Associates 2009b). Based on the modeling results performed for the Freeport McMoRan feasibility study, the Sierrita Mine Alternative 5 would result in a predicted ground water elevation decline directly below the Preferred Alternative's recharge facility of between 20 and 25 feet at the end of 2020 and about 30 feet at the end of 2040 (HGC 2008).[12] This cumulative impact would result in a smaller impact area where long-term impacts from Project-related recharge would occur.

[12] Ground water withdrawal associated with the Freeport McMoran preferred sulfate remediation action was not incorporated into the Proposed Project modeling because it was not available at the time of the modeling, and has yet to be approved by ADEQ.

CAP water recharged by the Proposed Project would help alleviate potential land surface subsidence within the Project area during the lifetime of the Proposed Project; however, many current and possible future actions would affect the potential for subsidence to occur. These current and possible future actions include, but are not limited to, continued pumping for agricultural and mining purposes, direct use of CAP water rather than recharge, and long-term ground water withdrawals associated with future implementation of the Sierrita Mine Alternative 5.

Recharge of CAP water by the Proposed Project would be an incremental addition to other sites recharging CAP water and treated effluent within the Green Valley/Sahuarita area, as discussed in Section 3.6.1.4—Affected Environment—Existing Recharge Projects. The combined effect of recharge by the Proposed Project and other facilities would reduce ground water overdraft, ground surface subsidence, aquifer compaction, and the need to deepen wells or incur greater pumping costs. Beneath the Town of Sahuarita WWTP, the ground water level rise after 20 years of recharge is estimated to be 10 feet. Beneath the Robson Ranch Quail Creek facility, the ground water level rise after 20 years of recharge is estimated to be 50 to 70 feet. Beneath the PMR facility, the ground water level rise after 20 years of recharge is estimated to be 2 to 9 feet. Beneath the San Xavier Arroyos Project, the ground water level rise after 20 years of recharge is estimated to be less than 1 foot. Those recharge facilities were incorporated into the model based on the total quantity permitted and the permitted life of the facility to ensure there are no adverse impacts from the proposed recharge facility in anticipation of the ADWR permit application process. Based on the model results, the cumulative impact of the Preferred Alternative does not substantially alter the ground water mounding beneath these facilities because of the small change anticipated to occur and the substantial depth to ground water in the Project area.

As explained at the beginning of Section 3.6.2—Environmental Consequences, concern was raised during the public scoping process regarding the Preferred Alternative's relationship to the proposed Rosemont Mine. The outcome and timing of the Rosemont Mine project will not be known until a Record of Decision is issued on the EIS for the proposed Rosemont Mine.[13] However, to address this concern, ground water level changes for both the No Action and Preferred alternatives were modeled for a 20-year analysis period using three scenarios regarding Rosemont Mine-related ground water pumping:

Case 4 – Potential Mine pumping without the Proposed Project: This case is the same as Case 1 (No Action Alternative) with potential Rosemont Mine pumping modeled to occur at two locations in Sections 17 and 21, Township 17 South, Range 14 East, as shown on Figure 9. Potential Mine pumping is simulated for a 20-year period from 2012 through 2031. The simulated pumping rate is 5,400 AFY for the first eight years of operation (2012 through 2019), and 4,700 AF/yr for the last 12

[13] See the CNF schedule at: http://www.rosemonteis.us/node/78.

years of operations (2020 through 2031).

Case 5 – Potential Mine pumping with the Proposed Project: This case is the same as Case 2 (Preferred Alternative) with potential Rosemont Mine pumping, as described in Case 4 above.

Case 6 – Potential Mine pumping with the North Parcel: This case is the same as Case 3 (North Parcel Alternative) with potential Rosemont Mine pumping, as described in Case 4 above.

Figure 9 displays the difference between Case 4 (No Action with Rosemont Mine-related pumping) and Case 5 (Preferred Alternative recharge and Rosemont Mine-related pumping), which is the ground water mound formed by the proposed recharge, assuming that Rosemont Mine-related pumping is occurring. The difference between Case 4 and Case 6 (Rosemont Mine-related pumping and North Parcel) was modeled and reported by Montgomery and Associates (2010).

Table 11 provides a summary of major differences between the six modeling cases. As described for Case 2 (see Section 3.6.2.2.1—Environmental Consequences—Regional Aquifer), the Preferred Alternative recharge would result in elevated ground water levels in an approximate radial pattern, slightly elongated downgradient to the north in response to regional ground water flow direction. Assuming Rosemont Mine-related ground water pumping occurs as described in Rosemont Mine's water balance plan (M3 2007), only small differences are noted in the projected ground water level rise between the two scenarios (compare Figure 7 with Figure 9). With Rosemont pumping, the ground water mound from recharge would be slightly smaller than under the Preferred Alternative (Case 2), and would extend about ½ mile less to the north (Figure 9). In addition, the minimum depth to ground water under Case 5 beneath the recharge facility is about 3 feet lower than Case 2 because of the lowered water table surface associated with Rosemont pumping. If Rosemont pumping occurs, the maximum projected ground water level rise for the Preferred Alternative is estimated to be 205 feet compared to 186 feet under the No Action Alternative without Rosemont pumping (for a difference of 19 feet).[14] As a result of Rosemont pumping, the minimum depth to ground water beneath the recharge facility changes from 124.5 feet at the end of 2017 under Case 2 to 127.8 feet under Case 5. Similarly, the minimum depth to ground water at the edge of the Staker Parson Gravel Pit changes from 175.3 feet under Case 2 to 187.2 feet under Case 5.

[14] The maximum projected ground water level rise is actually higher than without Rosemont Mine-related pumping because Rosemont pumping would lower the baseline water table and create more vertical storage space in the aquifer for recharge water. Although the ground water level rise from baseline would be greater, the top of the ground water mound under the recharge facility in Case 5 would actually be slightly lower than under Case 2 due to the difference in baseline conditions.

Table 11. Model Case Scenario Summary.

Case	Case Description	Northern Extent of Ground Water Mound (miles)	Maximum Ground Water Level Change (feet)	Minimum Depth to Ground Water Beneath Recharge Facility (Year) (feet)	Depth to Water at the end of 2031 (feet)
1	No Action Alternative	NA	-145	NA	336
2	Preferred Alternative	9.8	186	124.5 (2017)	149.8
3	North Parcel Recharge Site Alternative	10	158	152.5 (2021)	178.8
4	Potential Mine Pumping Without the Proposed Project	NA	-165	NA	356
5	Potential Mine Pumping with the Proposed Project	9.3	205	127.8 (2017)	153.1
6	Potential Mine Pumping with the North Parcel	9.4	165	159.8 (2021)	194

NA = Not Applicable.
(2017) = Year minimum depth to ground water reached.

Ground water quality impacts beneath and in the vicinity of the recharge facility under Case 5 is similar to Case 2 except the extent of CAP water migration would be about 1.1 miles, or 0.1 mile more, to the north at the end of 2031 (compare Figure 8 with Figure 10). Under Case 5, two additional wells are within the extent of CAP water migration impact area when compared to the Preferred Alternative. According to the ADWR database, the two wells are listed for irrigation use. As with the Preferred Alternative, the number of impacted wells is approximate and based on modeling assumptions and well locations in the database. The number of impacted wells would likely increase with time as CAP water continues to move in a northerly flow direction. As discussed in Section 3.6.2.2.2—Environmental Consequences—Water Quality, the difference in water quality between CAP supplies and existing CWC ground water is not substantial, and the CAP water is being used by many municipalities in central Arizona.

If both ground water pumping associated with the proposed Rosemont Mine and withdrawals associated with Sierrita Mine Alternative 5 (which are expected to be about 723,000 AF from 2010 to 2035) occur, the aerial extent of the CAP water migration would be reduced from what is described above for Case 5 and depicted in Figure 10. The reduced CAP water migration would be due to the overall lowering of the water table, which would increase the vertical extent of CAP water infiltration.

Construction of the CAP Terminus Alternative, in addition to the other components of the Proposed Project with either the North or the South parcel, would have the same cumulative impacts to ground water resources as the Proposed Project because no change in the amount of water recharged would occur.

Compared to the Proposed Project, construction of the CAP Entitlements or CWC-Only alternative would have fewer ground water cumulative effects due to the smaller amount of water recharged.

3.7 Surface Water Resources

The Project area for evaluation of impacts to surface water resources is the immediate vicinity of the Preferred Alternative recharge sites and the downstream floodplain. The Project area lies within the Upper Santa Cruz River watershed of the Gila River Basin.

3.7.1 Affected Environment

The Santa Cruz River and its tributaries in the Project area are ephemeral, meaning they flow only in response to storm events (Pope et al. 1998). The only perennial reaches of the Santa Cruz River near the Project area are effluent-dependent reaches approximately 18 miles upstream and 25 miles downstream of Green Valley (ADWR 2008a). The ground water level is currently estimated to be approximately 200 feet under the Santa Cruz River, and is declining (Section 3.6.1—Ground Water Resources). The closest United States Geological Survey (USGS) gage to the Project area is the Santa Cruz River at Continental, Arizona (stream gage number 09482000). The gage is about 3.5 miles upstream from the Project area. The drainage area above the gage is 1,682 square miles.

Based on Federal Emergency Management Area (FEMA) Flood Insurance Rate Maps (FIRM) for the Project area,[15] the 100-year floodplain has an approximate width ranging from 3,300 to 5,800 feet, with an elevation of approximately 13 feet above the bottom of the river channel. Within the Project area, the Santa Cruz River bottom ranges in elevation from 3 to 10 feet below the first terrace deposit on which the proposed recharge facility alternatives would be constructed. Two similarly constructed recharge basins, Green Valley WWTP and Robson Ranch Quail Creek, are upstream of the Project area within the FEMA 100-year floodplain.

Flooding along the Santa Cruz River near the Project area occurs in response to short periods of heavy precipitation. Table 12 displays the annual peak discharges for each water year measured at the Santa Cruz River at Continental gage.

[15] The Project area is on FEMA FIRM 04019C3415K. The map can be viewed by searching for the map number at: http://msc.fema.gov/webapp/wcs/stores/servlet/QuickOrderView?storeId=10001&catalogId=10001&langId=-1&userType=G.

Table 12. Annual Peak Discharges Measured at the Santa Cruz River at Continental, Arizona.

Water Year	Date	Annual Peak Discharge (ft^3/s)	Gage Height (ft)	Gage Height Code	Water Year	Date	Annual Peak Discharge (ft^3/s)	Gage Height (ft)	Gage Height Code
1940	08-14-40	12,100	8.85	3	1977	07-18-77	3,290	7.32	
1941	08-09-41	3,670	5.40	3	1978	10-09-77	26,500	16.70	
1942	07-28-42	2,700	4.95	3	1979	12-18-78	16,000	10.00	
1943	08-01-43	4,000	5.55	3	1980	08-25-80	2,360	6.20	
1944	08-12-44	4,440	5.80	3	1981	09-05-81	3,350	7.10	
1945	08-09-45	7,820	7.25	3	1982	08-15-82	2,160	5.85	
1946	09-09-46	4,120	5.94	2,3	1983	02-04-83	4,800	8.39	
1947	10-01-46	5,330	6.40	3	1984	10-02-83	45,000	16.34	
1952	08-15-52	1,820	4.20	3	1985	12-28-84	11,600	9.66	3
1953	07-14-53	4,910	6.20	3	1986	07-16-86	840	5.27	
1954	08-05-54	14,600	10.10	3	1987	08-05-87	340	3.60	
1955	08-19-55	17,500	11.34	3	1988	07-28-88	930	4.75	
1956	07-29-56	3,090	4.00	3	1989	09-03-89	1,200	5.32	
1957	08-21-57	1,690	3.62	3	1990	10-05-89	1,790	6.21	
1958	08-05-58	5,620	5.83	3	1991	09-01-91	1,270	4.02	
1959	08-17-59	3,900	5.43	3	1992	08-24-92	4,120	6.86	
1960	01-12-60	3,740	5.70	3	1993	01-19-93	32,400	14.75	
1961	08-23-61	4,820	5.80	3	1994	08-22-94	707	4.50	
1962	01-25-62	2,480	4.80	3	1995	01-06-95	2,350	6.38	
1963	08-06-63	4,220	5.65	3	1996	09-03-96	1,520	5.60	
1964	09-10-64	14,000	10.13	3	1997	09-06-97	2,140	6.20	
1965	09-12-65	370	6.15	3	1998	07-22-98	1,940	5.88	
1966	12-23-65	5,990	9.34	6	1999	07-23-99	896	4.81	
1967	07-27-67	3,730	8.81		2000	08-23-00	2,590	6.57	
1968	12-20-67	18,000	15.30		2001	10-23-00	5,290	8.19	
1969	08-05-69	1,680	5.79		2002	09-06-02	600	5.06	
1970	07-20-70	3,720	7.80		2003	07-28-03	3,580	7.25	
1971	08-20-71	3,270	7.30		2004	09-18-04	541	4.18	
1972	07-14-72	3,290	8.72		2005	08-02-05	3,970	7.49	
1973	03-14-73	2,130	7.20		2006	07-25-06	1,830	5.92	
1974	09-03-74	3,450	8.10		2007	07-19-07	4,700	6.79	
1975	09-01-75	3,350	8.15		2008	07-13-08	1,650	4.34	
1976	07-12-76	3,800	7.90						

ft = feet.
ft^3/s = cubic feet per second.
Gage height qualification codes:
2: Gage height not the maximum for the year.
3: Gage height at different site and (or) datum.
6: Gage datum changed during this year.

3.7.2 Environmental Consequences

3.7.2.1 No Action Alternative

No adverse impacts on surface water resources would occur under the No Action Alternative because existing conditions would continue for the foreseeable future.

3.7.2.2 Preferred Alternative

The Preferred Alternative involves activities within the FEMA 100-year floodplain and would result in impacts on flood flows and the floodplain. The activities to be conducted in the floodplain include construction of a portion of the CAP water delivery pipeline, a booster station, temporary and permanent access roads, temporary staging areas, and a recharge facility with equipment storage area.

Flood impacts resulting from construction of underground piping, temporary and permanent access roads, and a storage area would cause a negligible increase in flood elevation. Both the access roads and storage area would be constructed on bare ground. These activities would result in a negligible reduction in the natural floodplain recharge capability due to vehicle compaction of surface soils and installation of impermeable pipes below the ground surface.

As permanent structures in the floodplain, a booster station and a recharge facility could directly increase local flood elevations by reducing the natural floodplain recharge capacity, floodplain storage capacity, and displacement of floodwaters around the structures. Flood flow impacts from the Preferred Alternative could include increased channelization and the localized increase in floodwater velocities due to narrowing of the cross-sectional area.

Based on a comparison of the FEMA 100-year flood water elevation to the Proposed Project or its alternatives, the surface elevation of the 100-year flood is about the same as the perimeter wall elevation around the proposed recharge facility. For flood events that overflow the Santa Cruz River channel, the floodplain recharge capacity reduction and floodwater displacement would be proportional to the footprint of the structures. The booster station would cover an area of about 1.1 acres to a height of 8 feet. The recharge facility would cover an area of about 15.6 acres to a height of 5 feet.

If a flood event occurs that is large enough to either inundate the recharge facility or erode a perimeter wall, the net reduction in material (approximately 18,000 cubic yards) removed from the floodplain as a result of the recharge basin construction would offset the initial flood elevation rise and would likely result in a localized lowering of the 100-year floodplain elevation.

For flood events that overflow the Santa Cruz River channel but do not inundate the recharge basins, the resulting flood elevation rise would be localized and minor based on the relatively small area of the recharge basin footprint. Agricultural and residential properties in the immediate vicinity of the Project area are currently within the FEMA

100-year flood zone. As a result, no significant impacts to neighboring properties due to a negligible increase in flood elevation are anticipated. Any increase in floodwater velocity would be a localized effect resulting in increased channel scouring, increased size of material conveyed during the flood event for a short distance, and increased downstream deposition of the eroded material. Because no developed properties are within the Santa Cruz River channel immediately downgradient of the Preferred Alternative recharge site, no significant impacts from increased flood flow velocities to neighboring properties are anticipated.

The Preferred Alternative does not involve direct recharge to the Santa Cruz River. As a result, there would be no impact on the quantity or quality of surface water resources because the Proposed Project or its alternatives would not cause ground water levels to rise sufficiently to affect surface water flow. Additionally, the Proposed Project or its alternatives would not cause a significant decrease in flood channel infiltration because the recharge basins would not be in the stream channel and the basins would cover a relatively small area (15.6 acres) relative to the total surface area of the Santa Cruz River and its floodplain. As discussed in Section 3.6.2—Ground Water Resources—Environmental Consequences, the minimum depth to ground water resulting from the proposed recharge would be 124.5 feet, which would occur directly beneath the recharge site.

3.7.2.3 North Parcel Recharge Site Alternative

Because the impacted area for the North Parcel is the same as the Preferred Alternative site, all impacts described in Section 3.7.2.2 above are applicable to the North Parcel. The width of the FEMA 100-year floodplain at the North Parcel is nearly identical to that at the Preferred Alternative (South Parcel).

3.7.2.4 CAP Terminus Alternative

The CAP terminus is within the FEMA 100-year floodplain. Construction of the additional underground vault associated with this alternative is likely to have a negligible impact on flood elevation due to the negligible reduction in floodplain infiltration. The underground vault would not alter flood flow. As a result, the impacts associated with this alternative are the same as the Proposed Alternative.

3.7.2.5 CAP Entitlements Alternative

The surface water effects for the CAP Entitlements Alternative would be reduced compared to the impacts of the Preferred Alternative because the new recharge facilities would be about 30 percent smaller.

3.7.2.6 CWC-Only Alternative

The impacts to surface water from the CWC-Only Alternative would be less than the impacts of the Preferred Alternative because the recharge facility would be reduced by approximately 55 percent.

3.7.3 Cumulative Effects

Assuming future development within the Project area will be limited to the available area outside of the FEMA 100-year floodplain, none of the reasonably foreseeable actions in the Project area are likely to have an effect on flooding in the area; therefore, the cumulative effects are the same with the Proposed Project and the action alternatives.

A reasonably foreseeable action near the proposed recharge alternatives is the continued gravel mining at the Staker Parson Gravel Pit. The gravel pit is within the FEMA 100-year floodplain. In the event of a 100-year flood, continued removal of material over time from the pit will help mitigate local flood elevation rises due to the action alternatives.

3.8 Socioeconomic Resources

The analysis of social and economic conditions addresses the relationships between the Proposed Project and the communities it may affect. The Project area for evaluation of socioeconomic impacts is Pima County because the Proposed Project use would occur in the south-central portion of the county. Direct and indirect socioeconomic effects of construction would occur primarily in Green Valley, Sahuarita, and nearby communities. Some direct and indirect socioeconomic impacts are likely to occur in the Tucson metropolitan area as the result of construction activities. The CWC service area and nearby water users relying on the same portion of the ground water aquifer would experience some socioeconomic effects associated with water recharge and pumping.

3.8.1 Affected Environment

3.8.1.1 Data Sources

Information from federal, state, and local sources was used to characterize the overall baseline and future economic and demographic conditions in the Project area. Data were collected for population, employment, household and per capita incomes, wage rates, and other economic and demographic variables. Specific sources of data include:

- Regional, county, municipal, and water company reports and information;
- Arizona Department of Commerce; and
- U.S. Department of Commerce, Census Bureau.

Most data sources have not been updated since 2007, so they do not reflect the economic downturn experienced in 2008 and 2009.

3.8.1.2 Population

The population of Pima County has grown rapidly over the past 10 years and is projected to grow steadily over the next 40 years at a declining rate (Table 13).

Table 13. Pima County Historical, Current, and Projected Population and Percent of Change.

Year	Total Population	Change	Percent Change
1990	666,880	--	--
2000	846,746	179,860	27%
2010	1,070,723	223,977	26%
2020	1,271,921	201,198	16%
2030	1,442,420	170,499	13%
2040	1,585,983	143,563	10%
2050	1,709,026	123,043	8%

Source: ADOC 2007.

The Town of Sahuarita has experienced exponential population growth in the past 20 years. However, the growth rate is expected to significantly taper off after 2020. Table 14 shows Sahuarita's population growth, which has been much more rapid than Pima County's as a whole (compare Table 13 with Table 14).

Table 14. Town of Sahuarita Historical, Current, and Projected Population and Percent of Change.

Year	Total Population	Change	Percent Change
1990	1,622	--	--
2000	3,242	1,620	100%
2010	37,965	34,723	1,071%
2020	71,479	33,514	88%
2030	84,714	13,235	19%
2040	92,230	7,516	9%
2050	101,274	9,044	10%

Sources: Sahuarita 2008a; Tucson 2006; ADOC 2007.

Green Valley's population has risen steadily in the last 10 years, but at a slower rate than that of Sahuarita (Chamber 2008). Population projections for Green Valley are not available for comparison to Sahuarita and Pima County. However, CWC anticipates the population of its service area to more than double from its current level of 22,000 to about 43,000 by 2020 (Stantec 2006).

3.8.1.3 Employment and Income Patterns

Primary components of the Pima County economy are government, business, industry, and technology. Government (federal, state, and local) is a major employer providing opportunities in management, public administration, and education. Major business enterprises include Raytheon in manufacturing, Wal-Mart Stores in retail trade, and Freeport-McMoRan in mining. Construction is a major component of the Pima County economy, a reflection of Pima County's growth. In 2006, the value of permitted

construction decreased to slightly under $2 billion from a recent (2005) high of more than $2.5 billion. Construction and extraction jobs in 2006 accounted for 6.7 percent of the total working population, which is fourth in the list of employees by occupation for Pima County (2007b).

The Pima County civilian labor force is estimated to be approximately 457,000 (ADOC 2007). Based on the 2000 census, unemployment in the County was slightly lower than for the State of Arizona. Table 15 shows that 1999 median household and per capita incomes in the County were slightly lower than similar levels in Arizona. Similarly, the percentage of families living below the poverty level in Pima County was slightly higher than the State of Arizona.

Table 15. Economic Attributes for Pima County.

Attribute	Pima County	Arizona
Population	843,746	5,130,632
Employment, civilian (2007)	457,101	3,029,090
Unemployment rate (2007)	3.7%	3.8%
Median household income (2004)	$38,687	$43,696
Per capita income (1999)	$19,785	$20,275
Families below poverty level (2004)	15.6%	14.6%

Sources: Census 2000; ADOC 2007, 2008.

The average entry-level wage earned by employees in Pima County was $7.56 per hour in 2007. This falls in the 10th percentile for the United States. The average wage for experienced employees was $21.93 per hour, which is in the 75th percentile for the United States (ADOC 2008).

Because Sahuarita is only 15 miles from Tucson, more than half of its employed residents commute to the city to work. The main source of employment in Sahuarita is education and health services. The unemployment rate for the town in 2000 was 2.9 percent, well below Pima County and state averages (Census 2000).

Green Valley is primarily a retirement community with more than 70 percent of its residents aged 65 or older (Census 2000). Only 14.2 percent of Green Valley residents aged 16 or older are employed (ADOC 2008).

3.8.2 Environmental Consequences

The socioeconomic impacts from the No Action and Preferred alternatives related to construction and operation of the Proposed Project are discussed in this section. The impact area for socioeconomic resources extends to the Tucson metropolitan area due to the likelihood that the employment base for construction workers needed for the Proposed Project would come from the Tucson area.

3.8.2.1 No Action Alternative

No substantial adverse impacts on socioeconomic resources in the impact area is anticipated under the No Action Alternative because existing conditions would continue for the foreseeable future. It is assumed that any additional water treatment costs due to contamination of wells would be paid by the parties responsible for the contamination.

3.8.2.2 Preferred Alternative

The estimated construction costs of the Proposed Project is $19.7 million. The components of the total costs are:

- Materials, Equipment, and Other Costs = $15.6 million
- Labor = $4.1 million

Pipeline construction would require approximately 33 workers for 6.5 months. Concrete, horizontal boring, and mechanical-electrical crews would employ approximately 27 workers. Earth moving for construction of the recharge basin would require an additional five workers. It is estimated that a maximum of about 65 construction workers would be required to complete the Proposed Project in a 6.5-month period.

Minor short-term benefits to socioeconomic resources would occur with implementation of the Preferred Alternative from construction expenditures of $19.7 million, which would be approximately 0.01 percent of the annual Pima County total construction expenditures in 2006. Similarly, the employment of up to 65 workers during peak construction would provide a short-term minor benefit in jobs. Indirectly, there would be a short-term minor economic benefit for local businesses due to construction workers' expenditures on lodging and food, although most of the work force would likely commute from their homes in the Tucson area. Given the relatively small scale and short term of construction activity, there would not be a discernable impact on services or government tax receipts. Economic benefits to the impact area through employment and expenditures related to ongoing operation and maintenance requirements of the pipeline and recharge facility would be negligible. The Preferred Alternative is not anticipated to have any long-term adverse impacts on socioeconomic resources in the impact area. CWC and its customers would benefit by securing a reliable source of water, in the event additional water supply wells become contaminated by the sulfate plume. Landowners and water users within the impact area also would benefit from reduced ground water overdraft, reduced ground surface subsidence, and reduced costs for deepening wells or pumping from deeper water levels.

3.8.2.3 North Parcel Recharge Site Alternative

Socioeconomic impacts from the North Parcel would be about the same as the Preferred Alternative. Total construction costs would be about $19.2 million, or about 2.5 percent less than the Preferred Alternative.

3.8.2.4 CAP Terminus Alternative

Estimated costs of the CAP Terminus Alternative would be about $5.1 million higher than either the Preferred Alternative or the North Parcel, an increase of approximately 26 percent. Approximately the same maximum number of workers would be required, with the pipeline crews working another 1.5 months. The minor beneficial socioeconomic impacts to the regional economy under the CAP Terminus Alternative would be slightly greater than the Preferred Alternative. However, most of the increase in construction costs would be for pipe and equipment, which would likely be purchased from outside the region. Like the Preferred Alternative, landowners and water users within the impact area would benefit from reduced ground water overdraft, reduced ground surface subsidence, and reduced costs for deepening wells or pumping from deeper water levels.

3.8.2.5 CAP Entitlements Alternative

The estimated cost of the CAP Entitlements Alternative would be less than the Preferred Alternative because of the smaller size of the facilities. Thus, the minor beneficial socioeconomic impacts to the regional economy of the CAP Entitlements Alternative would be smaller. Like the Preferred Alternative, there also would be benefits to landowners and water users within the Project impact area due to reduced ground water overdraft, reduced ground surface subsidence, and reduced costs for deepening wells or pumping from deeper water levels, although these benefits would be smaller.

3.8.2.6 CWC-Only Alternative

The estimated cost of the CAP Entitlements Alternative would be less than the Preferred Alternative because of the smaller pipe size and smaller recharge facility, and the maximum number of employees would be reduced. As a result, the minor beneficial socioeconomic impacts to the regional economy of the CWC-Only Alternative would be smaller than those of the Preferred Alternative. Compared to the Preferred Alternative, the CWC-Only Alternative would result in fewer benefits to landowners and water users within the Project impact area due to reduced ground water overdraft, reduced ground surface subsidence, and reduced costs for deepening wells or pumping from deeper water levels.

3.8.3 Cumulative Effects

As described in Section 3.1—Background for Cumulative Effects, a number of road and housing projects are expected to be constructed within the impact area. The Preferred Alternative and other action alternatives, when added to the past, present, and reasonably foreseeable future construction activity in the Project area, would provide short-term minor socioeconomic benefits from construction expenditures. Long-term beneficial cumulative impacts from the Project would occur as the result of recharge, which would reduce ground water overdraft, ground surface subsidence, and costs for deepening wells or pumping from deeper water levels.

3.9 Resources Considered But Not Affected

3.9.1 Recreation

Construction, operation, and maintenance of the Proposed Project would primarily occur within existing previously disturbed ROWs and on private land. Thus, existing recreation resources would not be affected. The minor potential adverse impacts on future recreation trails are discussed in Section 3.3.2—Land Use—Environmental Consequences.

3.9.2 Climate Change

As discussed in Section 3.2.2—Air Quality—Environmental Consequences, the action alternatives would result in minor amounts of emissions over a period of up to seven months. Thus, potential adverse impacts on climate change are likely to be negligible and were not considered further.

4.0 Environmental Laws and Directives Considered

Following is a summary of selected federal laws, regulations, and Executive Orders considered in preparation of this revised DEA.

National Environmental Policy Act of 1969, as amended (P.L. 91-190)

This law requires federal agencies to evaluate the potential environmental consequences of major federal actions. NEPA also requires full public disclosure about the proposed action, accompanying alternatives, impacts, and mitigation.

Public scoping was initiated on August 11, 2008. Twenty-eight written comments were received. In addition, a public scoping meeting was held on August 26, 2008, which was attended by approximately 70 people. This revised DEA was prepared in accordance with NEPA requirements. The initial DEA was issued on March 9, 2009 for a 46-day public review and comment period. Reclamation received 16 comment letters on the adequacy of the DEA. A public hearing was held in Green Valley, Arizona on March 26, 2009 to obtain verbal comments on the adequacy of the DEA.

This revised DEA is being circulated for a 30-day public review and comment period.

Fish and Wildlife Coordination Act (FWCA) (P.L. 85-624)

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 is required on all federal water development projects. The effects of the CAP were originally addressed in an amended FWCA report prepared by the FWS in 1989. The Proposed Project does not constitute a federal water resource project that impounds, diverts, or otherwise modifies a stream or other natural body of water. No further coordination pursuant to the FWCA is required.

Endangered Species Act of 1973 (P.L. 93-205)

The ESA provides protection for plants and animals that are currently in danger of extinction (endangered) and those that may become extinct in the foreseeable future (threatened). Section 7 of this law requires federal agencies to ensure that all federally associated activities do not have adverse impacts on the continued existence of threatened or endangered species or designated areas (critical habitat) that are important in conserving those species.

Reclamation submitted a BA (prepared by Stantec) on November 25, 2008, which concluded that the Proposed Project may affect, but is not likely to adversely affect, the LLNB. We also concluded that the Proposed Project may affect, and is likely to adversely affect, the PPC. Reclamation requested the initiation of formal consultation pursuant to Section 7(b) of the ESA. A December 24, 2008 letter from FWS indicated that additional information was required prior to initiating formal consultation. An informal consultation meeting was held on January 12, 2009, with representatives from Reclamation, CWC, and FWS, to provide the requested Project information.

Reclamation provided supplemental information to the FWS concerning Project changes on February 10, 2010, based on a January 11, 2010 site visit and informal consultation (site visit and discussion) with FWS on January 25, 2010 (see Section 3.4.2—Biological Resources—Environmental Consequences). The final EA will include FWS's response, as well as any additional requirements identified by FWS.

Wild and Scenic Rivers Act of 1968 (P.L. 90-542)

This law designated the initial components of the National Wild and Scenic River System, and established procedures for including other rivers or reaches of rivers that possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, and preserving them in a free-flowing condition. No recommended or designated wild and scenic rivers are within or near the Project area.

Clean Water Act (P.L. 92-500, as amended) (CWA)

This law establishes the basic structure for regulating discharges of pollutants into the nation's rivers, lakes, estuaries, and coastal waters. Under Section 404 of the CWA, the Corps regulates the discharge of dredged and/or fill material into waters of the U.S. including wetlands. At the present time, it does not appear that waters of the U.S. would be impacted by the Proposed Project. If waters of the U.S might be affected by construction of the proposed CWC water delivery system, a delineation of waters of the U.S. and application(s) for 404 permit(s) would be submitted to the Corps. Authorization under Section 402 of the CWA, the National Pollutant Discharge Elimination System (NPDES), has been delegated to ADEQ. An Arizona Pollutant Discharge Elimination System (AZPDES) general permit for construction activities, and other required discharge permits, would be obtained from ADEQ by CWC prior to construction. If required, a CWA Section 401 certification would be obtained by CWC.

National Historic Preservation Act (P.L. 89-665) (NHPA)

This law provides for the protection of historic and prehistoric sites that are eligible for listing on the NRHP. The NHPA requires federal agencies to identify potential impacts to cultural resources, and conduct mitigation to protect or record resources as determined appropriate in consultation with the SHPO or Tribal Historic Preservation Office prior to initiating a federal project.

Cultural resource investigations of the Project area were performed by Stantec and its subcontractors. Section 3.5 describes the cultural resources in the Project area and mitigation of possible impacts. Reclamation has consulted with the SHPO and received concurrence on a finding of no adverse effect for the Proposed Project as a whole. Several Native American Tribes also were consulted as part of Section 106 compliance including the Hopi Tribe, Tohono O'odham Nation, and Pascua Yaqui Tribe.

Farmland Protection Policy Act (P.L. 97-98)

This law requires identification of proposed actions that would adversely affect any lands classified as prime and unique farmlands to minimize the unnecessary and irreversible conversion of farmland to nonagricultural uses. The U.S. Department of

Agriculture's Natural Resources and Conservation Service administers this law. The proposed pipeline transects an area of prime irrigated farmland, but would be constructed in an existing ROW that has already been permanently taken out of farming. Thus, the Proposed Project would not impact any prime or unique farmlands.

Executive Order 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 Project would have negligible impacts on floodplain development and management (see Section 3.7.2.2—Surface Water Resources—Environmental Consequences).

Executive Order 12898 (Environmental Justice)

Executive Order 12898 requires federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of federal actions on minority populations and low-income populations. Low-income populations include communities or individuals living in close geographic proximity to one another, identified by U.S. Census Bureau statistical thresholds for poverty. Minority populations are identified where the percentage of minorities in the affected area exceeds 50 percent, or where the minority population percentage of the affected area is meaningfully greater than the minority population percentage of a much broader area. Neither of these conditions exist within the impact area or Pima County as a whole. No disproportionately high or adverse human health or environmental effects on minority populations and low-income populations would result from the Proposed Project.

Executive Order 11990 (Wetlands)

Executive Order 11990 requires federal agencies, in carrying out their land management responsibilities, to take action that would minimize the destruction, loss, or degradation of wetlands; and take action to preserve and enhance the natural and beneficial values of wetlands. No wetlands would be affected by the Proposed Project.

Department of the Interior, Secretarial Order, Indian Trust Assets (ITAs)

ITAs are legal interests in assets held in trust by the U.S. Government for Indian tribes or individual Indians. These assets can be real property or intangible rights, including lands, minerals, water rights, hunting rights, money, and other natural resources. The trust responsibility requires that all federal agencies take actions reasonably necessary to protect ITAs. The primary ITAs in the area involve the San Xavier District of the Tohono O'Odham Nation (Figure 1). The starting point for the proposed pipeline is near the southeast corner of the San Xavier District boundary. The Proposed Project would be constructed within existing road ROWs. Construction impacts would be temporary and would not likely affect ITAs. The proposed recharge site is approximately 5.4 miles southeast of the San Xavier District and would not likely have an effect on reservation

ground water resources (see Section 3.6.2—Environmental Consequences). No ITAs are currently known to exist within the Project area or that could be affected by implementation of the Proposed Project. Consultation with appropriate tribes and the Bureau of Indian Affairs would be undertaken if it is determined that ITAs could be affected by the Proposed Project.

5.0 Agencies and Persons Consulted

List of Preparers

Reclamation
- Sandra Eto, NEPA Specialist
- Diane Laush, Wildlife Biologist

ERO Resources Corporation (ERO)
- Mike Galloway, Senior Hydrogeologist
- Jenn McLeland, Researcher
- Brian Olmstead, Geologist
- Craig Sommers, Water Resources Specialist, Project Manager

Other Contributors and Reviewers

Reclamation
- Marci Donaldson, Archaeologist
- Bruce Ellis, Environmental Resource Management Division Chief
- John McGlothlen, NEPA Specialist

ERO
- Mark DeHaven, Natural Resource Specialist
- Denise Larson, Ecologist

GeoSystems Analysis, Inc.
- Meg Buchanan, Environmental Scientist
- Dale Hammermeister, RG, Technical Director
- Jason Keller, Project Hydrogeologist
- Mike Milczarek, Senior Soils Scientist, Program Director
- Bob Rice, Senior Hydrologist/Soil Scientist

Montgomery and Associates
- Hale Barter, Hydrologist
- Jeff Meyer, Hydrogeologist
- Marla Odum, Hydrologist

Stantec
- Gary Brady, Project Manager
- Bob Larkin, Manager, Environmental Planning & Archaeology
- David Logue, Senior Associate, Environmental Infrastructure
- Kathy Meadows, Biologist
- Robert Welch, Senior Associate

Community Water Company of Green Valley
- Pat Carlstad, Assistant to the President
- Virgil Davis, Secretary
- Arturo Gabaldón, President
- Ken Taylor, Chairman of the Board
- Norris West, Operations Manager

Cooperating Agencies
- Arizona Department of Water Resources
- Arizona State Land Department
- Central Arizona Water Conservation District

Other Agencies and Entities Consulted
- Coronado National Forest
- FICO
- Hopi Tribe
- Pascua Yaqui Tribe
- Tohono O'odham Nation
- U.S. Fish and Wildlife Service

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Figures