Volume 1 of 4 : Final Feasibility Report

Volume 2 of 4 : Final Feasibility Report Technical Appendices

Volume 3 of 4 : Final Feasibility Report Technical Appendices

Volume 4 of 4 : Final Environmental Impact Statement

Va Shly'ay Akimel
FINAL Salt River Ecosystem Restoration Study

Prepared by:

U.S. Army Corps of Engineers
South Pacific Division
Los Angeles District

In partnership with:

Salt River Pima-Maricopa Indian Community

and the

City of Mesa

Va Shly'ay Akimel Salt River Ecosystem Restoration Feasibility Study

Final Environmental Impact Statement

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Jones & Stokes. 2004. *Va Shly'ay Akimel Salt River Ecosystem Restoration Feasibility Study, Final Environmental Impact Statement*. September. (J&S 03048) Phoenix, AZ. Prepared for U.S. Army Corps of Engineers, Los Angeles District, Phoenix Field Office.

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FINAL ENVIRONMENTAL IMPACT STATEMENT
FOR THE VA SHLY'AY AKIMEL ECOSYSTEM RESTORATION
FEASIBILITY STUDY,
MARICOPA COUNTY, ARIZONA

The responsible federal lead agency is the Department of the Army, U.S. Army Corps of Engineers, Los Angeles District.

ABSTRACT

This final environmental impact statement (FEIS) analyzes the potential environmental impacts associated with the proposed Va Shly'ay Akimel restoration project in Maricopa County, Arizona. Ecosystem restoration is the primary purpose of the proposed action. The project study area, located east of Phoenix, extends from the Granite Reef Dam at its easternmost boundary to the Pima Freeway (State Route 101), a distance of approximately 14 miles. The project area includes portions of the Salt River Pima-Maricopa Indian Community (SRPMIC) and the City of Mesa. This document addresses the no action, the preferred action and five alternative plans developed to improve and increase native vegetation and overall wildlife habitat values in the project area, and to provide a greater diversity of habitat for threatened and endangered species such as the Yuma clapper rail and southwestern willow flycatcher. Incidental benefits would include both passive and active recreational opportunities, general improvement in the aesthetic quality of the project area and a slight reduction in the potential for flood damage. Each of the alternatives has been designed to minimize adverse impacts to the maximum extent practicable. The anticipated cumulative effects of implementation of the proposed action have been considered and addressed. Analyses and documentation are consistent with the National Environmental Policy Act and other applicable laws, regulations, and policies, and have been conducted in coordination with the U.S. Army Corps of Engineers, the SRPMIC, the City of Mesa, and concerned resource agencies and members of the public. Information referred to in this document, as well as in the accompanying feasibility report and appendices, is incorporated by reference.

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EXECUTIVE SUMMARY

ES.1 INTRODUCTION

This final environmental impact statement (FEIS) has been prepared by the U.S. Army Corps of Engineers (Corps), Los Angeles District, to analyze potential environmental impacts associated with the implementation of restoration alternatives for the Va Shly'ay Akimel project study area, located along the Salt River approximately 11 miles east of downtown Phoenix, Maricopa County, Arizona. The approximately 14-mile-long, 2-mile-wide study area extends from Granite Reef Dam to the Pima Freeway (State Route 101) and includes portions of the Salt River Pima-Maricopa Indian Community (SRPMIC) and the City of Mesa.

This FEIS provides a description of restoration alternatives, including the No-Action Alternative; provides an analysis of the existing and future conditions of the area without the project; and analyzes the impacts associated with five alternatives that have been determined to be the most feasible, including the preferred alternative (proposed action). Alternative O has been identified as the recommended plan based on its achievement of project objectives, and its meeting of completeness, efficiency, effectiveness, and preliminary public acceptability criteria.

ES.2 MAJOR CONCLUSIONS

ES.2.1 FORMULATION AND SCREENING OF ALTERNATIVES

The purpose of the project alternatives associated with the study is to provide for increasing and improving native vegetation in the project area, wildlife habitat values, and habitat diversity for threatened and endangered species. Incidental benefits would include passive and active recreation, as well as improvement in the aesthetics of the project area.

Specific planning objectives were to create a complete and diverse riparian system similar to the natural riparian habitat typical of this area. The restored areas should incorporate a diverse mix of riparian habitat types, including velvet mesquite, cottonwood-willow, Sonoran desertscrub uplands, wetland marsh, and open water.

The project team developed a set of ecorestoration components that could be combined in various ways under each alternative to provide different approaches to accomplishing the project objectives. These components are listed below.

- Vegetation Planting Palettes. These palettes include cottonwood-willow, mesquite, wetland, Sonoran Desert scrub-shrub, and river bottom.
- Saltcedar Eradication. In order to improve habitat values, saltcedar would be replaced with one or several of the vegetation types listed above.

- Water Distribution System for Irrigation. The water distribution system is the infrastructure needed to deliver water (surface water, groundwater, or wastewater) from the source (irrigation canal, well, or effluent line) to the vegetated areas, exclusive of the irrigation system. Surface water from the SRPMIC would be the primary source of water for all construction alternatives.
- Channelization. Channelization may be constructed that would entail confining flows of the Salt River to a narrower and deeper channel than the current main channel. This would be done to offset the reduction in the capacity of the channel to convey water in certain areas due to planting of vegetation within the main channel.
- Grade Control Structure. A grade control structure may be constructed to help reduce upstream migration ("headcutting") and thus stabilize the river system, improving the likelihood of success of vegetation established upstream and downstream.

Relatively little fill material will need to be acquired for any of the construction alternatives, as most materials can be gained during reshaping prior to planting. Any waste materials will be transported to either a recycling facility if appropriate or to the nearest appropriate landfill. Vector control and environmental monitoring would be incorporated into all restoration features.

Five primary design alternatives have been studied in detail for this site: Alternatives F, N, O, E, and A. These alternatives, considered during the plan formulation process, each contain all of the above-referenced components, with the exception of channelization, which is only included in Alternatives F and E, and the grade control structure, which is only included in Alternatives F, N, and O.

Operations and maintenance (O&M) activities have also been identified for the project and have been evaluated in this EIS. These activities include maintenance and replacement of pumps, pipelines, and other water delivery and irrigation infrastructure features, and periodic removal of sediment, surface reshaping, or replanting of project features damaged by flood events.

ES2.2 AREAS OF CONTROVERSY AND UNRESOLVED ISSUES

The National Environmental Policy Act ensures public involvement and notification of a proposed project. An initial public meeting was held on January 24, 2002 and a final public meeting was held on June 3, 2004. Multiple public workshops, information sessions, and meetings were also held as part of the scoping process. Public concerns expressed at the public meetings included the following (those items in bold were expressed repeatedly):

1. **Where will the water come from and how will future droughts be addressed?**
2. Who will maintain the aquifer in the future and what are the risks of aquifer contamination?
3. Concern was expressed about the City of Mesa's involvement.

4. **Concern was expressed about future rights to the land surrounding the river and future possession by federal government.**
5. Concern was expressed about future property loss of project site.
6. Where does project fit in with Sand and Gravel mining?
7. Concern was expressed about the protection of burial grounds.
8. Concern was expressed that preservation of this land would encourage the FAA to cement their flight plans over Community land due to lack of human establishment.
9. **Concern was expressed about future restrictions of Community land use due to project.**

Additional information regarding the public involvement and scoping process is provided in Chapter 11.

Endangered Species Act, Section 7 informal consultation was completed during the production of the study's FEIS. The U.S. Fish and Wildlife Service concurred with a determination of "may affect, not likely to adversely affect" for the Yuma clapper rail, southwestern willow flycatcher, cactus ferruginous pygmy owl, California brown pelican and bald eagle. This concurrence ends the Section 7 consultation process. Details of the Section 7 informal consultation are provided in Appendix F. The Clean Water Act Section 404(b)(1) Compliance Evaluation can be found in Appendix A of this document.

Initiation and completion of activities associated with Va Shly'ay Akimel restoration project depends on the resolution of the following issues:

- Water Quality Certification under Section 401 of the Clean Water Act.
- Further evaluations of cultural resources in the project area will need to be conducted in accordance with Section 106 of the NHPA. If resources were determined to be NRHP eligible and avoidance is not feasible, further mitigation measures would be detailed in a Memorandum of Agreement between the Corps, the SRPMIC, the City of Mesa, and the SHPO. These would include field surveys, testing, and data recovery. These would include field surveys, testing, and data recovery. Mitigation measures would also contain provisions that if cultural or paleontological resources are encountered during construction or other activities, work in the area will stop until a qualified archaeologist can evaluate the finds and determine whether further investigation is necessary. The Corps, SRPMIC, City of Mesa, and the SHPO will be notified if buried cultural resources are encountered.
- Future operational activities associated with sand and gravel mining in the project area will need to be defined.

It is expected that these issues will be resolved during the preliminary engineering design phase of the project after the Final EIS has been published.

ES2.3 SUMMARY OF POTENTIAL ENVIRONMENTAL EFFECTS

Each of the alternatives has been analyzed to determine the environmental effects that would result if that alternative were implemented. Mitigation measures have been developed to avoid, minimize, or reduce the effects of any substantial adverse impacts. A cumulative analysis has also been prepared for each resource area. Table ES-1 provides a summary of the impacts and mitigation measures for each resource area by alternative. These impacts include unavoidable significant impacts on prehistoric and historic cultural resources. Unavoidable significant impacts are impacts that remain following the implementation of mitigation measures, or impacts for which there are no mitigation measures. These significant impacts could occur as a result of implementing any of the analyzed construction alternatives [F, N, O, E, and A]. More detailed information on unavoidable significant impacts is provided in Section 6 of the FEIS.

Based on the HGM and ICA analyses, Alternative O was determined to be the environmentally preferable alternative. Alternative O is also the non-federal sponsor(s) preferred alternative.

Table ES-1. Environmental Impact Summary Matrix

Environmental Element	Alternative F	Alternative N	Alternative O	Alternative E	Alternative A	No Action
5.1 GEOLOGY AND TOPOGRAPHY						
Impact: Minor Geomorphologic Changes in River Channel						
Level of Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Mitigation Measure(s)	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant
5.2 HYDROLOGY AND WATER RESOURCES						
Impact: Temporary Adverse Effects on Water Quality during Project Construction						
Level of Significance	Significant	Significant	Significant	Significant	Significant	N/A
Mitigation Measure(s)	Implement erosion control measures	Implement erosion control measures	Implement erosion control measures	Implement erosion control measures	Implement erosion control measures	N/A
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	N/A
Impact: Potential Adverse Effects on Water Quality Associated with Accidental Spills of Fuels or Other Toxic Materials During Project Construction						
Level of Significance	Significant	Significant	Significant	Significant	Significant	N/A
Mitigation Measure(s)	Implement SWPPP	Implement SWPPP	Implement SWPPP	Implement SWPPP	Implement SWPPP	N/A
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	N/A
Impact: Changes in 100-year Water Surface Elevations						
Level of Significance	Significant	Significant	No Impact	Significant	No Impact	Less than significant

Table ES-1. Environmental Impact Summary Matrix

Environmental Element	Alternative F	Alternative N	Alternative O	Alternative E	Alternative A	No Action
Mitigation Measure(s)	Identify possible changes to the water surface elevation and redesign alternative	Identify possible changes to the water surface elevation and redesign alternative	No Mitigation	Identify possible changes to the water surface elevation and redesign alternative	No Mitigation	No Mitigation
Residual Significance	Less than significant	Less than significant	No Impact	Less than significant	No Impact	Less than significant
Impact: Changes in Groundwater Hydrology (from installation of new well)						
Level of Significance	Significant	Significant	Significant	Significant	N/A	N/A
Mitigation Measure(s)	Develop institutional agreements for groundwater use	Develop institutional agreements for groundwater use	Develop institutional agreements for groundwater use	Develop institutional agreements for groundwater use	N/A	N/A
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	N/A	N/A
Impact: Potential Adverse Effects on Water Quality Associated with Irrigation Water						
Level of Significance	Significant	Significant	Significant	Significant	Significant	Less than significant
Mitigation Measure(s)	Conduct additional stormwater quality sampling and analysis	Conduct additional stormwater quality sampling and analysis	Conduct additional stormwater quality sampling and analysis	Conduct additional stormwater quality sampling and analysis	Conduct additional stormwater quality sampling and analysis	No Mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant
5.3 BIOLOGICAL RESOURCES						
Impact: Long-Term Increase in Saltcedar and Decrease in Cottonwood-Willow Vegetation						

Table ES-1. Environmental Impact Summary Matrix

Environmental Element	Alternative F	Alternative N	Alternative O	Alternative E	Alternative A	No Action
Level of Significance	N/A	N/A	N/A	N/A	N/A	Less than significant
Mitigation Measure(s)	N/A	N/A	N/A	N/A	N/A	No mitigation
Residual Significance	N/A	N/A	N/A	N/A	N/A	Less than significant
Impact: Long-Term Decrease in Wildlife Habitat						
Level of Significance	N/A	N/A	N/A	N/A	N/A	Less than significant
Mitigation Measure(s)	N/A	N/A	N/A	N/A	N/A	No mitigation
Residual Significance	N/A	N/A	N/A	N/A	N/A	Less than significant
Impact: Substantial Short-Term Impacts on Vegetation						
Level of Significance	Significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Mitigation Measure(s)	Project construction phasing & area restrictions	Project construction phasing & area restrictions	Project construction phasing & area restrictions	Project construction phasing & area restrictions	Project construction phasing & area restrictions	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Impact: Short-Term Impacts on Common Wildlife Species						
Level of Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Mitigation Measure(s)	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation

Table ES-1. Environmental Impact Summary Matrix

Environmental Element	Alternative F	Alternative N	Alternative O	Alternative E	Alternative A	No Action
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Impact: Potential Impacts on Vegetation, Wildlife, and Sensitive Species during Long-Term O&M Activities						
Level of Significance	Significant	Significant	Significant	Significant	Significant	No impact
Mitigation Measure(s)	Maintenance activities on rotating basis & only during non-nesting periods	Maintenance activities on rotating basis & only during non-nesting periods	Maintenance activities on rotating basis & only during non-nesting periods	Maintenance activities on rotating basis & only during non-nesting periods	Maintenance activities on rotating basis & only during non-nesting periods	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Impact: Short-Term Impacts on Waters of the United States						
Level of Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Mitigation Measure(s)	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Impact: Short-Term Impacts on Waters of the United States During O&M Activities						
Level of Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Mitigation Measure(s)	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Impact: Short-Term Impacts on Habitat for Listed Wildlife Species						
Level of Significance	No impact	Significant	Significant	Significant	No impact	No impact

Table ES-1. Environmental Impact Summary Matrix

Environmental Element	Alternative F	Alternative N	Alternative O	Alternative E	Alternative A	No Action
Mitigation Measure(s)	No mitigation	Conduct surveys for the presence of Yuma Clapper Rails (Section 7 Consultation if necessary)	Conduct surveys for the presence of Yuma Clapper Rails (Section 7 Consultation if necessary)	Conduct surveys for the presence of Yuma Clapper Rails (Section 7 Consultation if necessary)	No mitigation	No mitigation
Residual Significance	No impact	Less than significant	Less than significant	Less than significant	No impact	No impact
5.4 CULTURAL RESOURCES						
Impact: Potential Disturbance of Loss of Properties Listed or Eligible for Listing on the National Register						
Level of Significance	Significant	Significant	Significant	Significant	Significant	No impact
Mitigation Measure(s)	Develop MOA between the Corps, SRPMIC, City of Mesa and SHPO	Develop MOA between the Corps, SRPMIC, City of Mesa and SHPO	Develop MOA between the Corps, SRPMIC, City of Mesa and SHPO	Develop MOA between the Corps, SRPMIC, City of Mesa and SHPO	Develop MOA between the Corps, SRPMIC, City of Mesa and SHPO	No mitigation
Residual Significance	Significant and unavoidable	Significant and unavoidable	Significant and unavoidable	Significant and unavoidable	Significant and unavoidable	No impact
5.5 AESTHETIC RESOURCES						
Impact: Potential Short-Term Adverse Aesthetic Effects						
Level of Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Mitigation Measure(s)	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Impact: Potential Long-Term Adverse Aesthetic Effects						

Table ES-1. Environmental Impact Summary Matrix

Environmental Element	Alternative F	Alternative N	Alternative O	Alternative E	Alternative A	No Action
Level of Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Mitigation Measure(s)	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant
5.6 AIR QUALITY						
Impact: Generation of Construction-Related and Operational Tailpipe Emissions						
Level of Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Mitigation Measure(s)	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Impact: Generation of Construction-Related and Operational Fugitive Dust Emissions						
Level of Significance	Significant	Significant	Significant	Significant	Less than significant	No impact
Mitigation Measure(s)	Implementation of PM-10 reducing Measure(s)s	Implementation of PM-10 reducing Measure(s)s	Implementation of PM-10 reducing Measure(s)s	Implementation of PM-10 reducing Measure(s)s	Implementation of PM-10 reducing Measure(s)s	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
5.7 NOISE						
Impact: Exposure of Sensitive Land Uses to Construction Noise						
Level of Significance	Significant	Significant	Significant	Significant	Significant	No impact

Table ES-1. Environmental Impact Summary Matrix

Environmental Element	Alternative F	Alternative N	Alternative O	Alternative E	Alternative A	No Action
Mitigation Measure(s)	Employ noise-reducing construction Measure(s)s	Employ noise-reducing construction Measure(s)s	Employ noise-reducing construction Measure(s)s	Employ noise-reducing construction Measure(s)s	Employ noise-reducing construction Measure(s)s	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Impact: Increase Traffic Noise in the Project Vicinity from Recreational Users						
Level of Significance	Less than significant	Significant	Significant	Significant	Significant	No impact
Mitigation Measure(s)	No mitigation	Employ noise-reducing construction Measure(s)s	Employ noise-reducing construction Measure(s)s	Employ noise-reducing construction Measure(s)s	Employ noise-reducing construction Measure(s)s	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Impact: Increase Traffic Noise from O&M Activities						
Level of Significance	Significant	Significant	Significant	Significant	Significant	No impact
Mitigation Measure(s)	Employ noise-reducing construction Measure(s)s	Employ noise-reducing construction Measure(s)s	Employ noise-reducing construction Measure(s)s	Employ noise-reducing construction Measure(s)s	Employ noise-reducing construction Measure(s)s	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
5.8 SOCIAL AND ECONOMIC RESOURCES						
Impact: No Direct Impacts Associated with Social and Economic Resources						
Level of Significance	No impact	No impact	No impact	No impact	No impact	No impact

Table ES-1. Environmental Impact Summary Matrix

Environmental Element	Alternative F	Alternative N	Alternative O	Alternative E	Alternative A	No Action
Mitigation Measure(s)	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation
Residual Significance	No impact	No impact	No impact	No impact	No impact	No impact
5.9 TRANSPORTATION						
Impact: Temporary Increase in Traffic on Existing Roadways during Project Construction						
Level of Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Mitigation Measure(s)	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Impact: Potential Damage to Roadway Surfaces during Project Construction						
Level of Significance	Significant	Significant	Significant	Significant	Significant	No impact
Mitigation Measure(s)	Repair damaged roadways	Repair damaged roadways	Repair damaged roadways	Repair damaged roadways	Repair damaged roadways	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Impact: Generation of Additional Vehicle Trips by Recreationists						
Level of Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Mitigation Measure(s)	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Impact: Minor Temporary Traffic Effects Associated with Restoration and Maintenance Activities						
Level of Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact

Table ES-1. Environmental Impact Summary Matrix

Environmental Element	Alternative F	Alternative N	Alternative O	Alternative E	Alternative A	No Action
Mitigation Measure(s)	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
5.10 LAND USE						
Impact: Temporary Adverse Effects on Land Use during Project Construction						
Level of Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Mitigation Measure(s)	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Impact: Temporary Adverse Effects on Land Use during Project Construction						
Level of Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Mitigation Measure(s)	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation
Residual Significance:	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
5.11 RECREATION						
Impact: Temporary Adverse Effects on Recreation during Project Construction						
Level of Significance	Less than significant	Less than significant	Less than significant	Less than significant	No impact	No impact
Mitigation Measure(s)	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	No impact	No impact

Table ES-1. Environmental Impact Summary Matrix

Environmental Element	Alternative F	Alternative N	Alternative O	Alternative E	Alternative A	No Action
5.12 PUBLIC HEALTH AND SAFETY						
Impact: Potential for Breach and/or Damage to Landfill Closure Caps						
Level of Significance	Significant	No impact	No impact	Significant	No impact	No impact
Mitigation Measure(s)	Redesign vegetation pallet for landfill closure caps	No mitigation	No mitigation	Redesign vegetation pallet for landfill closure caps	No mitigation	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Impact: Addition of Cover Materials on Tri-City Landfill May Cause Exceedance of Minimum Ground Clearance for Overhead Power Transmission Lines						
Level of Significance	Significant	No impact	No impact	Significant	No impact	No impact
Mitigation Measure(s)	Concrete encasements at bases of towers or poles	No mitigation	No mitigation	Concrete encasements at bases of towers or poles	No mitigation	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Impact: Temporary Construction-Related Water Quality Impacts						
Level of Significance	Significant	Significant	Significant	Significant	Significant	No impact
Mitigation Measure(s)	Construction management	Construction management	Construction management	Construction management	Construction management	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	No impact
Impact: Potential for Temporary Increases in Mosquito Breeding following Irrigation Activities						

Table ES-1. Environmental Impact Summary Matrix

Environmental Element	Alternative F	Alternative N	Alternative O	Alternative E	Alternative A	No Action
Level of Significance	Significant	Significant	Significant	Significant	Significant	Less than significant
Mitigation Measure(s)	Initiate vector control Measure(s)s	Initiate vector control Measure(s)s	Initiate vector control Measure(s)s	Initiate vector control Measure(s)s	Initiate vector control Measure(s)s	No mitigation
Residual Significance	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant	Less than significant

CHAPTER 1. INTRODUCTION

This environmental impact statement (EIS) has been prepared by the U.S. Army Corps of Engineers (Corps) to analyze the potential environmental effects associated with the implementation of a range of ecosystem restoration alternatives for the Va Shly'ay Akimel study area. This study area is located within the Salt River Pima-Maricopa Indian Community (SRPMIC) and the City of Mesa in Maricopa County, Arizona. Figure 1-1 shows the regional location for the study area. The study area focuses on the Salt River between State Route 101 (Pima Freeway) and Granite Reef Dam (Figure 1-2).

The Corps is investigating potential alternatives to restore riparian habitat within the Va Shly'ay Akimel study area to more closely resemble the conditions that existed in the study area before extensive modifications occurred within the Salt River channel and adjacent floodplain. This EIS investigates those feasible restoration alternatives that most closely meet the purpose and need for the proposed action and are consistent with the study authority given by Congress.

This study has been conducted under two separate authorities provide by Congress. The first and most recent authority is provided by House Resolution 2425 (HR 2425), dated May 17, 1994. HR 2425 states:

> The Secretary of the Army is requested to review reports of the Chief of Engineers on the State of Arizona…in the interest of flood damage reduction, environmental protection and restoration and related purposes.

The second authority is given in Public Law 761, 75th Congress, known as Section 6 of the Flood Control Act of 1938. This authority, dated June 28, 1938, states:

> The Secretary of War (now Secretary of the Army) is hereby authorized and directed to cause preliminary examinations and surveys . . . at the following localities: . . . Gila River and tributaries, Arizona.

This EIS provides a description of restoration alternatives, including the No-Action Alternative; provides an analysis of the existing and future conditions of the area without the project; and analyzes the impacts associated with the alternatives that have been determined to be most feasible, including the recommended or preferred alternative. The Corps, together with the local sponsors, the SRPMIC and the City of Mesa, will then use this EIS to make a decision regarding which alternative to implement.

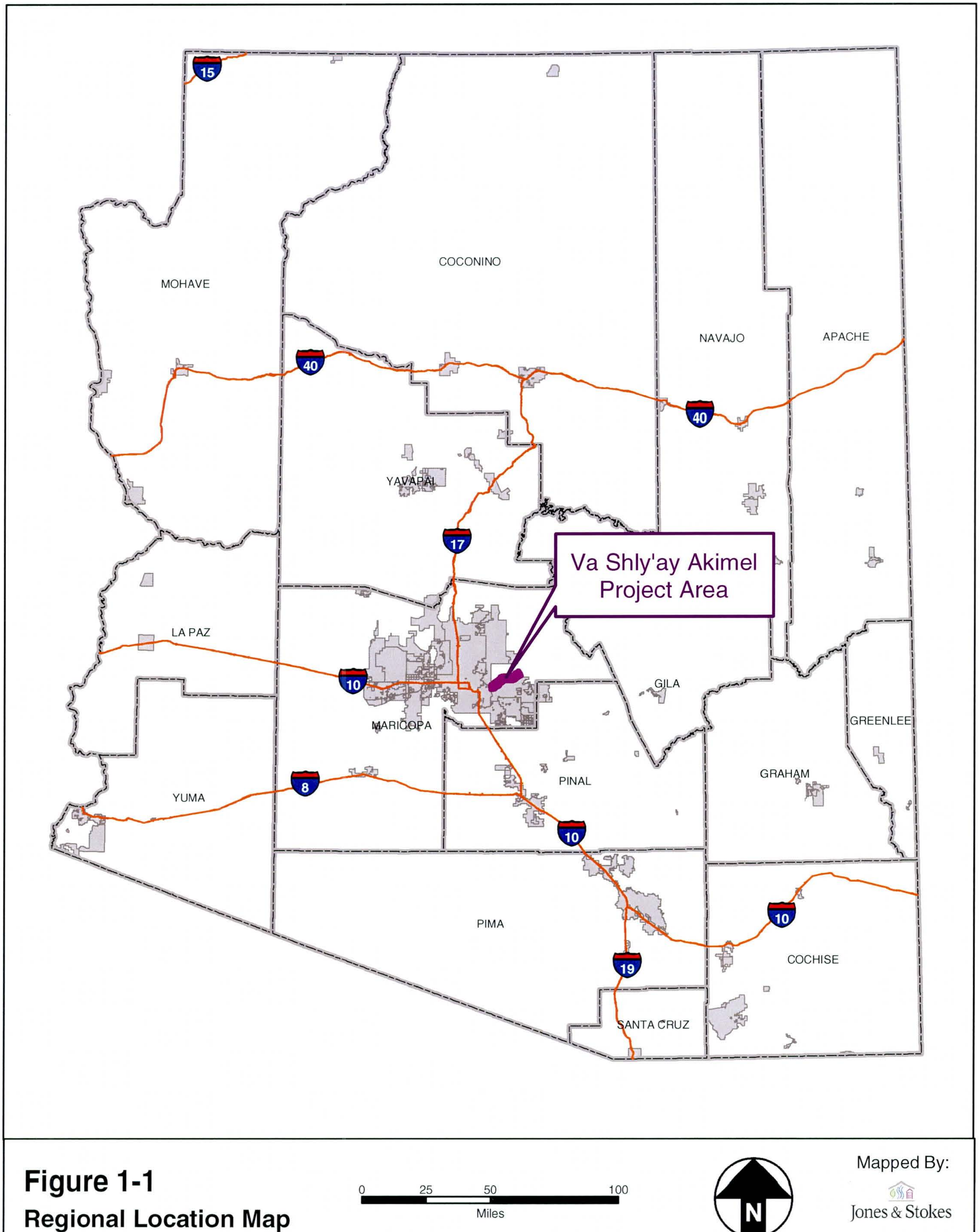


Figure 1-1
Regional Location Map

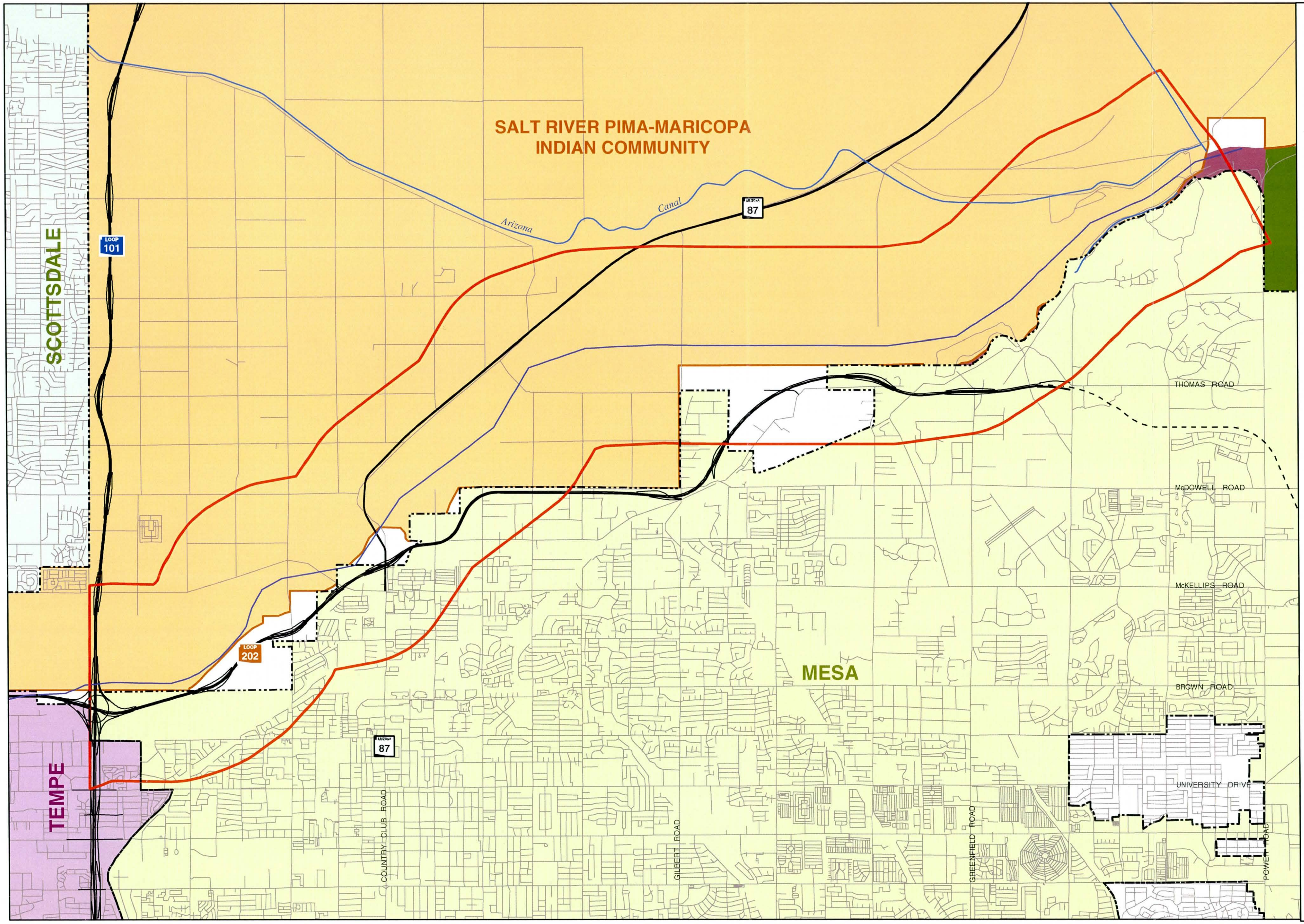


Figure 1-2

Project Study Area

- Project Study Area
- City Boundary
- Salt River Pima-Maricopa Indian Community
- Unincorporated County
- Tonto National Forest
- Bureau of Reclamation
- Freeway
- Unbuilt Freeway
- Streets
- Thalweg

N

0 0.5 1
Miles

Mapped by:

Jones & Stokes

CHAPTER 2. NEED FOR AND OBJECTIVES OF THE PROPOSED ACTION

2.1 DESCRIPTION OF PROPOSED ACTION

The proposed action involves the creation of a complete and diverse riparian system similar to the natural habitat historically characteristic of this portion of the Salt River. The restored areas will incorporate a diverse mix of typically riparian habitat types, including velvet mesquite, cottonwood/willow, wetland marsh, open water, and Sonoran desertscrub. Southwestern arid riparian systems are often ephemeral or intermittent. Because these systems cannot rely on a perennial source of water, they often include vegetative species that can also be found in upland areas. This vegetative series (Sonoran desert scrub shrub) is often found along dry channel beds and includes triangle bursage, rabbit brush, and desert broom.

2.2 PURPOSE AND NEED

2.2.1 BACKGROUND

The Salt River is a major tributary to the Gila River in Arizona. The river originates in eastern Arizona and flows westward to its confluence with the Gila River west of downtown Phoenix. Before agricultural development and urbanization of the Phoenix metropolitan area, the Salt River was a perennial stream fed by snowmelt from mountains in eastern Arizona. In the early part of the 20th century, major modifications to the river system occurred as part of the Salt River Project, which placed several dams along the Salt River to allow diversions of water for agricultural and urban uses. Sand and gravel mining operations and other activities along the river induced additional changes to the river channel and hydrology.

As diversions of water increased, the perennial flows in the river ceased, causing the groundwater table to drop. These changes in hydrological conditions caused the natural riparian ecosystem to decline to the point at which only small, isolated fragments of this former habitat remain. The changes in hydrology have also allowed saltcedar, an invasive nonnative plant species with minimal habitat value, to become established in the region. The study area now consists of a highly disturbed riverbed with minimal extant native vegetation.

2.2.2 PURPOSE AND NEED

The purpose of the proposed action is to produce a viable riparian ecosystem that will support native wildlife and vegetation and thereby improve the overall ecological health of the river and return the project area to a less degraded, more natural condition. Implementation of the proposed action would increase the diversity of native plants and animals, enhance the ability of the area to sustain larger populations of key indicator species or more biologically desirable species, and produce a viable riparian ecosystem that would require a minimal level of annual maintenance. The proposed action would also provide a number of incidental benefits including passive and active recreation and general improvements to the aesthetic appeal of the project area.

Flood control and water supply projects within the Gila River watershed have resulted in substantial alteration of the hydrological regime. This alteration and increased agricultural development and urbanization of the metropolitan Phoenix area have resulted in the substantial alteration of the native cottonwood/willow, mesquite bosque, freshwater marsh, and willow woodland habitat types. Without restoration, habitat values in the study area are expected to further decline within the next 50 years. Continued degradation will decrease the overall habitat value for wildlife and reduce habitat for the endangered Yuma clapper rail, southwestern willow flycatcher, and other sensitive species.

This project is also needed to provide an ecological connection between other riparian restoration projects that are currently underway along the Salt River. (See Section 2.4.2, "Relationship to Other Projects," below.)

2.3 PROJECT LOCATION

The study area is located in Maricopa County, Arizona, and includes portions of the SRPMIC and the City of Mesa. The study area is approximately 14 miles long, extending along the Salt River between the Pima Freeway and Granite Reef Dam. The study area is approximately 2 miles wide and encompasses approximately 17,435 acres.

2.4 PROJECT OBJECTIVES

2.4.1 STUDY OBJECTIVES

This feasibility study has planning objectives that are similar to, and compatible with, the objectives established for other proposed restoration projects located along the Salt River. Specific planning objectives developed for the Va Shly'ay Akimel project include the following:

- Identify water sources within and outside the project boundary that can be committed for the life of the project to sustain the riparian restoration features
- Restore the riparian ecosystem to the degree that it supports native vegetation and wildlife through the Salt River from immediately downstream of the Granite Reef Dam to the Pima Freeway (SR 101).
- Establish a functional floodplain in unconstrained river reaches of the study area that is ongoing and mimics the natural processes found in other naturalized riparian corridors in Arizona.
- Provide passive recreation opportunities for visitors of all ages, abilities, and backgrounds that are in harmony with the SRPMIC's management of its culture and native ecology.

- Create awareness through ongoing educational opportunities of the significance of the cultural resources relating to the Salt River.
- Create awareness through ongoing education opportunities of the significance of the Salt River ecosystem.
- Maintain or improve the existing level of flood protection in the study area for as long as the project remains authorized.
- Create awareness through ongoing educational opportunities of the ecological connection between other ongoing riparian restoration projects along the Salt River.

2.4.2 RELATIONSHIP TO OTHER PROJECTS

The Va Shly'ay Akimel project is one of four ecosystem restoration projects in various stages of development by the Corps and local sponsors along the Salt River downstream from Granite Reef Dam. Figure 2-1 shows the location of the Va Shly'ay Akimel project relative to these other projects.

The Rio Salado project, just downstream from Va Shly'ay Akimel, was the first of this series of projects to be proposed. This project is currently under construction. The Rio Salado Oeste project is immediately downstream of the Rio Salado project and is currently on a parallel feasibility study schedule with Va Shly'ay Akimel. The Tres Rios project, just downstream from Rio Salado Oeste, is currently in the design stage.

2.5 SCOPE OF THE ENVIRONMENTAL IMPACT STATEMENT

This EIS contains the following major elements:

- Chapter 1, Introduction.
- Chapter 2, Need for and Objectives of the Proposed Action. This section describes the overall authority, purpose, and need for the study.
- Chapter 3, Alternatives. This section describes the alternatives considered in detail, provides a summarized analysis of the environmental impacts of each alternative, and compares the impacts of each project alternative. Descriptions of alternatives considered, but subsequently eliminated from further evaluation, are also provided.
- Chapter 4, Affected Environment. This section describes the existing environmental baseline conditions of the study area and estimates the conditions of the site in the future without the project.
- Chapter 5, Environmental Consequences of the Proposed Action and Alternatives. This section describes the impacts of each alternative analyzed in detail and identifies mitigation measures for significant impacts.

The EIS focuses on major issue areas, including:

- geology and topography;
- hydrology and water resources;
- biological resources (e.g., wildlife, vegetation, and endangered species);
- cultural resources;
- aesthetic resources;
- air quality;
- noise;
- social and economic resources (including environmental justice);
- transportation;
- land use;
- recreation; and
- public health and safety (hazardous materials and waste).

2.6 PUBLIC INVOLVEMENT

The National Environmental Policy Act ensures public involvement and notification of a proposed project. An initial public meeting was held on January 24, 2002 and a final public meeting was held on June 3, 2004. Multiple public workshops, information sessions, and meetings were also held as part of the scoping process. Details of the public involvement and scoping process are provided in Chapter 11.

2.7 APPLICABLE REGULATORY COMPLIANCE AND COORDINATION

Table 2-1, which is included in the text after the following page, provides a summary of the applicable regulatory compliance and coordination for the study. The Clean Water Act Section 404(b)(1) Compliance Evaluation can be found in Appendix A of this document. Endangered Species Act, Section 7 informal consultation was completed during the production of the study's FEIS. The U.S. Fish and Wildlife Service concurred with a determination of "may affect, not likely to adversely affect" for the Yuma clapper rail, southwestern willow flycatcher, cactus ferruginous pygmy owl, California brown pelican and bald eagle. This concurrence ends the Section 7 consultation process. Details of the Section 7 informal consultation are provided in Appendix F.

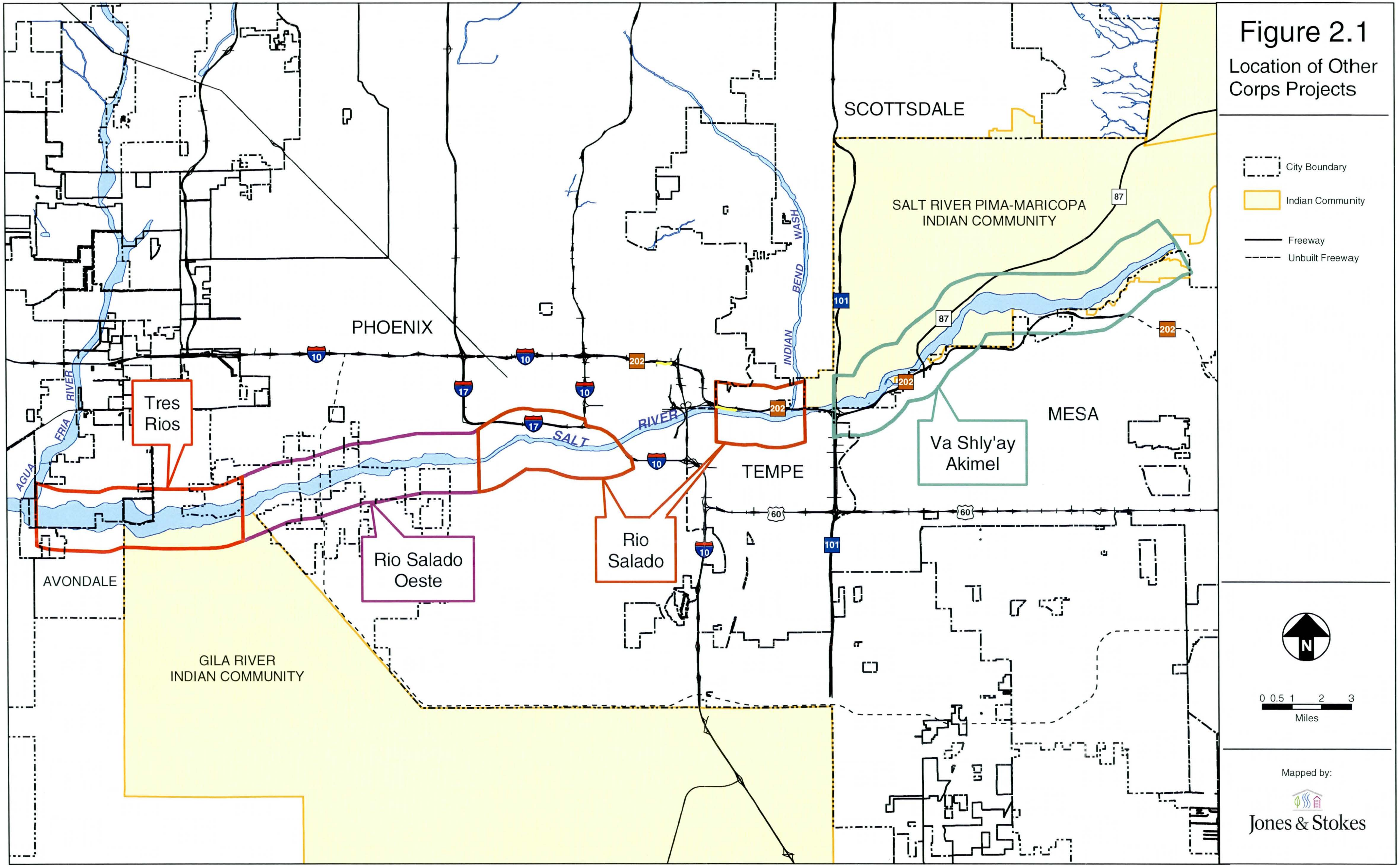


Figure 2.1
Location of Other Corps Projects

Table 2-1. Summary of Applicable Regulations

Statute	Status
National Environmental Policy Act and the Council on Environmental Quality Implementing Regulations	This EIS has been prepared in accordance with the requirements of NEPA, the Council on Environmental Quality regulations for implementing the procedural provisions of NEPA, and Corps of Engineers Engineering Regulation 200-2-2, "Procedures for Implementing NEPA."
ER-200-2-2, "Environmental Quality, Procedures for Implementing NEPA," CECW-RE (now CECW-A), March 4, 1998.	This engineering regulation provides guidance on implementing NEPA within the context of the Corps' civil works program.
Fish and Wildlife Coordination Act	Coordination efforts have been initiated and continue with U.S. Fish and Wildlife Service (USFWS) and the Arizona Game and Fish Department in accordance with the Fish and Wildlife Coordination Act. This consultation is ongoing with both agencies, and both agencies are involved in the habitat evaluation analysis.
Federal Endangered Species Act, as amended	As required by Section 7 of the federal Endangered Species Act, the Corps requested from USFWS a list of species that are listed under the act as threatened or endangered, proposed for listing, or candidates for listing. Section 7 consultation will be conducted as part of this action.
National Historic Preservation Act of 1966: Public Law 89-665; 16 U.S.C. 470-470m, as amended, 16 U.S.C. 460b, 470l-470n.	The National Historic Preservation Act provides for an expanded National Register of Historic Places, including district, sites, buildings, structures, and objects significant in American history, architecture, archeology, and culture. It authorizes a program matching grants-in-aid to the states and development projects. It also established the Advisory Council on Historic Preservation, appointed by the President, to advise the President and the Congress on matters relating to historic preservation. The Advisory Council is authorized to secure information it may need from federal agencies in order to carry out its responsibilities. The most recent changes in the Act require that a plan be developed for public and Native American involvement in the process. Section 106 of the Act required federal agencies to identify and protect significant properties which are located on federal lands and or which would be affected by federal actions.
American Indian Religious Freedom Act of 1978: Public Law 95-341; 42 U.S.C. 1966	The American Indian Religious Freedom Act makes it policy of the federal government to protect and preserve the inherent rights of American Indians, Eskimo, Aleut, and Native Hawaiian to believe, express and exercise their traditional religions. This includes, but is not limited to access to religious sites, use and possession of sacred objects, and freedom to worship through ceremonials and

Statute	Status
	traditional rites. It directs federal agencies to evaluate their policies and procedures to determine if changes are needed to ensure that such rights and freedoms are not disrupted by agency practices. The act also requires that the views of Native American leaders are to be obtained and considered where a proposed land use might conflict with traditional Indian religious beliefs or practices.
Native American Graves Protection and Repatriation Act of 1990: Public Law 101-601	The Native American Grave Protection and Repatriation Act (NAGPRA) addresses the recovery, treatment and repatriation of Native American and Native Hawaiian remains, including human remains, associated funerary objects, sacred objects, and objects of cultural patrimony.
Executive Order 13084 of May 14, 1999: Consultation and Coordination with Indian Tribal Governments	President Clinton established this order to establish regular and meaningful consultation and collaboration with Indian Tribal governments in the development of regulatory practices on Federal matters that significantly or uniquely affect their communities.
Clean Water Act, as amended	Each of the alternatives may require the discharge of fill material into waters of the United States. A Section 404(b)(1) evaluation will be prepared to address practicable alternatives. An NPDES permit will also be required for construction. A Section 404(r) exemption is applicable to the project. The Corps is requesting that this project be declared exempt under the 404(r) exemption because it is a Congressionally authorized project. The Corps will work with the local sponsors to help them obtain the necessary Section 404 permit and Section 401 water quality certification that will be required for post-construction operations and maintenance activities that take place after construction is complete. This EIS will be used for the purpose of issuing a Section 404 permit for subsequent operations and maintenance. Because each of the alternatives may result in the discharge of fill material into waters of the United States, a Section 404(b)(1) evaluation was prepared to analyze the practicable alternatives (Appendix A). Based on this evaluation, the project as proposed is in compliance with Section 404(b)(1) Guidelines with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem. A Section 404(r) exemption is applicable for this project, and the Corps will be requesting that this project be declared exempt under Section 404(r) exemption because it is a congressionally authorized project. Section 404(r) of the Clean Water Act waives the requirement to obtain either the State water quality certificate or the 404 permit if: 1) information on the effects of the discharge of dredged or

Statute	Status
	fill material into waters of the United States, including the application of the Section 404(b)(1) Guidelines, are included in an EIS on the proposed project; *and* 2) The EIS is submitted to Congress before the actual discharge takes place and prior to either authorization of the proposed project or appropriation of funds for its construction. A NPDES permit will also be required for construction. The Corps will work with the local sponsors to help them obtain the necessary Section 404 permit and Section 401 water quality certification for post-construction operations and maintenance activities that take place after construction is complete. The EIS will be used for the purpose of issuing a Section 404 permit for subsequent operations and maintenance.
Clean Air Act	The project site is in an air quality nonattainment area for carbon monoxide, ozone, and PM10. Maricopa County is the agency with jurisdiction to enforce the Clean Air Act in this area. Significant impacts may occur during construction. Feasible measures for reduction of emissions have been proposed.
Migratory Bird Treaty Act	The Migratory Bird Treaty Act prohibits the taking, killing, or possession of migratory birds. Coordination with USFWS has been ongoing. Mitigation measures proposed for the alternatives would ensure compliance with this act by ensuring that active nests of migratory species would not be disturbed.
Bald and Golden Eagle Protection Act	The Bald and Golden Eagle Protection Act prohibits any form of possession or taking of bald and golden eagles, alive or dead, including eagle body parts, feathers, nests, or eggs. The statute imposes criminal and civil sanctions as well as an enhanced penalty provision for subsequent offenses. The statute exempts from its prohibitions on possession the use of eagles or eagle parts for exhibition, scientific, and Indian religious uses.
Executive Order 11990, Protection of Wetlands	The Corps considered the effect of the alternatives on wetlands. This project will increase the acreage of wetlands in the project study area and improve the quality of existing wetlands.
Executive Order 12898, Environmental Justice	The purpose of this order is to avoid the disproportionate placement of any adverse environmental, economic, social, or health impacts resulting from federal actions and policies on minority and low-income populations. An analysis of environmental justice impacts has been included in this EIS.
Executive Order 11988, Floodplain	The alternatives will affect floodplains in the project area in a beneficial manner with regard to the natural

Statute	Status
Management	environment and flood protection.
Resource Conservation and Recovery Act of 1976 (PL 94-580)	Chemical and pesticide use will be in conformance with this law.
Farmland Protection Policy Act	This law is intended to minimize the extent to which federal activities contribute to the conversion of agricultural land to nonagricultural uses. Appropriate coordination between the Corps and the Natural Resources Conservation Service will occur as required under this statute.
Arizona Executive Order 91-6 Protection of Riparian Areas	Under this executive order, the Governor of Arizona has established state policy: ■ To recognize that the protection and restoration of riparian areas are of critical importance to the State; ■ To actively encourage and develop management practices that will result in maintenance of existing riparian areas and restoration of degraded riparian areas; ■ To promote public awareness through the development of educational programs of the benefits and values of riparian areas and the need for their protection and careful management; ■ To seek and support cooperative efforts and local group and citizen involvement in the protection, maintenance and restoration of riparian areas; ■ To actively encourage the preservation, maintenance, and restoration of instream flows throughout the State; and ■ that any loss or degradation of riparian areas will be balanced by restoration or enhancement of other riparian areas of equal values and functions.
Executive Order 13045, Environmental Health and Safety Risks to Children	Under this executive order, each federal agency: (a) shall make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children; and (b) shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks.

CHAPTER 3. DESCRIPTION OF ALTERNATIVES CONSIDERED, INCLUDING THE PREFERRED ALTERNATIVE

This section provides:

- an overview of the alternative formulation and screening process conducted for the Va Shly'ay Akimel Ecosystem Restoration Project;
- descriptions of the biologically and incrementally cost effective alternatives (including the No-Action Alternative) selected for evaluation in this document;
- brief descriptions of the alternatives that were evaluated and eliminated from consideration during the screening process; and
- preliminary recreation options that could be implemented with any of the alternatives selected for evaluation.

3.1 FORMULATION AND SCREENING OF ALTERNATIVES

The Corps' six-step planning process is used to develop, evaluate, and compare the array of candidate plans that are considered. The plan formulation process includes the following steps:

10. The specific problems and opportunities to be addressed in the study are identified, and the causes of the problems are discussed and documented. Planning goals are set, objectives are established, and constraints identified.
11. Existing and future without-project conditions are identified, analyzed, and forecasted. The existing condition resources, problems, and opportunities critical to plan formulation, impact assessment, and evaluation are characterized and documented.
12. The study team formulates alternative plans that address the planning objectives. An initial set of alternatives is developed and is evaluated at a preliminary level of detail.
13. Alternative project plans are evaluated for effectiveness, efficiency, completeness, and acceptability.
14. Alternative plans are compared. Cost-effectiveness and incremental cost analysis is used to prioritize and rank ecosystem restoration alternatives. A public involvement program obtains public input to the alternative identification and evaluation process.
15. The plan with the greatest net benefits is selected for recommendation if at least one plan exists demonstrating federal interest.

The Va Shly'ay Akimel feasibility study process involves successive iterations of solutions to the defined ecosystem degradation problem. These alternatives were based upon the study objectives and constraints and address problems and opportunities, which are outlined in

Chapter 2. Once the planning goals and objectives were defined, the existing condition of the study area was characterized. This, in essence, involved taking a "snapshot" in time to document what currently exists in terms of resources, problems, and opportunities for the area. Next, projections are developed to ascertain what the future may potentially look like in the same area if conditions and impacts remain unchanged. Once the study area's existing and future conditions are characterized, there is an opportunity to develop alternative solutions. The existing and future without-project conditions assessment can be found in detail in the Feasibility Study.

The alternative formulation begins initially by developing measures based on public input and suggestions, Corps and other federal and state agencies experiences with similar restoration opportunities, technical considerations based upon the characteristics of the area, and flood damage reduction considerations for improving or maintaining the existing level of protection. Preliminary management measures addressed such categories as ecosystem restoration, channel stabilization, public education, and recreation.

A combination of these measures formed the first array of five preliminary alternative plans developed by the Corps and the local non-federal sponsor(s) (SRPMIC and the City of Mesa) during the alternatives formulation process. These five preliminary alternatives indicated that a range of potential alternatives exist for ecosystem restoration in the study area. The alternatives vary with respect to habitat focus and the ability to restore function to the river, water requirements and total scale. This initial screening of alternatives relied on informed judgment of experts, empirical data, and acceptability by the stakeholders. Based on this screening process, a second array of alternatives was developed and compared.

The second array of alternatives examined a total of 31 alternatives. The initial array of five alternatives was expanded to 15 alternatives and were alphabetically coded Alternative A through Alternative O. The "No-Action Alternative" was coded Alternative P. Each of the initial 15 alternatives have a numeric subset, identifying the alternative with a "1" representing that it utilizes drip irrigation or with a "2" indicating that it utilizes surface braided network (SBIN) irrigation. Therefore, 30 alternatives were alphanumerically numbered "A1, A2, B1, B2 …" and so forth through Alternative O, and the 31st alternative is the "No-Action" Alternative P.

These alternatives represented varying combinations of restoration treatments (e.g., vegetation types, channel modification, water source, infrastructure). The alternatives were ranked and screened based on associated habitat benefits and implementation costs. The Hydrogeomorphic (HGM) method assesses and quantifies the capacity to restore river function (e.g., plant community characteristics, channel dynamics, water storage, connectivity) and evaluates and quantifies future changes in these characteristics and associated habitat benefits resulting from implementation of the restoration alternatives. Results of the HGM assessment were then incorporated into the Corps' standard cost evaluation analysis to identify the alternatives that provided the highest habitat benefits per unit cost. Following formulation and refinement of the project alternatives, the alternatives were ranked and screened based on associated habitat benefits and implementation costs. Additional formulation, engineering, design, cost estimating, incremental evaluation, benefit-to-cost analyses, and project impacts were completed during this secondary screening in order to more accurately compare the features of each of the remaining alternatives.

Furthermore, as part of federal guidelines for water resources projects, the alternatives are compared against the general feasibility criteria that are required to be met as follows:

- *Technical Feasibility*: Alternatives must be technically capable of performing the intended function, have a reasonable certainty of addressing the problem, and conform to Corps technical standards, regulations, and policies;
- *Environmental Feasibility*: Alternatives must comply with all applicable environmental laws, including NEPA;
- *Economic Feasibility*: Alternatives must be economically justifiable in that the economic benefits or, in the case of National Ecosystem Restoration (NER) Plan (non-monetary) benefits, must exceed the economic costs, in accordance with applicable regulations, policies, and procedures; and
- *Public Feasibility*: Alternatives must be publicly acceptable as evidenced by a cost-sharing, non-federal sponsor and further documented through an open public involvement process that incorporates the public's input into the formulation of the alternatives.

3.1.1 CHOOSING THE PREFERRED ALTERNATIVE

Once the 31 study alternatives were determined, two techniques were used to determine the most cost-effective alternatives. The first method, which compares alternatives respective of their cost effectiveness, is termed the Cost Effectiveness Analysis (CEA). Using this method, alternatives that produced increased levels of output, measured by the HGM method as Average Annual Functional Capacity Units (AAFCUs), for the same or lesser costs were considered "effective" alternatives and were retained. Those alternatives that provided lesser return for higher associated cost were dropped from consideration.

The second technique measuring cost-effectiveness involves conducting an Incremental Cost Analysis (ICA) using those alternatives that were deemed "cost-effective." In short, the ICA explores the costs associated with a given incremental increase in output of a given alternative. The results of this two-part analysis identified alternatives that are both cost- and incrementally effective. Annualized costs and outputs for all alternatives, as well as the results of the CEA and ICA evaluations are discussed in depth in the feasibility study economic appendices.

3.1.1.1 Cost-Effective Alternatives

The cost analysis indicates that the six most cost-effective alternatives are Alternatives A2, B2, L2, E2, O2 and F2. The AAFCUs for the cost-effective alternatives are provided in Table 3-1.

Table 3-1. Cost-Effective Alternatives

Alternative	AAFCU	AA COST	AAC/AAFCU*
A2	389	2,522	$6.5
B2	619	6,276	$10.1
L2	792	8,935	$11.3
E2	966	9,304	$9.6
O2	1006	10,127	$10.1
F2	1084	16,632	$15.3

* AAC/AAFCU dollar figures are in thousands.

3.1.1.2 Incrementally Effective Alternatives

Results of the ICA indicate that the four incrementally cost-effective alternatives are Alternatives A2, E2, O2, and F2. Alternative A2 is included as an ICA alternative as it is the least expensive plan. On the other end of the spectrum, Alternative F2 provides the highest number of functional capacity units, but at a substantially higher cost per AAFCU than the other three incrementally cost effective alternatives. Alternatives E2 and O2 are both incrementally cost effective, producing a similar level of outputs. While alternative E2 is slightly more cost effective compared to Alternative O2, the study team elected Alternative O2 as the environmentally preferred alternative and the Tentatively Recommended Plan. The incremental costs of these alternatives are show in Table 3-2.

Table 3-2. Incrementally Cost-Effective Alternatives

Alternative	AAFCU	Incremental AA Cost	Incremental AAC/AAFCU*
A2	389	$2,522	$6.5
E2	966	$9,304	$11.8
O2	1,006	$10,127	$20.6
F2	1,084	$16,632	$83.4

* AAC/AAFCU dollar figures are in thousands.

Further explanation is warranted and provided here as to why Alternative O2 is recommended over Alternative E2 and the NER Plan. While Alternative O2 only provides an extra 40 AAFCUs and 70 acres of habitat, relative to Alternative E2, the additional cost is justified due to the type of vegetation planted. In the HGM model, all four vegetation types (cottonwood-willow, mesquite, Sonoran desert scrub shrub and wetlands) were assigned the same value. In other words, the FCU value of an acre of cottonwood-willow vegetation was equal to the FCU value of an acre of Sonoran desert scrub shrub. While it can be said that it is not possible to value one habitat type over another, the study team held that there are inherent differences.

Given the historical presence and current rarity of cottonwood-willow and wetland vegetation in the arid Southwest relative to the desert scrub shrub, it can be argued that there would be more environmental gain if the rare habitat were reestablished. For example, in the arid Southwest, roughly 70% of the listed threatened and endangered vertebrate species are considered riparian obligates (Johnson 1989). Alternative O establishes approximately 883 acres of cottonwood-willow and 200 acres of wetlands. Alternative E establishes only 287 acres of cottonwood-willow and 52 acres of wetland, a difference of 596 acres and 148 acres respectively. Alternative O would reestablish considerably more riparian habitat and therefore provide a larger benefit for those listed obligate species. Thus, Alternative O is considered the least environmentally damaging practicable alternative that meets the objective of the purpose and need for this project. It is the rarity of riparian vegetation, and its inherent value, that the project delivery team determined justifies the additional cost of Alternative O.

Based on the HGM and ICA analyses, Alternative O2 is the environmentally preferable alternative and therefore is the Tentatively Recommended NER Plan. Alternative O2 is also the non-federal sponsor(s) preferred alternative. Alternative O2 ranked as the second biological alternative and as an incrementally cost effective alternative. The strong functional capacity output, the incremental cost effectiveness, and the non-federal sponsor(s) strong preferences for this alternative moves Alternative O2 forward as the Tentatively Recommended Plan.

3.2 DESCRIPTION OF THE PROJECT ALTERNATIVES

Following the HGM and ICA screening processes, the four incrementally cost effective alternatives (A2, E2, O2, F2) as well as the No-Action Alternative (P) remained under consideration for this project. The alternatives vary with respect to the amounts and types of vegetation to be established, water sources, methods for distributing water, irrigation techniques, and where or whether river channelization, surface reshaping, and bank stabilization would occur. For ease of comparison, the river in the project area was divided into nine reaches (Figure 3-1).

This section begins by discussing components that are common to all of the alternatives. The No-Action Alternative, Alternative F, Alternative O (the Tentatively Recommended Plan), Alternative E, and Alternative A are then described. The descriptions of the four alternatives are ordered from the alternative that entails the greatest amount of work effort to the alternative that would require the least work effort. In a previous iteration, Alternative N was an incrementally cost-effective plan as well. However, with recent modifications to the cost estimates, Alternative N is no longer cost effective. Nevertheless, the analysis previously completed on Alternative N remains in the document for information purposes only. Finally, all incrementally cost-effective plans used the SBIN method; therefore, all discussions throughout the following sections will refer to the alternative simply by its alphabetical name, and not the alphanumeric name (e.g., "Alternative A" instead of "Alternative A2"). Table 3-3 presents a comparison of the salient characteristics of each of these alternatives.

Table 3-3. Comparison of Alternatives

Feature	Alternative F	Alternative N	Alternative O	Alternative E	Alternative A	No Action
Channelization	Yes: Reaches 2, 3, 4, 6	No	Yes: Reaches 2,3	Yes: Reach 2, 5	No	No
Bank stabilization	Yes: Reaches 2, 5, 6	No	No	Yes: Reaches 2, 5, 6	No	No
Installation of grade control structure	Yes: Reach 5	Yes: Reach 5	Yes: Reach 5	No	No	No
Removal of invasive plant species (e.g., saltcedar)	Yes: Reaches 8, 9	Yes: Reaches 8, 9	Yes: Reaches 8, 9	Yes: Reaches 8, 9	Yes: Reaches 8, 9	No
Irrigation via SBIN	Yes: Reaches 2, 3, 4, 5, 6	Yes: Reaches 2, 3, 4, 5, 6	Yes: Reaches 1, 2, 3, 4, 5, 6	Yes: Reaches 4, 5, 6	Yes: Reaches 5, 6	No
Irrigation from new groundwater well	Yes: Reaches 5, 6	Yes: Reaches 5, 6	Yes: Reaches 5, 6	Yes: Reaches 5, 6	Yes: Reach 5	No
Flood irrigation	Yes: Reach 6	Yes: Reach 6	No	Yes: Reach 6	No	No
Irrigation via effluent	Yes: Reach 1	Yes: Reach 1	Yes: Reach 1	Yes: Reach 1	No	No
Creation of wetland features	Yes: Reaches 2, 3, 4, 5, 6	Yes: Reaches 2, 4, 5, 6	Yes: Reaches 1,2, 4, 5, 6	Yes: Reaches 2, 5, 6	No	No
Establishment of new cottonwood	Yes: Reaches 2, 3, 4, 5, 6	Yes: Reaches 1, 2, 3, 4, 5, 6	Yes: Reaches 1, 2, 3, 4, 5, 6	Yes: Reaches 1, 2, 5, 6	No	No
Establishment of new mesquite	Yes: Reaches 2, 4, 5, 6	Yes: Reaches 2, 4, 5, 6	Yes: Reaches 2, 4, 5, 6	Yes: Reaches 2, 4, 5, 6	No	No
Establishment of new Sonoran Desert vegetation	Yes: Reaches 4, 5	Yes: Reach 5	Yes: Reach 5	Yes: Reaches 2, 5	Yes: Reaches 5, 6	No
Total irrigated area (acres)	1,711	1,387	1,486	1,416	496	0
Total annual water demand (acre-feet)	8,304	7,736	8,550	4,540	992	0
Total new habitat (acres)	2,119	1,589	1,712	1,733	652	0

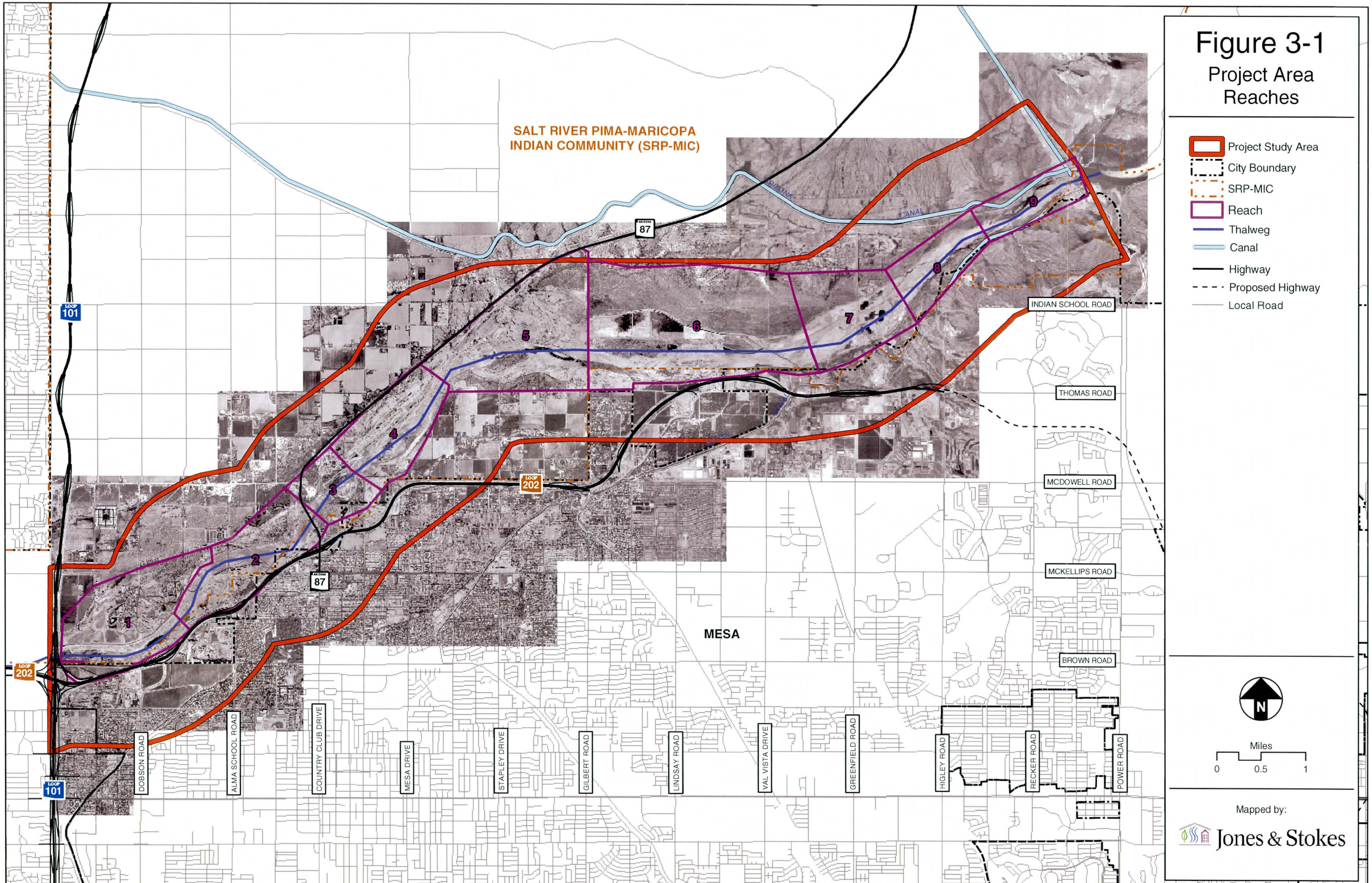


Figure 3-1
Project Area Reaches
Project Study Area
City Boundary
SRP-MIC
Reach
Thalweg
Canal
Highway
Proposed Highway
Local Road
SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY (SRP-MIC)
MESA
INDIAN SCHOOL ROAD
THOMAS ROAD
MCDOWELL ROAD
MCKELLIPS ROAD
BROWN ROAD
DOBSON ROAD
ALMA SCHOOL ROAD
COUNTRY CLUB DRIVE
MESA DRIVE
STAPLEY DRIVE
GILBERT ROAD
LINDSAY ROAD
VAL VISTA DRIVE
GREENFIELD ROAD
HIGLEY ROAD
RECKER ROAD
POWER ROAD
LOOP 101
LOOP 202
87
1
2
3
4
5
6
7
8
9
Miles
0
0.5
1
N
Mapped by:
Jones & Stokes

3.2.1 COMPONENTS COMMON TO ALL CONSTRUCTION ALTERNATIVES

3.2.1.1 Water Sources

The alternatives rely primarily on surface water and groundwater from the SRPMIC and effluent from the City of Mesa Wastewater Treatment Facility. According to SRPMIC staff, 30,000 acre-feet/year of water can be allocated to the project. Groundwater is considered a secondary source of water.

3.2.1.2 Water Distribution System

The water distribution system is the infrastructure needed to deliver water (surface water, groundwater, or wastewater) from the source (irrigation canal, or well) to the vegetated areas, exclusive of the irrigation system. Surface water from the SRPMIC would be the primary source of water for all construction alternatives. No modifications will be made to existing stormwater drainage infrastructure; however, the project will utilize stormwater runoff as available.

Surface water would enter the project area through irrigation canals controlled by SRPMIC. It is assumed that the SRPMIC will distribute the water to satisfy water demands for the project areas. A flow diversion structure would be used to store and divert surface water from the irrigation channels. During the Preliminary Engineering Design phase of the project, the Corps will coordinate with the Salt River Project to assess the feasibility of using the Hennessey Drain to transport SRPMIC surface water from the south canal.

Effluent will be used as a water source to irrigate vegetation established in the existing recharge basins only. Groundwater would be pumped to the drainage ditches and channels through a buried pipeline.

3.2.1.3 Irrigation Techniques

Surface water from stormwater sources, irrigation canals, and ditches would be conveyed to various vegetated areas through a network of lined irrigation channels and buried pipes. The size of the channel and pipe would depend on site-specific conditions, such as flow requirements and terrain. Pumps may be needed to distribute water. To irrigate the vegetated areas it is recommended that either a surface braided irrigation network (SBIN), flood irrigation, or drip irrigation be used. These methods differ as follows:

- SBIN distributes water through a network of shallow ditches, 6 inches deep and 2 to 3 feet wide. Maintenance of these lined channels may be necessary after larger flow events. Water distribution would need to be manually controlled for the life of the project. Figure 3-2 depicts the layout of the SBIN irrigation method.

- Flood irrigation consists of inundating an area by overland flow. This method has a low irrigation efficiency but also low maintenance requirements and construction costs. Water distribution would need to be manually controlled for the life of the project.
- Drip irrigation distributes water to individual plants through a network of small-diameter tubes.
- Granite Reef Underground Storage Project (GRUSP): Because the vegetation surrounds the GRUSP site, it may affect or be affected by, the groundwater mound created by the GRUSP. The issues involved in planting around the GRUSP site will be further addressed prior to construction.

3.2.1.4 Surface, Vegetation, and Irrigation Reshaping

Surface reshaping is defined as moving material to alter significant features such as large mounds, filling quarry pits, and reducing the side slopes of quarry walls. Although the extent of surface reshaping varies greatly among some alternatives, all construction alternatives involve at least the reshaping of the old Gilbert quarry to create new river bottom.

Vegetation reshaping is minor reshaping required for planting purposes and to ensure that gravity irrigation systems will be feasible. It is assumed that for vegetation reshaping, 2 feet of material would be moved per acre of vegetated area.

Irrigation reshaping is the construction of irrigation ditches needed in the flood irrigation and SBIN irrigation methods (2 to 3 feet wide and 6 inches deep) and the construction of drainage ditches (15 feet wide and 3 feet deep).

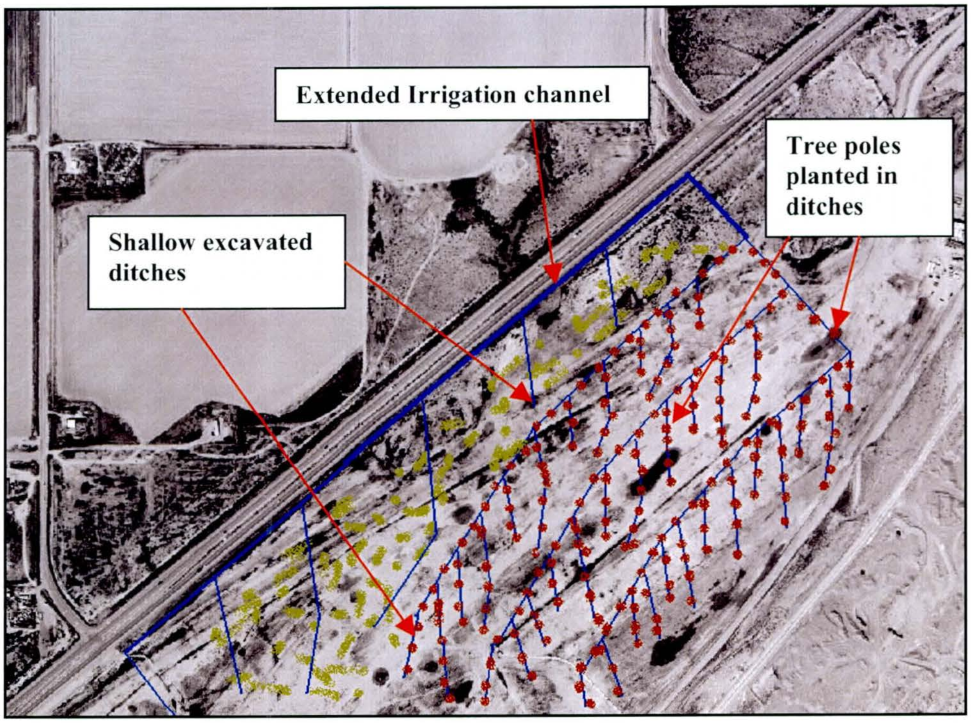
3.2.1.5 Operation and Maintenance

Operation and maintenance activities (O&M) would occur after the project is constructed in order to keep project features functioning as designed. These activities may include:

- maintenance and replacement of pumps, pipelines, and other water delivery and irrigation infrastructure features,
- vector control,
- environmental monitoring, and
- periodic removal of sediment, surface reshaping, or replanting of project features damaged by flood events.

The types of O&M activities necessary would generally be the same for each construction alternative, although the level of effort would be proportional to the amount of new habitat created and the extent of structural features built for that alternative. Alternative A would require the least amount of O&M and Alternative F would require the greatest amount of effort

Figure 3-2. Surface Braided Irrigation Network (SBIN) Diagram



and cost. A table comparing O&M costs for each alternative is available in Chapter V of the Feasibility Study.

Drainage Maintenance

This maintenance activity consists of clearing debris from drainage structures, including outfalls and channels, and general earthwork maintenance. This is expected to occur on an as-needed basis (inspections would occur more frequently). Excess soil materials would be disposed of locally in areas that are not environmentally sensitive or subject to Clean Water Act permitting.

Maintenance and Replacement of Water Distribution System and Irrigation Infrastructure

Preventive maintenance and routine repairs would be performed on an as-needed basis on pumps and pipelines, diversion structures, irrigation canals and ditches, the SBIN, and drip irrigation equipment (inspections would occur more frequently).

Vector Control

Depending upon the duration and frequency of surface water flow in wetland and riparian habitat areas, the implementation of vector control management activities may be required to protect public health. Management activities that may be implemented to reduce potential habitat and inhibit the development of mosquito larvae include:

- providing pulse flows/periodic flushes;
- removing vegetation to increase wind-driven circulation;
- scheduling irrigation to avoid creating shallow ponded areas;
- stocking mosquito fish in areas where a regular source of standing water is available;
- applying larvicides such as *Bacillus thuringiensis israeliensis* and *Bacillus sphaericus* would be applied by spraying at a frequency of every 2 to 4 weeks during the mosquito season; and
- applying a broad spectrum adulticide such as Malathion in the event of an imminent public health threat.

Environmental Monitoring

Monitoring of habitat and wildlife would occur periodically. This would include monitoring water quality and water supplies as well as vegetation monitoring and management. During the first 5 years following construction of the project, the Corps would share responsibility for monitoring water quality and the success of the restoration components with the project sponsors. In the succeeding years, monitoring would be accomplished by the project sponsors only. Appendix B contains a Monitoring and Adaptive Management Plan prepared by the Corps for this project.

Sediment Removal

After periods of high flows in the river, substantial quantities of sediment may be deposited in channelized portions of the Salt River or in newly established habitat areas. To maintain the flow conveyance capacity of the river, channelized portions would need to be excavated and reshaped to restore design specifications if conveyance is significantly affected. Sediment removal would occur on an as-needed basis (inspections would occur more frequently).

Sediments may also need to be removed to maintain the viability of areas vegetated for the project. This is anticipated to occur once each year on a rotating basis so that no more than 25% of the marsh area would be affected in any one year. The work would be performed outside the nesting season for birds.

An estimated average of 50 cubic yards of sediment would be removed during each sediment removal event. This material would be provided to commercial sand and gravel operators for reuse or would be used in project repairs.

Maintenance Activities in Specific Areas

Maintenance activities in constructed wetlands would include performing work on outlets and berms to ensure proper functioning and to correct damage from beavers or other rodents that may colonize these areas. Saltcedar and other potentially invasive plant species would be removed on a periodic basis for the life of the project, since local seed sources would continue to be available. Vegetation removal would be done either by mechanical means or by burning in place. A burn permit would be required in the latter case.

Maintenance of cottonwood/willow areas would be limited to debris removal, minor saltcedar removal, minor grade adjustments, and replacement of plants if necessary. Work would not be performed during the nesting season for birds.

Maintenance in mesquite and Sonoran desert areas would consist of monitoring the success of vegetation establishment and replacing plants where necessary. Irrigation systems would need to be periodically inspected during the establishment period but may not be needed after establishment, except perhaps under excessive drought conditions.

3.2.1.6 Vegetation

Varying amounts and locations of five vegetation types are considered in the five construction alternatives:

- Cottonwood/Willow (CW),

- Mesquite (MS),
- Wetland (WT),
- Sonoran Desert Scrub-Shrub (SD), and
- River Bottom (RB).

While all construction alternatives include establishing native vegetation, only some alternatives entail establishing all five vegetation types. The requirements for implementing each vegetation type are as follows.

Cottonwood/Willow (CW)

CW forests would be dominated by Fremont cottonwood and Gooding's willow. Other understory species would be planted, depending upon individual site conditions, but may include arrow weed, elderberry, and/or burro brush.

Under natural conditions, CW stands are restricted to near overbank areas of streams and rivers or areas with saturated soil conditions. They require a water table or saturated soil conditions 1 to 25 feet below the ground surface and have an average annual water demand range from 4 to 8.5 feet. Because the groundwater table for the majority of the study site is 60 feet below the surface, cottonwood/willow stands would rely upon soil saturated by irrigation. It is assumed that the average annual water demand is 6.3 feet. In areas where grading may be required, uneven grading is most beneficial, allowing for depressions where sediment can collect and shelter seeds for establishment. Due to the relative high water demands of CW, a drip irrigation system may be used to help ensure establishment. Once established, CW stands would rely on flood irrigation or SBIN for water needs.

The CW areas would be planted at a density of approximately 20 cottonwood trees, 40 willows, and 5 understory brush species per acre. Understory forbs would also be planted using a native seed mixture.

Mesquite (MS)

Mesquite bosques would be dominated by honey mesquite with scattered velvet mesquite and some understory shrubs, such as desert thorn, blue paloverde, and brittlebush, as well as forbs.

MS areas are commonly found 5 to 20 feet above the river channel where there is adequate water. They require a water table or semi-saturated soil conditions 10 to 30 feet below surface elevation and rely on occasional saturated conditions 1 to 3 feet below surface. It was assumed that the average annual water demand average is 3.0 feet. A drip irrigation system may be necessary to establish the MS. However, once established, the MS would rely on flood irrigation or SBIN. Previous restoration efforts have shown that MS can survive on natural precipitation alone, even when groundwater is not available. However, this cannot be assumed for all locations. Therefore, a site-specific evaluation would need to be performed to determine if or how much supplemental water is required.

The mesquite bosques would be planted with a density of approximately 100 honey mesquite, 10 velvet mesquite, and 40 understory shrubs per acre. Understory forbs would also be planted using a seed mix.

Wetland (WT)

WT areas for this project would consist of areas of open water, emergent vegetation, or muddy shorelines, all requiring a water table at or near the surface. Wetland vegetation would be primarily cattails, tule, and sedges.

It was assumed that the average annual water demand is 9.0 feet. Because project area soils are porous, the surface of WT areas would be lined to maintain surface water or saturated soils. Excavation and layering of a silt clay soil substrate overlain by a mixed gravel layer and then a cobble layer is recommended. This soil structure would reduce disturbance of the soil-clay layer by reducing piping of fine material and turbulent forces acting on the layer.

WT areas proposed near storm drain outlets would require erosion control measures at the outlets to prevent scouring during high flows. To distribute water from the WT laterally, a series of drainage ditches would be constructed from the WT to convey water to other areas that require irrigation. The ditches would be semi-elliptical in shape with a top width of 4 feet and maximum depth of 2 feet. The drains would increase lateral dispersion of runoff to maximize the stormwater benefit.

Some WT areas would also include an outlet channel leading to the main channel of the Salt River. The preliminary design of the outlet channel proposes a 20-foot bottom width, 3-foot maximum depth, 2:1 side slopes, 300-foot length, and large cobble bottom. The Design Q (volume) equals 400 cubic feet per second (cfs). Not all proposed WT would require an outlet channel.

Sonoran Desert (SD)

The specific SD scrub-shrub species that would be planted would vary depending upon soil conditions. Likely species include rabbit brush, triangle bursage, blue paloverde, ironwood, and possibly some cactus species.

The proposed vegetation types would not require saturated soil conditions and it is assumed that the average annual water demand is 2.0 feet. The SD may need to be periodically inundated the first 1 to 5 years to establish the vegetation. However, once established, SD should be sustained by annual precipitation or with periodic inundation, via flood irrigation, during extreme drought periods.

Densities of plantings could range from 5 ironwoods per acre to 25 to 30 stems of triangle bursage or brittlebush per acre.

River Bottom (RB)

RB is found in the active river channel. It is expected to remain mostly unvegetated because of the cobble substrate and relatively high disturbance level found in these locations. However, some areas, where smaller aggregate soils have accumulated, may support scrub-shrub species such as burro brush or rabbit brush. Also, areas of standing water that has collected in natural depressions may support small pockets of emergent vegetation such as cattails or bulrush. RB would require only surface reshaping, including partially filling large depressions and excavating large mounds to reduce possible impacts to restoration efforts. RB areas may also require hydroseeding with a variety of native shrubs. These plants would be sustained with natural precipitation and any tailwater that may enter the river from other irrigation systems. Irrigation would not be required. In addition to planting, some reshaping may be necessary to provide the proper landscape to maintain and encourage the future propagation of this vegetation type.

3.2.2 NO-ACTION ALTERNATIVE (FUTURE WITHOUT PROJECT)

Under the No-Action Alternative, the Corps would take no action to restore the ecosystem and wildlife habitat within the study area. Plans with potential incidental benefits to reduce flood damage and improve water quality and water supply also would not be provided by the Corps. Although it is possible that local agencies would implement limited improvements, restoration efforts would not occur on the scale of the proposed project.

3.2.3 ALTERNATIVE F

As indicated earlier in this chapter, Alternative F is the alternative with the greatest number of project features. It is also one of two construction alternatives that include channelization of portions of the Salt River (the other is Alternative O) and bank stabilization features in certain reaches (the other is Alternative E).

Channelization would entail confining flows of the Salt River to a narrower and deeper channel than the current main channel. It would be done in order to offset the reduction in the capacity of the channel to convey water in certain areas due to planting vegetation within the main channel. A total of 16,500 linear feet would be channelized under this alternative.

The river bottom would be excavated to form a low-flow channel with a bottom width of 200 feet, 1V:3H side slopes, and a depth of 4 to 8 feet. The channel would be free to migrate. The excavated material would be used to create benches along the channel, to fill quarry pits, and to vary the local topography to encourage vegetation growth and reduce flood damage on proposed vegetation areas. Maintenance of the channel may be necessary after flow events. A

200-foot buffer on both sides of the low-flow channel would be incorporated into the design to allow for the migration of the channel.

Portions of the low-flow channel would be designed with a semi-impervious soil substrate to support wetland areas. It is recommended that Sonoran vegetation be planted along the low-flow channel to increase stability of the overbank area.

The purpose of bank stabilization (also called armoring) is to stabilize the river, reduce erosion, and provide protection for newly established vegetation. The preferred method of bank stabilization is soil cement.

A layout of the proposed restoration for Alternative F is shown in Figure 3-3. Activities proposed for each reach are described below.

Reaches 9 and 8: Invasive plant species, primarily saltcedar (*Tamarix* sp.), would be removed if no threatened or endangered wildlife species are found associated with them. To prevent rapid reestablishment of the invasive species, native vegetation would be planted in its place. Because of the relatively good quality of the existing habitat in this reach, no other changes to the current conditions are proposed.

Reach 7: No changes are proposed in Reach 7 due to the presence of the active Higley Quarry. It is assumed that any vegetation planted would be damaged due to in-channel mining operations. The continual removal of materials from the Higley Quarry would cause scouring to occur along the main channel downstream, particularly in Reach 6. This could potentially damage any attempts to establish vegetation along Reach 6. To reduce the affects from mining operations at the Higley Quarry, the quarry operators should be encouraged to preserve a narrow corridor unaltered by mining within the existing main channel or to create a channel at grade to convey flows and bed load material to Reach 6. By reducing the deposition, bed load material will continue to flow downstream, maintaining the stability of the channel within Reach 6.

Reach 6: Relatively large areas of CW and MS would be established along the north side of the river. The CW would be located south of the GRUSP site and irrigated using surface water from the Hennessey Drain. The MS would be north of the GRUSP site, immediately outside of the active channel and outside the 10-year floodplain, and would be irrigated using surface water from the North Canal. In both areas the water will be distributed by flood irrigation or by a SBIN. Because the vegetation surrounds the GRUSP site, it may affect or be affected by, the groundwater mound created by the GRUSP. The issues involved in planting around the GRUSP site will be further addressed prior to construction. On the south bank of the river, CW would be planted in an unnamed abandoned quarry depression directly east of Gilbert Road, between a larger quarry and the channel, and within the 5-year floodplain. The area would be irrigated using surface water and stormwater when available. Flood irrigation is the preferred method of irrigation.

A larger abandoned quarry further upstream along the south bank would be reconnected to the Salt River with two spillways. No reshaping of this quarry is recommended because of the extremely large volume of material that would be required to fill the quarry to the channel invert

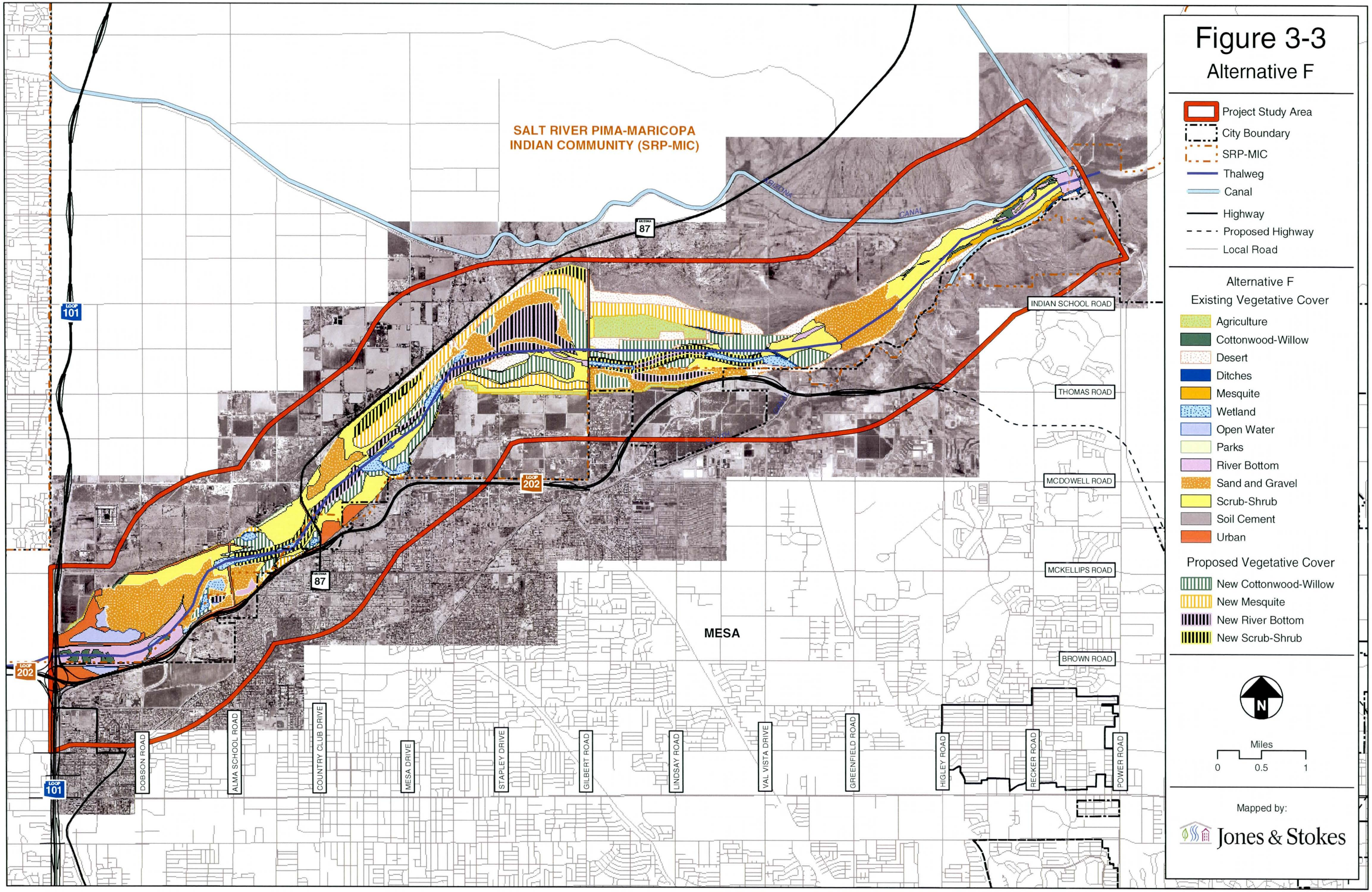


Figure 3-3
Alternative F
Project Study Area
City Boundary
SRP-MIC
Thalweg
Canal
Highway
Proposed Highway
Local Road
Alternative F
Existing Vegetative Cover
Agriculture
Cottonwood-Willow
Desert
Ditches
Mesquite
Wetland
Open Water
Parks
River Bottom
Sand and Gravel
Scrub-Shrub
Soil Cement
Urban
Proposed Vegetative Cover
New Cottonwood-Willow
New Mesquite
New River Bottom
New Scrub-Shrub
N
Miles
0
0.5
1
Mapped by:
Jones & Stokes
SALT RIVER PIMA-MARICOPA
INDIAN COMMUNITY (SRP-MIC)
MESA
87
101
202
INDIAN SCHOOL ROAD
THOMAS ROAD
MCDOWELL ROAD
MCKELLIPS ROAD
BROWN ROAD
DOBSON ROAD
ALMA SCHOOL ROAD
COUNTRY CLUB DRIVE
MESA DRIVE
STAPLEY DRIVE
GILBERT ROAD
LINDSAY ROAD
VAL VISTA DRIVE
GREENFIELD ROAD
HIGLEY ROAD
RECKER ROAD
POWER ROAD

level. The quarry pit would be partially filled with material. This quarry is oriented such that during high flows, the river could be redirected south into the quarry pit, causing bank erosion along the south bank and a headcut migration upstream and downstream of the quarry (Va Shly'ay Akimel Hydraulic Sediment Analysis). Headcutting would adversely affect vegetation establishment within Reach 6 and might damage the Gilbert Road Bridge at the west end of Reach 6. To ensure that the quarry does not affect the current channel layout, the south bank of the river would be reestablished north of the quarry and hard-banked. Approximately 6,000 linear feet of the south river bank would armored (Figure 3-4).

A wetland (WT) would be constructed in the riverbed near the existing Hennessey Drain outlet near the east end of Reach 6. A berm of coarse rock would be constructed on the upstream side of the WT to provide some protection from scour during flow events and help force flows away from the south bank. The WT would be lined with a low-permeability liner system to help maintain surface water level and the saturated soil conditions necessary for vegetation growth. The WT would be adjacent to a new CW stand at its upper (east) end, taking advantage of the saturated soil conditions, and would be irrigated using surface water from the Hennessy Drain and either SBIN or flood irrigation.

The WT would also serve as the upstream starting point of the low-flow channel for the portion of the Salt River that would be channelized. The larger wetland feature would narrow to fit within the channelized portion of the river. This section of channelization would continue downstream to approximately Gilbert Road (the western limit of Reach 6), with a total of two WT features within the channel, one at the eastern end and one at the western end. SD would be established on the benches.

Reach 5: The north bank of the Salt River in the vicinity of the Gilbert Quarry pit would be armored to prevent the river from potentially moving north into the Gilbert Quarry pit during high flows. If the river channel were to break through into the quarry pit, headcutting could occur both upstream and downstream of this area. Soil cement is the recommended bank stabilization material.

The Gilbert Quarry pit would be reshaped and converted to river bottom. Two spillways would be constructed as part of the bank stabilization to allow water flow into and out of the pit from the river. CW, MS, and SD would be planted on the overbank area. The SD and MS would be irrigated using groundwater from a new well. The CW would be irrigated using surface water diverted from the drainage distribution channel via the SBIN.

The river channel in the western portion of this reach would also be reshaped and converted to river bottom. WT and MS would be established at Evergreen Drain, on the north side of the channel. The MS would be irrigated using groundwater from the new well, and the WT would be supported by runoff from Evergreen Drain.

The south bank would be vegetated with CW and MS. Surface water and stormwater would be used to irrigate these areas. The south bank CW and MS would continue eastward, ending at Gilbert Road. Irrigation of the CW and MS would be done by SBIN.

A grade control structure is proposed to protect the channel and the newly-restored upstream riparian area from headcutting associated with extensive mining that has occurred downstream of the Gilbert Road Bridge. Mining operations have altered the channel system, creating a nickpoint, or area where an abrupt change in elevation and slope occurs. Water flowing over a nickpoint generally results in headcutting, causing erosion and downcutting, which allows the channel to migrate upstream. Results from the Va Shly'ay Akimel Hydraulic Sediment Analysis indicate that the headcut could undermine the bridge and damage features directly upstream of the quarry.

The grade control structure would help reduce the upstream migration and stabilize the river system, improving the likelihood of success of vegetation established upstream and downstream. The grade control structure would be placed in the main channel at the center point of the former Gilbert Quarry. It would be designed to the estimated scour depth, would span the entire width of the riverbed, and would stand 10 feet tall with a 20-foot toe depth (total height 30 feet). The depth of the structure would be 8 feet and the length 1,100 feet. Riprap would be placed on the downstream end to prevent erosion.

Figure 3-5 shows the longitudinal profile of the Salt River with the structure. The future main channel was assumed to have been lowered 20 feet due to mining.

Reach 4: A large portion of this reach is located on a terrace north of the channel that is the site of the closed Tri-City Landfill. MS, SD, and a small stand of CW could be established in this area if there are no water quality issues (e.g., potential leachate and methane production) and the soil layer over the landfill cap is sufficiently deep to allow trees and shrubs to root. The area would be irrigated using surface water and stormwater by way of the SBIN.

The area along the south bank would support CW, MS, and WT. Two surface water outlets on the south bank would supply water to the SBIN to irrigate the vegetation. The western outlet would support the WT as well as surrounding CW and MS. Since this southern area is relatively protected from the main channel, damage to the channel and the irrigation system has the potential to occur less frequently.

The western wetland feature would be the upstream starting point for the second section of channelized river bottom. In Reach 4, this channelized area would support two WT features within the channel and SD on the benches. Channelization would extend from this point in Reach 4 downstream through all of Reach 3 and Reach 2.

Reach 3: As indicated in the previous paragraph, the river would be channelized for the entire length of Reach 3, thus reshaping and creating new river bottom along this entire reach.

A channel would be constructed to drain the southern portion of Reach 4 to supply water to a portion of the WT and CW vegetation to be established within the river channel in Reach 3. Water would be conveyed to the CW using the SBIN.

Figure 3-4. Bank Stabilization Locations

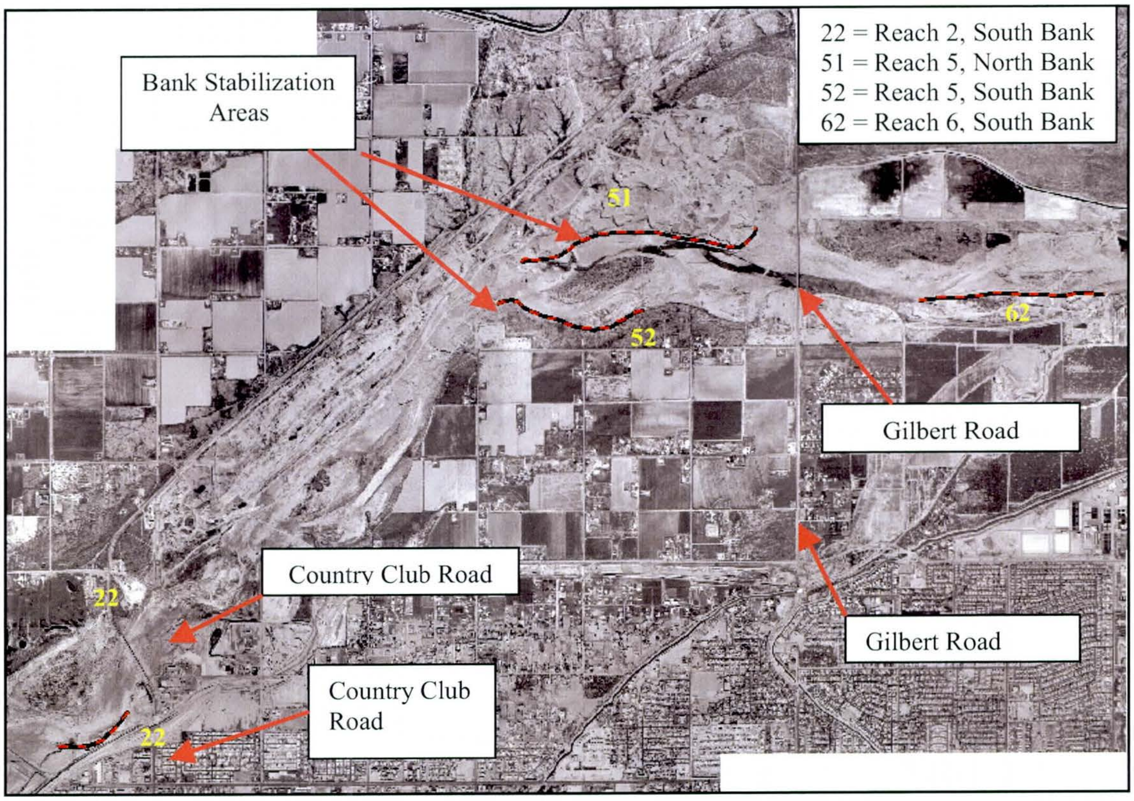
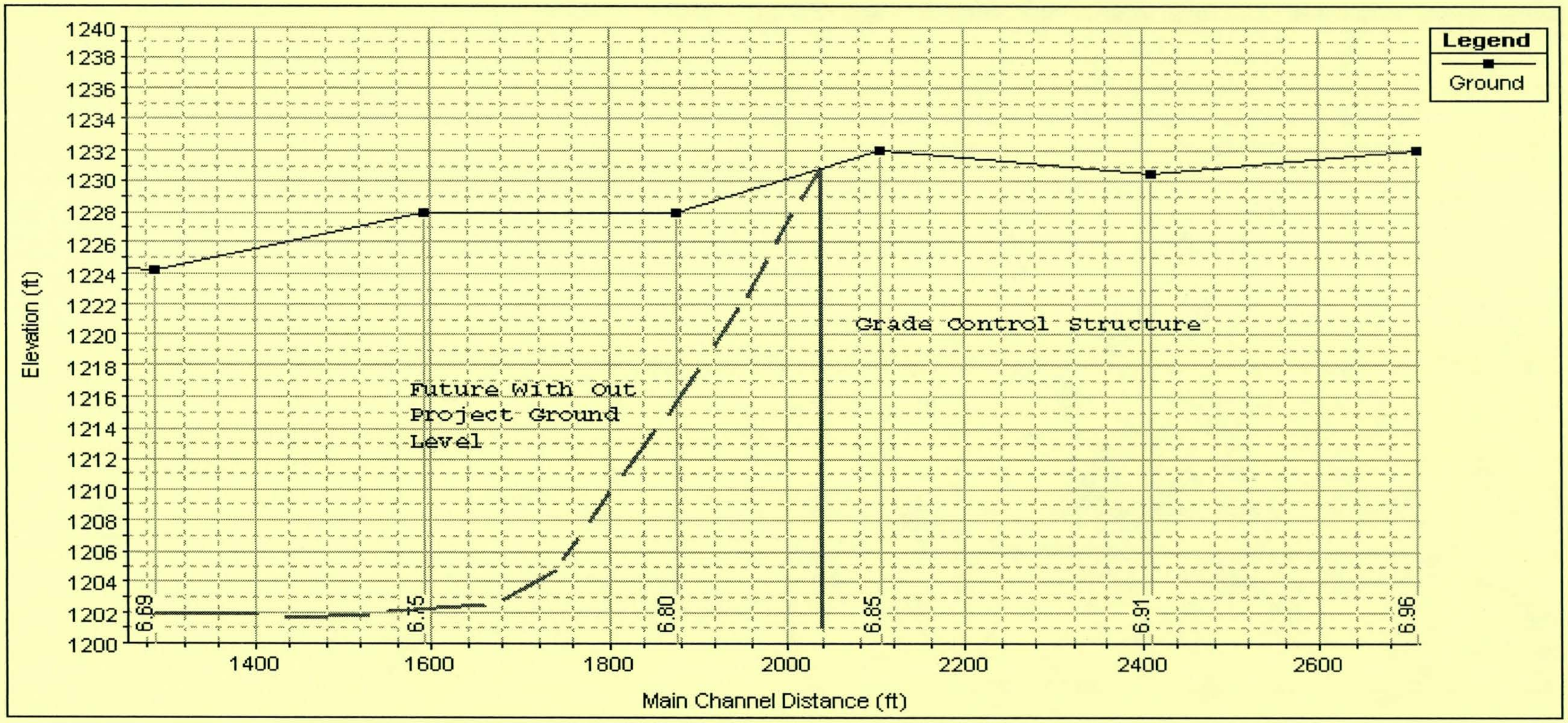


Figure 3-5. Longitudinal Profile of Salt River Main Channel with Grade Control Structure



Reach 2: The river would be channelized for the entire length of Reach 2. It would support an in-channel WT that terminates in a larger wetland immediately downstream of Alma School Road.

Bank stabilization with soil cement is recommended for the south bank between Country Club Road and Alma School Road (Figure 3-4) to prevent a southerly migration of the river resulting in damage to project features and Highway 202. Soil cement bank protection in this area would be 3,000 feet long, 40 feet tall, and 6 feet deep.

The northern portion would support a WT feature surrounded by CW to the west, south, and east, and MS to the north. These features would be supported by surface water outlets and maintained using a SBIN. Additional water may be supplied by a golf course located north of the Salt River, if the water is of sufficient quality.

The south bank would include a small WT and small areas of CW and MS. One stand of CW would surround the wetland; the second stand would be downstream of the first, with the stand of MS located between the two CW areas. The WT would be constructed near the Country Club Storm Drain on the existing river bottom and will need to withstand stormwater runoff.

The WT would be surrounded by CW and irrigated using SBIN.

Reach 1: No work is proposed for Reach 1. The SRPMIC has expressed an interest in developing this area for commercial purposes.

3.2.3.1 Water Sources Related Structures

Eleven new irrigation diversion structures and one new groundwater well are proposed for this alternative.

3.2.3.2 Water Demand

The total annual evapotranspiration demand for Alternative F is 8,960 acre-feet (Table 3-4).

Table 3-4. Vegetated Area and Evapotranspiration Rate for Alternative F

Reach	Area (acres)	Evapotranspiration (acre-ft)
1	0	0
2	233	1,298
3	29	181
4	344	1,668
5	495	2,204

Reach	Area (acres)	Evapotranspiration (acre-ft)
6	610	2,952
Total	1,711	8,304

3.2.4 ALTERNATIVE N

A layout of the proposed restoration for Alternative N is shown in Figure 3-6. As noted earlier, Alternative N would include most of Alternative F's vegetation features but lacks most of its structural features. Most notably, it does not include either channelization or bank stabilization. Activities proposed for each reach are described below.

Reaches 9 and 8: Invasive plant species, primarily saltcedar (*Tamarix* sp.), would be removed if no threatened or endangered wildlife species are found associated with them. To prevent rapid reestablishment of the invasive species, native vegetation would be planted in its place. Because of the relatively good quality of the existing habitat in this reach, no other changes to the current conditions are proposed.

Reach 7: No changes are proposed in Reach 7 due to the presence of the active Higley Quarry. It is assumed that any vegetation planted would be damaged due to in-channel mining operations. The continual quarrying of the Higley Plant would cause scouring to occur along the main channel downstream, particularly in Reach 6. This could potentially damage any attempts to establish vegetation along Reach 6. To reduce the effect of the Higley mining operations, the quarry operators should be encouraged to preserve a narrow corridor unaltered by mining within the existing main channel or to create a channel at grade to convey flows and bedload material to Reach 6. By reducing the deposition, bedload material will continue to flow downstream, maintaining the stability of the channel within Reach 6.

Reach 6: Relatively large areas of CW and MS will be established along the north side of the river. The CW would be located south of the GRUSP site and irrigated using surface water from the Hennessey Drain. The MS would be north of the GRUSP site, immediately outside of the active channel and outside the 10-year floodplain, and would be irrigated using groundwater from a new well. In both areas the water will be distributed by flood irrigation or by a SBIN. Because the vegetation surrounds the GRUSP site, it may affect or be affected by, the groundwater mound created by the GRUSP. The issues involved in planting around the GRUSP site will be further addressed prior to construction.

On the south bank of the river, two areas of CW will be planted. One CW would be located in an abandoned quarry depression directly east of Gilbert Road and within the 5-year floodplain. The second CW would be a relatively narrow strip along the southern edge of the main channel. Both areas will be irrigated using surface water and stormwater when available. Flood irrigation is the preferred method of irrigation.

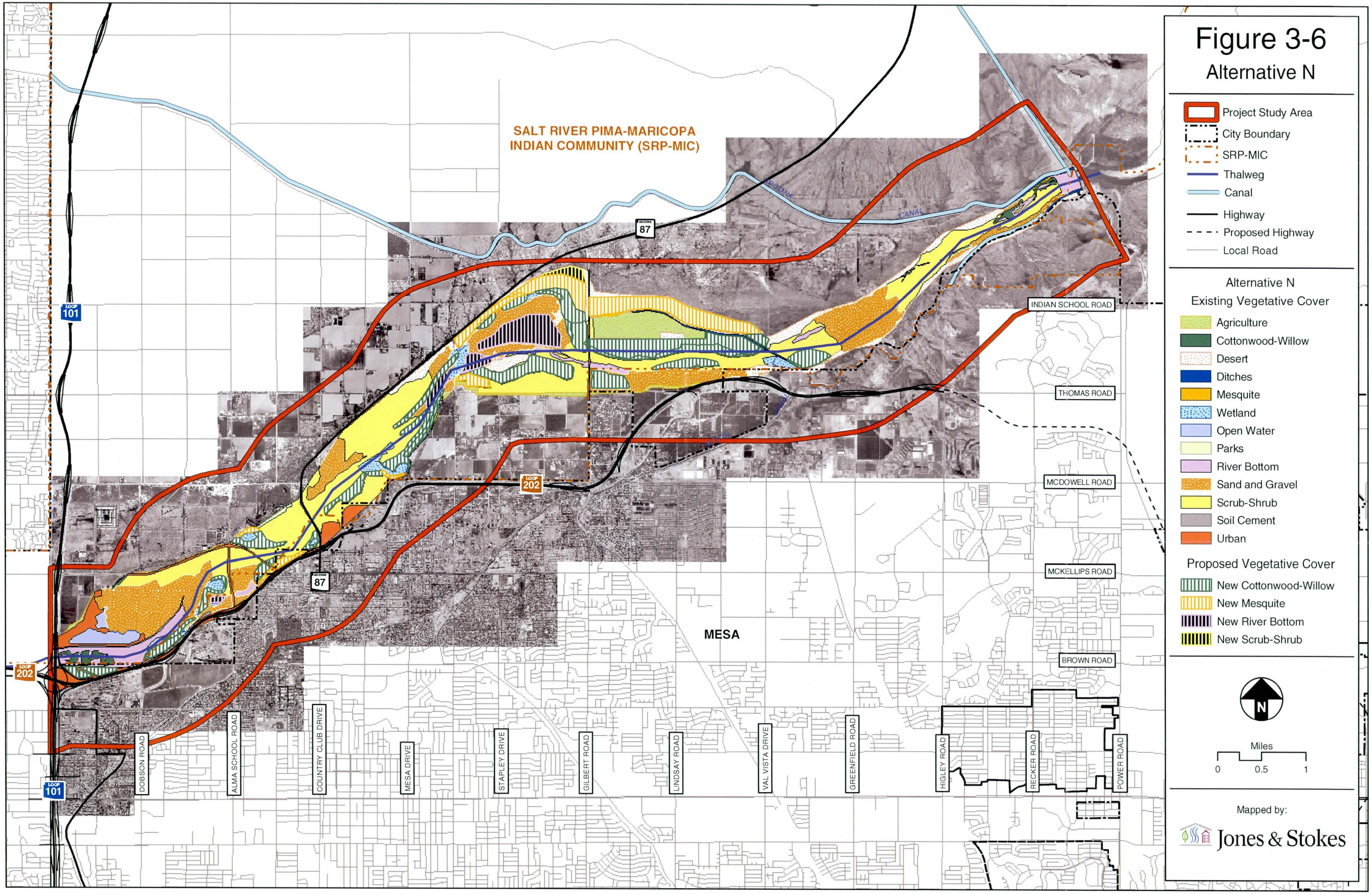


Figure 3-6
Alternative N
Project Study Area
City Boundary
SRP-MIC
Thalweg
Canal
Highway
Proposed Highway
Local Road
Alternative N
Existing Vegetative Cover
Agriculture
Cottonwood-Willow
Desert
Ditches
Mesquite
Wetland
Open Water
Parks
River Bottom
Sand and Gravel
Scrub-Shrub
Soil Cement
Urban
Proposed Vegetative Cover
New Cottonwood-Willow
New Mesquite
New River Bottom
New Scrub-Shrub
N
Miles
0
0.5
1
Mapped by:
Jones & Stokes
SALT RIVER PIMA-MARICOPA
INDIAN COMMUNITY (SRP-MIC)
MESA
INDIAN SCHOOL ROAD
THOMAS ROAD
MCDOWELL ROAD
MCKELLIPS ROAD
BROWN ROAD
DOBSON ROAD
ALMA SCHOOL ROAD
COUNTRY CLUB DRIVE
MESA DRIVE
STAPLEY DRIVE
GILBERT ROAD
LINDSAY ROAD
VAL VISTA DRIVE
GREENFIELD ROAD
HIGLEY ROAD
RECKER ROAD
POWER ROAD
LOOP 101
LOOP 202
87
ARIZONA CANAL

A WT would be constructed in the riverbed near the existing Hennessey Drain outlet, near the east end of Reach 6. A berm of coarse rock would be constructed on the upstream side of the WT to provide some protection from scour during flow events and help force flows away from the south bank. The WT would be lined with a low-permeability liner system to help maintain surface water levels and the saturated soil conditions necessary for vegetation growth. The WT would be adjacent to a new CW stand at its upper (east) end, taking advantage of the saturated soil conditions, and would be irrigated using surface water from the Hennessy Drain and either SBIN or flood irrigation.

Reach 5: The Gilbert Quarry pit would be reshaped and converted to river bottom. CW, MS, and SD would be planted on the overbank area. The MS and SD will be irrigated using groundwater from a new well. The CW will be irrigated using surface water diverted from an irrigation canal. The water will be distributed using SBIN.

The river channel in the western portion of this reach would also be reshaped and converted to river bottom. WT and CW would be established at Evergreen Drain. The CW would be irrigated using groundwater from the new well, and the WT would be supported by runoff from Evergreen Drain.

The south bank will be vegetated with CW and a small stand of MS. Surface water and stormwater will be used to irrigate these areas, with the water distributed by a SBIN.

A grade control structure would be placed in the main channel of the river at the center point of the former Gilbert Quarry. As noted in the description of this structure under Alternative F, this structure would help protect the channel and the newly-restored riparian area from head cutting associated with extensive mining that has occurred downstream. The structure would span the entire width of the riverbed, approximately 1,500 feet, and be designed to the estimated scour depth. Figure 3-5 shows the longitudinal profile of the Salt River with the structure.

Reach 4: A large portion of this reach is located on a terrace north of the channel that is the site of the closed Tri-City Landfill. The majority of this area will be left unvegetated due to the presence of the landfill. However, a narrow strip of CW would be established along the north bank of the river, at the edge of the main channel. The area will be irrigated using surface and stormwater distributed by a SBIN.

The area along the south bank would support CW, MS, and a relatively large WT. Two surface water outlets on the south bank would supply water to the SBIN to irrigate the vegetation. The western outlet would support the WT as well as surrounding CW and MS. Since this southern area is relatively protected from the main channel, damage to the channel and the irrigation system would occur less frequently.

Reach 3: A drainage channel would be constructed to drain the southern portion of Reach 4 to supply water to a new CW stand along the south bank that would be a continuation of the CW stand at the western end of Reach 4. Water would be conveyed to the CW using the SBIN.

Reach 2: The northern portion would support a WT surrounded by CW to the west, south, and east and MS to the north. These features would be supported by surface water outlets and maintained using a SBIN. Additional water may be supplied by a golf course located north of the Salt River, if the water is of sufficient quality.

The south bank would include a small WT and small areas of CW and MS. One stand of CW would surround the wetland; the second stand would be downstream of the first, with the stand of MS located between the two CW areas. The WT would be constructed near the Country Club Storm Drain on the existing river bottom and will need to withstand stormwater runoff.

MWWTP effluent would support two WT areas created at Alma School Road downstream of the old quarry. The western WT will be flanked by CW to the west that will continue into Reach 1. The CW will be irrigated using SBIN. A small area south of the wetlands will be reshaped and converted to new river bottom.

Reach 1: The CW stand adjacent to the western WT of Reach 2 will continue westward into the main channel of the river.

An old recharge area on the south side of the river would be converted from ruderal vegetation to a CW stand. The irrigation system currently used for recharge purposes can be used or modified to irrigate the CW vegetation. The water source for this area is MWWTP effluent.

No activity is planned for the north side of the river. The SRPMIC has expressed an interest in developing this area for commercial purposes.

3.2.4.1 Water Sources - Related Structures

Nine new irrigation diversion structures, no new WWTP diversion structures, and one new well are proposed for Alternative N.

3.2.4.2 Water Demand

The total annual evapotranspiration demand for Alternative N is 7,736 acre-feet (Table 3-5).

Table 3-5. Vegetated Area and Evapotranspiration Rate for Alternative N

Reach	Area (acres)	Evapotranspiration (acre-feet)
1	51	320
2	141	905
3	29	181

Reach	Area (acres)	Evapotranspiration (acre-feet)
4	152	1,057
5	434	2,224
6	580	3,048
Total	1,387	7,736

3.2.5 ALTERNATIVE O (PREFERRED ALTERNATIVE)

Under the Preferred Alternative, the Corps would vegetate large portions of the project area and provide minimal support or flood control structures. A layout of the proposed restoration for Alternative O is provided in Figure 3-7. Activities proposed within specific reaches are described below.

Reach 9 and 8: Invasive plant species, primarily salt cedar (*Tamarix* sp.), would be removed if no threatened or endangered wildlife species are found associated with it. To prevent rapid reestablishment of the invasive species, native vegetation would be planted in its place. Because of the relatively good quality of the existing habitat in this reach, no other changes to the current conditions are proposed.

Reach 7: No planting was proposed in Reach 7 because of the Higley Quarry Plant. It is assumed that any vegetation planted would be damaged due to in-channel mining operations. The continual quarrying of the Higley Plant would cause scouring to occur along the main channel downstream, particularly in Reach 6. This could potentially damage any attempts to establish vegetation along Reach 6. To reduce the affect of the Higley mining operations the quarry operators should be encouraged to preserve a narrow corridor unaltered by mining within the existing main channel or to create a channel at grade to convey flows and bed load material to Reach 6. By reducing the deposition, bed load material would continue to flow downstream, maintaining the stability of the channel within Reach 6.

A grade control structure would be placed in the main channel at the center point of the former Gilbert Quarry. The infrastructure is needed to guarantee the river cross-section to maintain the project features. Therefore, the grade control structure is necessary to stabilize the river. However, it also provides incidental protection of Gilbert Road Bridge. The structure would span the entire width of the riverbed, approximately 1,000 feet, and be designed to the estimated scour depth.

Reach 6: Relatively large areas of CW and MS would be established along the north side of the river. The CW would be located south of the GRUSP site and irrigated using surface water from the Hennessey Drain. The MS would be north of the GRUSP site, immediately outside of the active channel and outside the 10-year floodplain, and would be irrigated using groundwater from a new well. In both areas the water will be distributed by flood irrigation or by a SBIN.

Because the vegetation surrounds the GRUSP site, it may affect or be affected by, the groundwater mound created by the GRUSP. The issues involved in planting around the GRUSP site will be further addressed prior to construction.

On the south bank of the river, two areas of CW would be planted. One CW would be located in an abandoned quarry depression directly east of Gilbert Road and within the 5-year floodplain. The second CW would be a relatively narrow strip along the southern edge of the main channel. Both areas would be irrigated using surface water and stormwater when available. Flood irrigation is the preferred method of irrigation.

Reach 5: The Gilbert Quarry pit would be reshaped and converted to new river bottom. CW and MS, and a small pocket of SD would be planted on the overbank area. The MS and SD would be irrigated using groundwater from a new well. The CW would be irrigated using surface water diverted from the irrigation canal via the SBIN.

The river channel in the western portion of this reach would also be reshaped and converted to new river bottom. WT and CW would be established at Evergreen Drain, on the north side of the channel. The CW would be irrigated using ground water from the new well, and the WT would be supported by run off from Evergreen Drain.

The south bank would be vegetated with CW and a small stand of MS. Surface water and stormwater would be used to irrigate these areas. Irrigation of the CW and MS would be done by SBIN.

A grade control structure would be placed in the main channel at the center point of the former Gilbert Quarry. This structure would help protect the newly-restored channel and upstream riparian areas, as well as protect the Gilbert Road Bridge from head cutting associated with downstream mining activities. The structure would span the entire width of the riverbed, approximately 1,000 feet, and be designed to the estimated scour depth.

Reach 4: A large portion of this reach is located on a terrace north of the channel that is the site of the closed Tri-City Landfill. This area would be left unvegetated due to the presence of the landfill. The area along the south bank would support CW, MS and WT. Two surface water outlets on the south bank would supply water to the SBIN to irrigate the vegetation. The western outlet would support the WT as well as surrounding CW and MS. Since the southern area is relatively protected from the main channel, damage to the channel and the irrigation system has the potential to occur less frequently.

Reach 3: CW and MS stands would be established on the north and south banks. The SBIN network installed to irrigate vegetation installed along the south bank in Reach 4 would be extended to supply water to the CW vegetation in Reach 3. Water would be conveyed using the SBIN.

Reach 2: The northern portion would support a WT feature surrounded by CW to the west, south, and east. These features would be supported by surface water outlets, and maintained

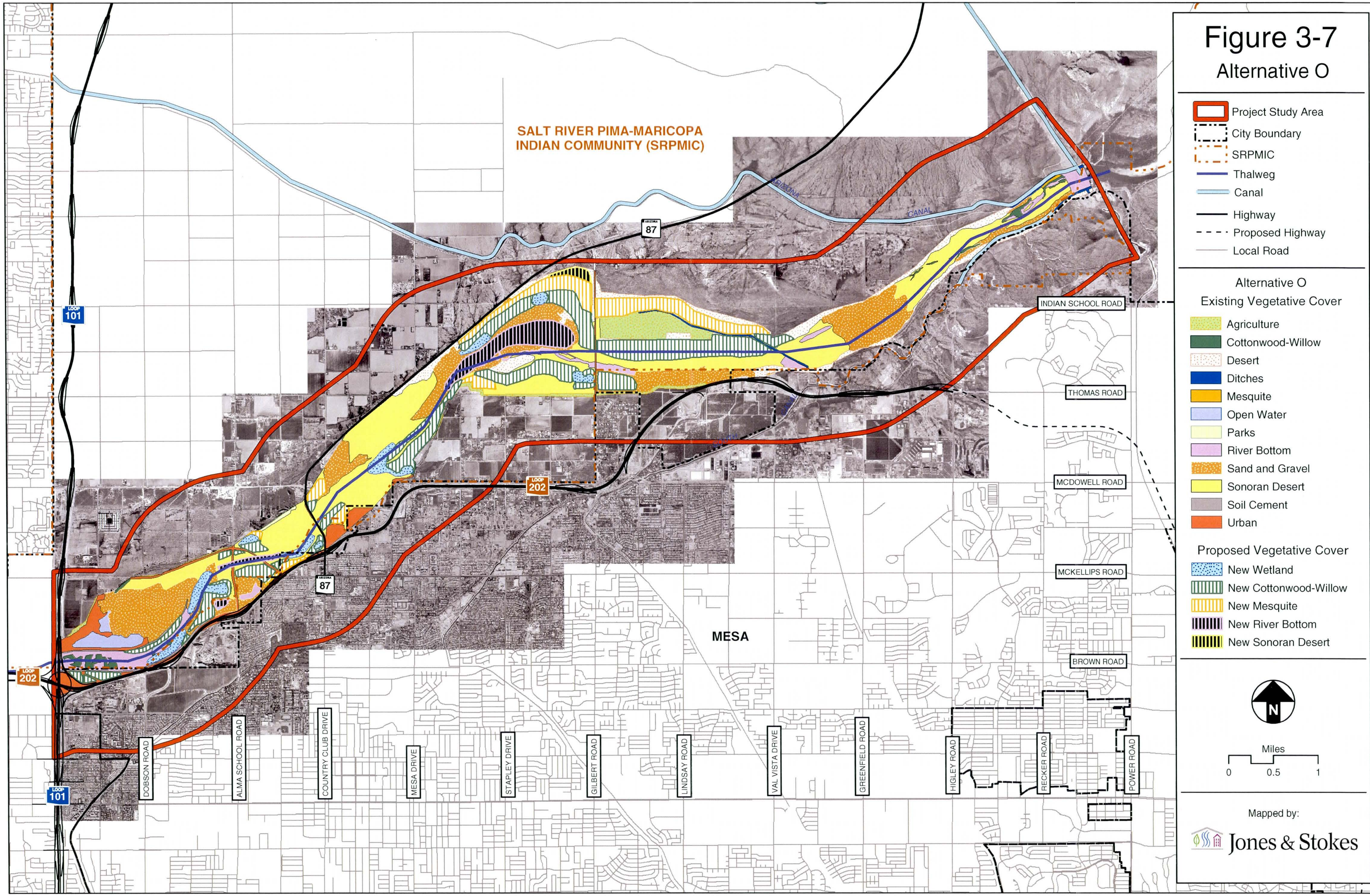


Figure 3-7
Alternative O
Project Study Area
City Boundary
SRPMIC
Thalweg
Canal
Highway
Proposed Highway
Local Road
Alternative O
Existing Vegetative Cover
Agriculture
Cottonwood-Willow
Desert
Ditches
Mesquite
Open Water
Parks
River Bottom
Sand and Gravel
Sonoran Desert
Soil Cement
Urban
Proposed Vegetative Cover
New Wetland
New Cottonwood-Willow
New Mesquite
New River Bottom
New Sonoran Desert
N
Miles
0
0.5
1
Mapped by:
Jones & Stokes
SALT RIVER PIMA-MARICOPA
INDIAN COMMUNITY (SRPMIC)
MESA
ARIZONA CANAL
INDIAN SCHOOL ROAD
THOMAS ROAD
MCDOWELL ROAD
MCKELLIPS ROAD
BROWN ROAD
DOBSON ROAD
ALMA SCHOOL ROAD
COUNTRY CLUB DRIVE
MESA DRIVE
STAPLEY DRIVE
GILBERT ROAD
LINDSAY ROAD
VAL VISTA DRIVE
GREENFIELD ROAD
HIGLEY ROAD
RECKER ROAD
POWER ROAD
101
202
87

using a SBIN. Additional water may be supplied by a golf course located north of the Salt River, if it is of sufficient quality.

The south bank would support two wetland features and small areas of CW and MS. One small stand of CW would surround the wetland; the second stand would be downstream of the first. The wetland would be constructed near the Country Club Storm Drain on the existing river bottom and would need to withstand storm water runoff.

Two wetland feature would be created in the old quarry downstream of Alma School Road . The larger WT to the east and a second smaller WT located just south would both be surrounded by CW stands. The CW would be irrigated using SBIN. A small area, south of the wetlands, would be reshaped and converted to new river bottom.

Reach 1: This Reach would support one wetland feature and two CW stands. The WT would be located to the north, within the main channel and would connect with a CW stand along the north bank. The percolation ponds found immediately outside of the southern bank would be planted with CW. This area would be supported using the existing irrigation infrastructure.

3.2.5.1 Water Sources - Related Structures

Eight new irrigation diversion structures, no new WTTP diversion structures, and one new well are proposed for Alternative O.

3.2.5.2 Water Demand

The total annual evapotranspiration demand for Alternative O is 8,550 acre-feet (Table 3-6).

Table 3-6. Vegetated Area and Evapotranspiration Rate for Alternative O

Reach	Area (acres)	Evapotranspiration. (acre-ft)
1	66	475
2	226	1,565
3	29	181
4	152	1,057
5	434	2,224
6	580	3,048
Total	1,486	8,550

3.2.6 ALTERNATIVE E

A layout of the proposed restoration for Alternative E is provided in Figure 3-8. Activities proposed within specific reaches are described below.

Reaches 9 and 8: Invasive plant species, primarily saltcedar, would be removed if no threatened or endangered wildlife species are found associated with them. To prevent rapid reestablishment of invasive species, native vegetation would be planted in its place. Because of the relatively good quality of the existing habitat in this reach, no other changes to the current conditions are proposed.

Reach 7: No changes were proposed in Reach 7 due to the presence of the active Higley Quarry. It was assumed that any vegetation planted would be damaged due to in-channel mining operations.

Reach 6: The existing drainage channel along the north side of the GRUSP site would be extended past Gilbert Road to supply water to northern portion of Reach 5. This channel presently carries Salt River Project water from the Hennessey Drain to the GRUSP.

CW would be planted south of the GRUSP site and MS and SD would be planted north of the GRUSP site. The CW would be irrigated using a SBIN. Water from the drainage channel would be diverted to the SBIN for CW use. MS and SD would be planted north of the drainage channel and irrigated using SBIN and/or a drip/bubbler system. Groundwater from a new well would be the source of water. Because the vegetation surrounds the GRUSP site, it may affect and be affected by, the groundwater mound created by the GRUSP. The issues involved in planting around the GRUSP site will be further addressed prior to construction.

On the south bank, the former quarry would be reshaped and seeded to establish SD. MS would be planted upstream of the quarry outside of the 20-year floodplain, with the area irrigated using SBIN with water diverted from the Hennessey Drain. The south bank would be stabilized with

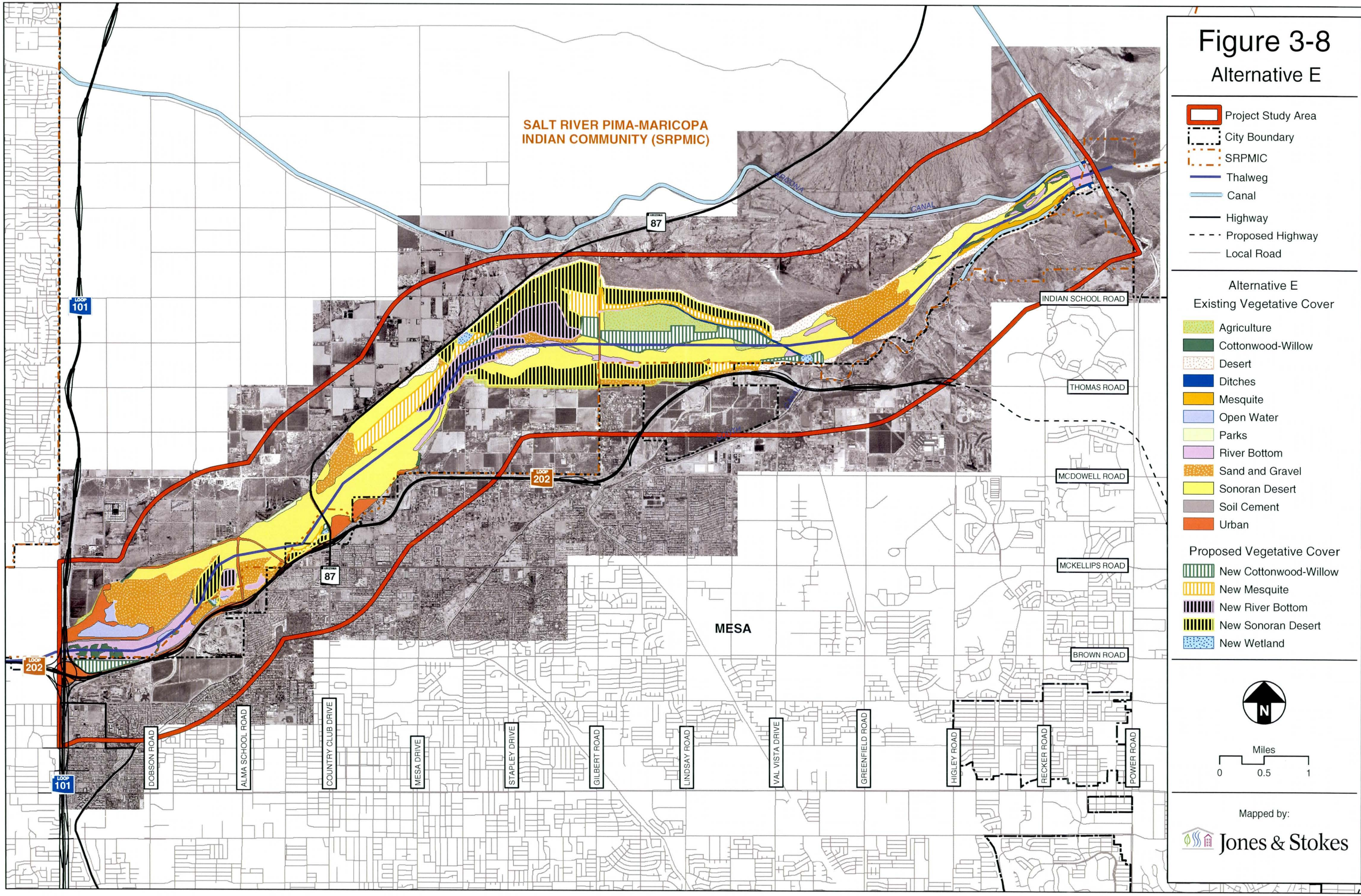


Figure 3-8
Alternative E
Project Study Area
City Boundary
SRPMIC
Thalweg
Canal
Highway
Proposed Highway
Local Road
Alternative E
Existing Vegetative Cover
Agriculture
Cottonwood-Willow
Desert
Ditches
Mesquite
Open Water
Parks
River Bottom
Sand and Gravel
Sonoran Desert
Soil Cement
Urban
Proposed Vegetative Cover
New Cottonwood-Willow
New Mesquite
New River Bottom
New Sonoran Desert
New Wetland
N
Miles
0
0.5
1
Mapped by:
Jones & Stokes
SALT RIVER PIMA-MARICOPA
INDIAN COMMUNITY (SRPMIC)
MESA
87
101
202
INDIAN SCHOOL ROAD
THOMAS ROAD
MCDOWELL ROAD
MCKELLIPS ROAD
BROWN ROAD
DOBSON ROAD
ALMA SCHOOL ROAD
COUNTRY CLUB DRIVE
MESA DRIVE
STAPLEY DRIVE
GILBERT ROAD
LINDSAY ROAD
VAL VISTA DRIVE
GREENFIELD ROAD
HIGLEY ROAD
RECKER ROAD
POWER ROAD

soil cement or coarse rock to prevent headcutting that could compromise the establishment of vegetation.

A WT and CW area would be established at the Hennessey Drain and GRUSP diversion. A berm of coarse rock would be constructed on the upstream side of the WT to provide some protection during flow events and contribute to forcing flow away from the south bank. The WT would be lined with a low-permeability liner system to help maintain surface water level and the saturated soil conditions necessary for vegetation growth. The WT would be surrounded by CW, taking advantage of the saturated soil conditions, and would be irrigated using SBIN and or flood irrigation. Surface water from the Hennessey Drain would be used to irrigate this area.

Reach 5: The Gilbert Quarry pit would be reshaped and converted to river bottom. The north drain from Reach 6 would continue downstream to Reach 5 to provide water to CW, MS, and SD in and around the new river bottom. The MS and SD would be irrigated using SBIN with groundwater from a new well.

A WT would be created on a terrace at the Evergreen Drain outlet. Groundwater from a new well can be used for additional water, if necessary. The WT would be designed to handle stormflows and disperse stormwater laterally. Side drains would be constructed to disperse the stormwater. The CW and MS surrounding the WT will be irrigated using SBIN.

On the south bank, from Gilbert Road to Lehi Cemetery, SD would be established in the upland area and irrigated with a SBIN, using diverted surface water. The south riverbank in this area would be stabilized (Figure 3-4), preferably using soil cement, to prevent erosion and the loss of newly established vegetation. If implemented, the structure would be 5,000 feet long, 30 feet tall, and 6 feet deep.

The main channel of the river would be reshaped to allow the establishment of river bottom and to increase channel conveyance capacity. Although naturally occurring flow events could also be used to reshape the river bottom, mechanical reshaping would provide material to use for the construction of proposed features.

Reach 4: A large portion of this reach is located on a terrace north of the channel that is the site of the closed Tri-City Landfill. MS could be established in this area if there are no water quality issues and the soil layer over the landfill cap is sufficiently deep to allow trees to establish an adequate root system. The area would be irrigated using surface water or stormwater redirected from the Evergreen Drain to the terrace via SBIN.

Reach 3: No activity is planned in this area.

Reach 2: Along the north bank and within the channel between Alma School Road and Longmore Road, SD would be established and irrigated using SBIN and surface water. A WT and small CW stand would also be established and irrigated using runoff from a golf course.

Along the south bank, a WT would be constructed near the Country Club Storm Drain on the existing river bottom. It appears that the wetland area is protected from main channel flow, but the WT will need to be able to withstand stormwater runoff. CW would be planted immediately adjacent to the WT. This area would be located in a high-velocity area and would suffer damage during flow events, on average once every 3 years. However, these flow events would also allow the transport of seeds and vegetative propagules further downstream, aiding establishment of vegetation in new areas.

The old quarry at Alma School Road would be converted to new river bottom.

Bank stabilization with soil cement is recommended for the south bank between Country Club Road and Alma School Road (Figure 3-4) to prevent a southerly migration of the river resulting in damage to project features and Highway 202. Soil cement bank protection in this area would be 3,000 feet long, 40 feet tall and 6 feet deep.

Reach 1: An abandoned water recharge area on the south side of the river would be converted from ruderal vegetation to a CW stand. The irrigation system currently used for recharge purposes can be used or modified to irrigate the CW vegetation. The water source for this area is MMWTP effluent.

The only measure that would be applied to the main channel of the river is the eradication of invasive vegetation species, provided that no threatened or endangered species are associated with them, followed by possible enhancement plantings to avoid reoccurrence of invasive plants.

3.2.6.1 Water Sources - Related Structures

Four new irrigation diversion structures, no new WWTP diversion structures, and one new well are proposed for Alternative E.

3.2.6.2 Water Demand

The total annual evapotranspiration demand for this alternative is 4,568 acre-feet (Table 3-7).

Table 3-7. Vegetated Area and Evapotranspiration Rate for Alternative E

Reach	Area (acres)	Evapotranspiration (acre-feet)
1	38	242
2	98	261
3	0	0
4	128	384
5	577	1,461
6	575	2,191
Total	1,416	4,540

3.2.7 ALTERNATIVE A

A layout of the proposed restoration for Alternative A is shown in Figure 3-9. Activities proposed within specific reaches are described below.

Reach 9 and 8: Invasive plant species, primarily saltcedar, would be removed if no threatened or endangered wildlife species are found associated with them. To prevent rapid reestablishment of invasive species, native vegetation would be planted in its place. Because of the relatively good habitat in this reach, no other changes to the current conditions are proposed.

Reach 7: No changes are proposed in Reach 7 due to the presence of the active Higley Quarry. It is assumed that any vegetation planted would be damaged due to in-channel mining operations.

Reach 6: In the northern part of the reach, SD would be planted on both the north and south sides of the GRUSP site. The SD would be irrigated using a SBIN and water diverted from the drainage channel. Because the vegetation surrounds the GRUSP site, it may affect and be affected by, the groundwater mound created by the GRUSP. The issues involved in planting around the GRUSP site will be further addressed prior to construction.In the southern part of the reach, SD would be established at the Hennessy Drain, where the north and south GRUSP channels diverge. This area would be irrigated using SBIN and/or flood irrigation. Surface water from the Hennessey Drain would be used as a water source.

Reach 5: The old Gilbert Quarry would be reshaped to create new river bottom. A new groundwater well would be drilled to provide water to SD planted in and around the new river bottom. The SD would be irrigated by SBIN. This water source can also be supplemented by overland flow from water diverted from the Evergreen Drain during storm events.

On the western end of the south bank, a small area of SD would be established along the upland area. The SD would be irrigated with SBIN using diverted surface water.

Reach 4: No activity is planned for this reach.

Reach 3: No activity is planned for this reach.

Reach 2: No activity is planned for this reach.

Reach 1: No activity is planned for this reach.

3.2.7.1 Water Sources - Related Structures

Three new irrigation diversion structures are proposed for this alternative.

3.2.7.2 Water Demand

The total annual evapotranspiration demand for this alternative is 1,001 acre-feet (Table 3-8).

Table 3-8. Vegetated Area and Evapotranspiration Rate for Alternative A

Reach	Area (acres)	Evapotranspiration (acre-feet)
1	0	0
2	0	0
3	0	0
4	0	0
5	198	396
6	298	595
Total	496	992

3.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER EVALUATION

Ten additional alternatives were developed and evaluated during the alternatives formulation and screening process but were eliminated from further consideration. A brief description of each of these alternatives is provided below, including the rationale for elimination from further analysis.

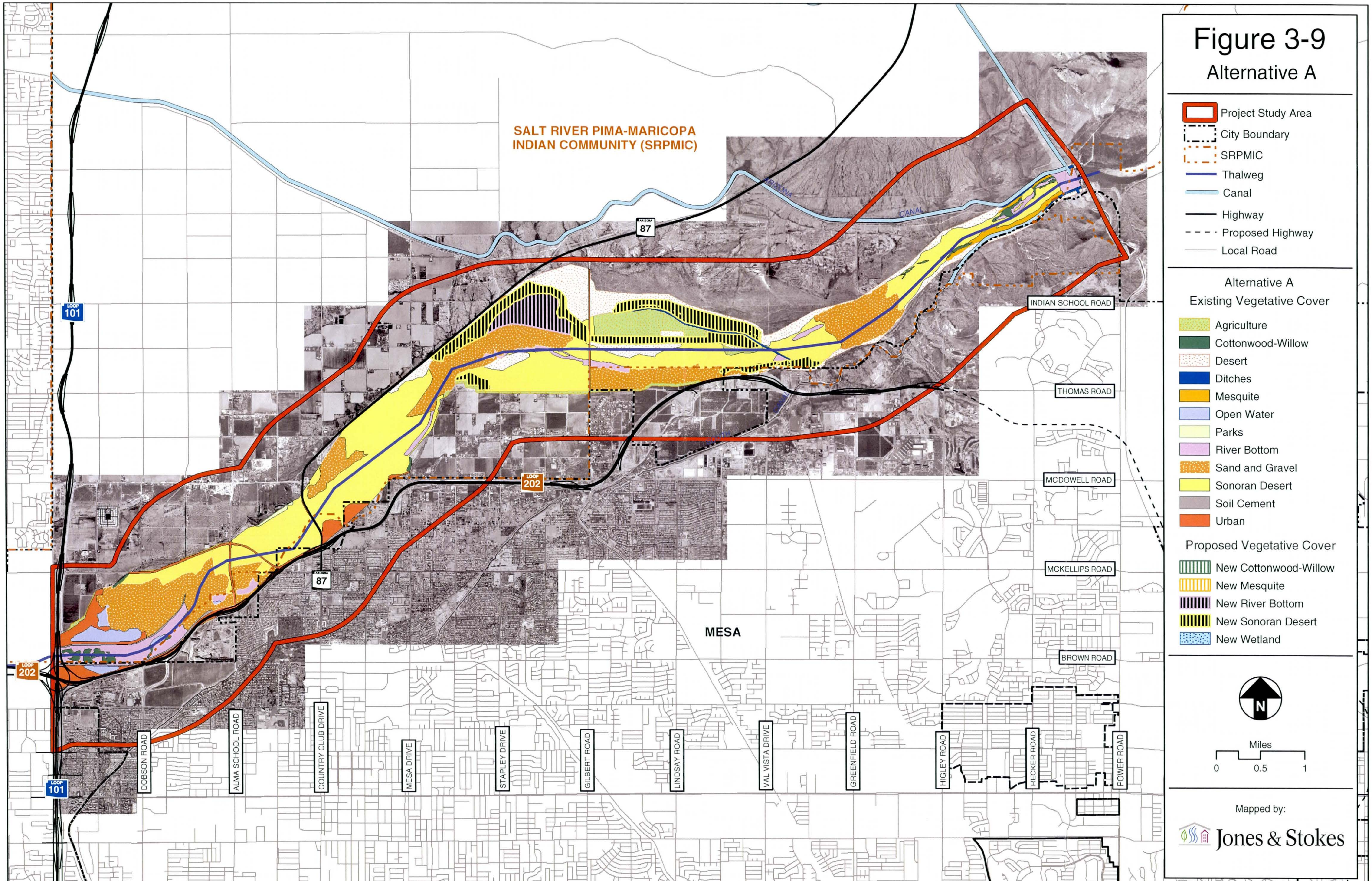


Figure 3-9
Alternative A
Project Study Area
City Boundary
SRPMIC
Thalweg
Canal
Highway
Proposed Highway
Local Road
Alternative A
Existing Vegetative Cover
Agriculture
Cottonwood-Willow
Desert
Ditches
Mesquite
Open Water
Parks
River Bottom
Sand and Gravel
Sonoran Desert
Soil Cement
Urban
Proposed Vegetative Cover
New Cottonwood-Willow
New Mesquite
New River Bottom
New Sonoran Desert
New Wetland
N
Miles
0
0.5
1
Mapped by:
Jones & Stokes
SALT RIVER PIMA-MARICOPA
INDIAN COMMUNITY (SRPMIC)
MESA
87
101
202
CANAL
INDIAN SCHOOL ROAD
THOMAS ROAD
MCDOWELL ROAD
MCKELLIPS ROAD
BROWN ROAD
DOBSON ROAD
ALMA SCHOOL ROAD
COUNTRY CLUB DRIVE
MESA DRIVE
STAPLEY DRIVE
GILBERT ROAD
LINDSAY ROAD
VAL VISTA DRIVE
GREENFIELD ROAD
HIGLEY ROAD
RECKER ROAD
POWER ROAD

3.3.1 ALTERNATIVE B

Vegetation Community Restoration

Under Alternative B, invasive plant species, primarily saltcedar, would be removed in the upper reaches of the project area and CW planted to discourage reestablishment of invasive species.

Native MS and SD vegetation would also be planted north and south of the GRUSP site and at the Hennessey Drain outlet.

In the middle reaches, a MS bosque would be created on a floodplain terrace at the outlet of the Evergreen Ditch, and SD vegetation would be planted along the south bank of the channel. Depending on water quality issues, SD vegetation may also be planted on a floodplain terrace north of the channel (Tri-City Landfill).

In the lower reaches of the project area, a small MS bosque and SD planting area would be constructed along the south bank of the channel near the Country Club Storm Drain.

Flow Conveyance Improvements, Diversion/Supply Structures and Irrigation

In the middle reaches of the project area, a low-flow channel and a spillway would be constructed to convey flow within the Gilbert Quarry. Riprap or soil cement would be placed on both sides of the spillway to prevent scouring and along the north bank of the channel to increase flow conveyance.

new diversion and/or supply structures would be constructed to provide irrigation water for the planting areas:

- five structures to divert agricultural tailwater and stormwater from the Evergreen Ditch and Hennessey Drain; and
- one new well located near the GRUSP site.

Irrigation water from new and existing sources would be distributed to the planting areas by a network of lined irrigation channels and underground pipes. The planting areas would be irrigated using either SBIN (composed of a network of shallow ditches), flood irrigation, or a drip irrigation system.

Rationale for Rejecting Alternative from Further Consideration

This alternative was rejected from further consideration because initial screening based on HGM modeling concluded it would not achieve the restoration objectives set forth in the purpose and need statement.

3.3.2 ALTERNATIVE C

Vegetation Community Restoration

Under Alternative C invasive plant species, primarily saltcedar, would be removed in the upper reaches of the project area and CW vegetation planted to discourage reestablishment of invasive species. Native CW, MS, and SD would also be planted along two water distribution channels downstream of the Hennessey Drain near the GRUSP site. A WT feature with CW vegetation would be created on the riverbed near the outlet of the Hennessey Drain.

In the middle reaches, SD, CW, and MS vegetation would be planted on the overbank area near the Gilbert Quarry, and a WT feature would be created at the Evergreen Ditch outlet. SD, CW, and MS vegetation would be planted around the WT feature to create a buffer from stormflows. Depending on water quality issues, SD vegetation may also be planted on a floodplain terrace north of the channel (Tri-City Landfill).

In the lower reaches of the project area, a small WT feature with SD, CW, and MS vegetation would be created near the Country Club Storm Drain.

Flow Conveyance Improvements, Diversion/Supply Structures and Irrigation

In the middle reaches of the project area, two water distribution channels would be created to convey irrigation and stormwater from the Hennessey Drain to downstream planting areas. A coarse rock berm would also be constructed near the Hennessey Drain outlet to protect the south bank from erosion during high flow events. Additionally, the Gilbert Quarry pit would be reshaped and a new river bottom created to convey flow. In the lower reaches, soil cement would be placed on the south bank between Country Club Road and Alma School Road to stabilize the bank and prevent future erosion.

Seven new diversion and/or supply structures would be constructed to provide irrigation water for the planting areas:

- six structures to divert agricultural tailwater and stormwater from the Evergreen Ditch and Hennessey Drain; and
- one new well located near the GRUSP site.

Irrigation water from new and existing sources would be distributed to the planting areas by a network of lined irrigation channels and underground pipes. The planting areas would be irrigated using either an SBIN composed of a network of shallow ditches, flood irrigation, or a drip irrigation system.

Rationale for Rejecting Alternative from Further Consideration

This alternative was rejected from further consideration because initial screening based on HGM modeling concluded it would not achieve the restoration objectives set forth in the purpose and need statement.

3.3.3 ALTERNATIVE D

Vegetation Community Restoration

Under Alternative D invasive plant species, primarily saltcedar, would be removed in the upper reaches of the project area and CW vegetation planted to discourage reestablishment of invasive species.

In the middle reaches, SD, CW, and MS vegetation would be planted on the overbank area near the Gilbert Quarry, and a WT feature would be created immediately west of Gilbert Road. CW and MS vegetation would be planted around the WT feature to create a buffer from stormflows. Depending on water quality issues, SD vegetation may also be planted on a floodplain terrace north of the channel (Tri-City Landfill).

In the lower reaches of the project area, a WT feature would be created within the main channel and a small strip of CW vegetation would be planted along the northern channel edge. An elongated WT feature with CW and MS vegetation would also be created along the south bank.

Flow Conveyance Improvements, Diversion/Supply Structures and Irrigation

In the middle reaches of the project area, the Gilbert Quarry pit and the river bottom would be reshaped to convey flow, and a grade control structure would be installed to control bed degradation and protect newly planted vegetation. Immediately downstream of the grade control structure, soil cement would be placed on the north bank (approximately 5,500 linear feet) to stabilize the bank and prevent future erosion.

Under this alternative, seven new diversion and/or supply structures would be constructed to provide irrigation water for the planting areas:

- six structures to divert agricultural tailwater and stormwater from the Evergreen Ditch and Hennessey Drain; and
- one new well located near the GRUSP site.

Irrigation water from new and existing sources would be distributed to the planting areas by a network of lined irrigation channels and underground pipes. The planting areas would be irrigated using either an SBIN composed of a network of shallow ditches, flood irrigation, or a drip irrigation system.

Rationale for Rejecting Alternative from Further Consideration

This alternative was rejected from further consideration because initial screening based on HGM modeling concluded it would not achieve the restoration objectives set forth in the purpose and need statement.

3.3.4 ALTERNATIVE G

Vegetation Community Restoration

Under Alternative G invasive plant species, primarily saltcedar, would be removed in the upper reaches of the project area and CW vegetation would be planted to discourage reestablishment of invasive species.

Native CW and MS vegetation would also be planted along two newly created water distribution channels located downstream of the Hennessey Drain. Additionally, a WT feature with CW vegetation would be created on the riverbed near the outlet of the Hennessey Drain.

In the middle reaches, CW and MS vegetation would be planted in and around the dry lakebed that would be created from the Gilbert Quarry pit, and a WT feature would be created at the Evergreen Ditch outlet. CW and MS vegetation would be planted around the WT feature to create a buffer from stormflows. CW and MS vegetation would also be planted along the banks of the newly created diversion channels as they extend downstream. Depending on water quality issues, SD vegetation may also be planted on a floodplain terrace north of the channel (Tri-City Landfill).

In the lower reaches of the project area, a WT feature would be created on the existing river bottom near the Country Club Storm Drain. CW and MS vegetation would be planted around the WT feature to create a buffer from stormflows. A second WT feature would be created near Alma School Road, downstream of the old quarry.

Flow Conveyance Improvements, Diversion/Supply Structures and Irrigation

In the middle reaches of the project area, two water distribution channels would be created to convey irrigation water and stormwater from the Hennessey Drain. A coarse rock berm would also be constructed near the Hennessey Drain outlet to protect the south bank from erosion during high flow events. Additionally, the Gilbert Quarry pit would be filled and reshaped, and four spillways would be constructed to convey flow. Riprap or soil cement would be placed on both sides of the spillways to prevent scouring and along the north bank of the channel to increase flow conveyance.

Downstream of the quarry the main channel would be reshaped to create river bottom and increase channel conveyance capacity. Soil cement would be placed along the south bank to protect Lehi Cemetery. In the lower reaches, soil cement would be placed on the south bank between Country Club Road and Alma School Road to stabilize the bank and prevent future erosion.

Ten new diversion and/or supply structures would be constructed to provide irrigation water for the planting areas:

- nine structures to divert agricultural tailwater and stormwater from the Evergreen Ditch and Hennessey Drain; and
- one new well located near the GRUSP site.

Irrigation water from new and existing sources would be distributed to the planting areas by a network of lined irrigation channels and underground pipes. The planting areas would be irrigated using either an SBIN composed of a network of shallow ditches, flood irrigation, or a drip irrigation system.

Rationale for Rejecting Alternative from Further Consideration

This alternative was rejected from further consideration because initial screening based on HGM modeling concluded it would not achieve the restoration objectives set forth in the purpose and need statement.

3.3.5 ALTERNATIVE H

Vegetation Community Restoration

Under Alternative H invasive plant species, primarily saltcedar, would be removed in the upper reaches of the project area and CW vegetation would be planted to discourage reestablishment of invasive species. Native MS and SD vegetation would be planted along two newly created water distribution channels downstream of the Hennessey Drain. Additionally, a WT feature with MS vegetation would be created on the riverbed near the outlet of the Hennessey Drain.

In the middle reaches, CW and MS vegetation would be planted in and around the dry lakebed that would be created from the Gilbert Quarry pit, and a WT feature would be created at the Evergreen Ditch outlet. MS and a small amount of CW vegetation would be planted around the WT feature to create a buffer from stormflows. MS vegetation would also be planted along the banks of the newly created diversion channels as they extend downstream. Depending on water quality issues, SD and MS vegetation may also be planted on a floodplain terrace north of the channel (Tri-City Landfill).

In the lower reaches of the project area, a WT feature would be created on the existing river bottom near the Country Club Storm Drain. MS and SD vegetation would be planted around the WT feature to create a buffer from stormflows. A second WT feature would be created near Alma School Road, downstream of the old quarry.

Flow Conveyance Improvements, Diversion/Supply Structures and Irrigation

In the middle reaches of the project area, two water distribution channels would be created to convey irrigation and stormwater from the Hennessey Drain. A coarse rock berm would also be constructed near the Hennessey Drain outlet to protect the south bank from erosion during high flow events. Additionally, the Gilbert Quarry pit would be filled and reshaped, and a spillway would be constructed to convey flow. Riprap or soil cement would be placed on both sides of the structure to prevent scouring and along the north bank of the channel to increase flow conveyance.

Downstream of the quarry the main channel would be reshaped to create river bottom and increase channel conveyance capacity. Soil cement would be placed along the south bank to protect Lehi Cemetery. In the lower reaches, soil cement would be placed on the south bank between Country Club Road and Alma School Road to stabilize the bank and prevent future erosion.

Flow Conveyance Improvements, Diversion/Supply Structures and Irrigation

Ten new diversion and/or supply structures would be constructed to provide irrigation for the planting areas:

- nine structures to divert agricultural tailwater and stormwater from the Evergreen Ditch and Hennessey Drain; and
- one new well located near the GRUSP site.

Irrigation water from new and existing sources would be distributed to the planting areas by a network of lined irrigation channels and underground pipes. The planting areas would be irrigated using either an SBIN composed of a network of shallow ditches, flood irrigation, or a drip irrigation system.

Rationale for Rejecting Alternative from Further Consideration

This alternative was rejected from further consideration because initial screening based on HGM modeling concluded it would not achieve the restoration objectives set forth in the purpose and need statement.

3.3.6 ALTERNATIVE I

Vegetation Community Restoration

Under Alternative I invasive plant species, primarily saltcedar, would be removed in the upper reaches of the project area and CW vegetation would be planted to discourage reestablishment of invasive species.

In the middle reaches, SD vegetation would be planted on benches along the newly created low-flow channel extending downstream from the Hennessey Drain to Gilbert Road, and two pockets of CW vegetation would be planted on terraces immediately above the 5-year floodplain. Additionally, a WT feature bordered by CW vegetation would be created on the riverbed near the outlet of the Hennessey Drain.

In the middle reaches, CW vegetation would be planted in the reshaped Gilbert Quarry pit, and WT features would be created within the channel. CW and MS vegetation would be planted around the WT features to create a buffer from stormflows.

In the lower reaches of the project area, WT features would be created at the upstream and downstream (Alma School Road) ends of the low-flow channel. Strips of CW vegetation would be planted along the channel to create a buffer from stormflows.

Flow Conveyance Improvements, Diversion/Supply Structures and Irrigation

In the middle reaches of the project area, a low-flow channel would be constructed from the downstream end of the Hennessey Drain to Gilbert Road to increase flow conveyance capacity. Buried dikes would be constructed in the overbank area to control lateral movement of the low-flow channel. A coarse rock berm would also be constructed near the Hennessey Drain outlet to protect the newly created wetland and the south bank from erosion during high flow events.

Farther downstream, the Gilbert Quarry pit would be reshaped to create river bottom, and the north bank would be set back and armored with riprap or soil cement to prevent scouring and increase flow conveyance. Downstream of the quarry the main channel would be reshaped to create river bottom and increase channel conveyance capacity, and grade control structures would be installed to control bed degradation and protect newly planted vegetation. Soil cement would also be placed along the south bank (approximately 5,500 linear feet) to protect the island immediately south of the Gilbert Quarry.

In the lower reaches, soil cement would be placed on the south bank between Country Club Road and Alma School Road to stabilize the bank and prevent future erosion, and buried dikes would be constructed in the overbank area to control lateral movement of the low-flow channel.

Nine new diversion and/or supply structures would be constructed to provide agricultural tailwater and stormwater from the Evergreen Ditch and Hennessey Drain to the planting areas.

Irrigation water from new and existing sources would be distributed to the planting areas by a network of lined irrigation channels and underground pipes. The planting areas would be irrigated using either an SBIN composed of a network of shallow ditches, flood irrigation, or a drip irrigation system.

Rationale for Rejecting Alternative from Further Consideration

This alternative was rejected from further consideration because initial screening based on HGM modeling concluded it would not achieve the restoration objectives set forth in the purpose and need statement.

3.3.7 ALTERNATIVE J

Vegetation Community Restoration

Under Alternative J invasive plant species, primarily saltcedar, would be removed in the upper reaches of the project area and CW vegetation planted to discourage reestablishment of invasive species.

In the middle reaches, CW and MS vegetation would be planted along the main channel near the GRUSP site, and CW vegetation would be planted in the abandoned quarry depression directly east of Gilbert Road. A WT feature bordered by CW vegetation would also be created on the riverbed near the outlet of the Hennessey Drain. SD, MS, and CW vegetation would be planted in the reshaped Gilbert Quarry pit. Near Gilbert Road a WT feature would be created and the south bank would be planted with MS and CW vegetation. Depending on water quality issues, SD and MS vegetation may also be planted on a floodplain terrace north of the channel (Tri-City Landfill).

In the lower reaches of the project area, a WT feature would be created on the existing river bottom near the Country Club Storm Drain. Two small pockets of CW vegetation would be planted near the WT feature to create a buffer from stormflows. A second WT feature surrounded by CW vegetation would be created near Alma School Road, downstream of the old quarry.

Flow Conveyance Improvements, Diversion/Supply Structures and Irrigation

In the middle reaches of the project area, the abandoned quarry east of Gilbert Road would be reshaped to create river bottom, and the south bank would be armored with soil cement to prevent erosion. A coarse rock berm would be constructed near the Hennessey Drain outlet to protect the newly created wetland and the south bank from erosion during high flow events.

Farther downstream, the Gilbert Quarry pit would be reshaped to create river bottom, and the south bank (approximately 5,500 linear feet) would be armored with soil cement to prevent erosion. The main channel, downstream of the Evergreen Drain outlet, would be reshaped to create river bottom and increase channel conveyance capacity.

In the lower reaches, a drainage channel would be constructed to supply irrigation water to planting areas, and the abandoned quarry would be reshaped to create river bottom. Soil cement would also be placed on the south bank between Country Club Road and Alma School Road to stabilize the bank and prevent future erosion.

Twelve new diversion and/or supply structures would be constructed to provide irrigation water for the planting areas:

- Eleven structures to divert agricultural tailwater and stormwater from the Evergreen Ditch and Hennessey Drain; and
- one new well located near the GRUSP site.

Irrigation water from new and existing sources would be distributed to the planting areas by a network of lined irrigation channels and underground pipes. The planting areas would be irrigated using either an SBIN composed of a network of shallow ditches, flood irrigation, or a drip irrigation system.

Rationale for Rejecting Alternative from Further Consideration

This alternative was rejected from further consideration because initial screening based on HGM modeling concluded it would not achieve the restoration objectives set forth in the purpose and need statement.

3.3.8 ALTERNATIVE K

Vegetation Community Restoration

Under Alternative K invasive plant species, primarily saltcedar, would be removed in the upper reaches of the project area and CW vegetation planted to discourage reestablishment of invasive species.

In the middle reaches, CW and MS vegetation would be planted along the North channel bank near the GRUSP site, and a WT feature would be created on the riverbed near the outlet of the Hennessey Drain. CW vegetation would be planted around the WT feature to provide a buffer against stormflows. SD, MS, and CW vegetation would be planted in the overbank areas, and a WT feature would be created at the Evergreen Drain outlet. WT features would also be created near Gilbert Road and planted with MS and CW vegetation to create buffers from stormflows. Depending on water quality issues, SD and MS vegetation may also be planted on a floodplain terrace north of the channel (Tri-City Landfill). Additionally, a WT feature with CW and MS vegetation would be created along the south bank.

In the lower reaches of the project area, a WT feature would be created on the existing river bottom near the Country Club Storm Drain. Two small pockets of CW vegetation would be planted near the WT feature to create a buffer from stormflows. A second WT feature surrounded by CW vegetation would be created near Alma School Road, downstream of the old quarry.

Flow Conveyance Improvements, Diversion/Supply Structures and Irrigation

In the middle reaches of the project area, a coarse rock berm would be constructed near the Hennessey Drain outlet to protect the newly created wetland and the south bank from erosion during high flow events. In the lower reaches, a drainage channel would be constructed to supply irrigation water to downstream planting areas.

Twelve new diversion and/or supply structures would be constructed to provide irrigation water for the planting areas:

- eleven structures to divert agricultural tailwater and stormwater from the Evergreen Ditch and Hennessey Drain; and
- one new well located near the GRUSP site.

Irrigation water from new and existing sources would be distributed to the planting areas by a network of lined irrigation channels and underground pipes. The planting areas would be irrigated using either an SBIN composed of a network of shallow ditches, flood irrigation, or a drip irrigation system.

Rationale for Rejecting Alternative from Further Consideration

This alternative was rejected from further consideration because initial screening based on HGM modeling concluded it would not achieve the restoration objectives set forth in the purpose and need statement.

3.3.9 ALTERNATIVE L

Vegetation Community Restoration

Under Alternative L invasive plant species, primarily saltcedar, would be removed in the upper reaches of the project area and CW vegetation would be planted to discourage reestablishment of invasive species.

In the middle reaches, CW and MS vegetation would be planted along the main channel near the GRUSP site, and two WT features would be created on the riverbed near the Hennessey Drain outlet. WT features would be created near Gilbert Road and upstream of the Evergreen Drain outlet. CW vegetation would be planted around the WT features to provide a buffer against stormflows and in designated areas along the channel banks.

In the lower reaches of the project area, a WT feature would be created on the existing river bottom near the Country Club Storm Drain. Two small pockets of CW vegetation would be planted near the WT feature to create a buffer from stormflows. A second WT feature surrounded by CW vegetation would be created near Alma School Road, downstream of the old quarry.

Flow Conveyance Improvements, Diversion/Supply Structures and Irrigation

In the middle reaches of the project area, the abandoned quarry east of Gilbert Road would be reshaped to create river bottom, and the south bank would be armored with soil cement or riprap to prevent erosion and increase flow conveyance capacity. A grade control structure would be constructed in center of the abandoned quarry to prevent bed degradation, and to protect the Gilbert Road Bridge and newly planted vegetation. Soil cement would also be placed on the south bank between Country Club Road and Alma School Road to stabilize the bank and prevent future erosion.

Eight new diversion and/or supply structures would be constructed to provide irrigation water for the planting areas:

- seven structure to divert agricultural tailwater and stormwater from the North Canal;
- one new well located near the GRUSP site.

Irrigation water from new and existing sources would be distributed to the planting areas by a network of lined irrigation channels and underground pipes. The planting areas would be irrigated using either an SBIN composed of a network of shallow ditches, flood irrigation, or a drip irrigation system.

Rationale for Rejecting Alternative from Further Consideration

This alternative was rejected from further consideration because initial screening based on HGM modeling concluded it would not achieve the restoration objectives set forth in the purpose and need statement.

3.3.10 ALTERNATIVE M

Vegetation Community Restoration

Under Alternative M invasive plant species, primarily saltcedar, would be removed in the upper reaches of the project area and CW vegetation would be planted to discourage reestablishment of invasive species.

In the middle reaches, WT features would be created on the upper channel banks and on the riverbed near the Hennessey Drain outlet. CW vegetation would be planted around the WT features to provide a buffer against stormflows. The abandoned quarry depression directly east of Gilbert Road would also be planted with CW vegetation. WT features would be located on the upper channel bank near Gilbert Road, at the Evergreen Drain outlet, and along the south bank. WT features would be planted with MS and CW vegetation to create buffers from stormflows. Depending on water quality issues, SD and MS vegetation may also be planted on a floodplain terrace north of the channel (Tri-City Landfill). Additionally, a series of WT features would be created along the south bank and planted with CW and MS vegetation.

In the lower reaches of the project area, a WT feature would be created on the existing river bottom near the Country Club Storm Drain. Two small pockets of CW vegetation would be planted near the WT feature to create a buffer from stormflows. A second WT feature surrounded by CW vegetation would be created near Alma School Road, downstream of the old quarry.

Flow Conveyance Improvements, Diversion/Supply Structures and Irrigation

In the middle reaches of the project area, the abandoned quarry on the south bank upstream of Gilbert Road would be reshaped to create river bottom, and the south bank would be armored with soil cement to prevent erosion. A coarse rock berm would be constructed near the Hennessey Drain outlet to protect the newly created wetland and the south bank from erosion during high flow events.

Farther downstream, the Gilbert Quarry pit would be reshaped to create river bottom, and a grade control structure would be constructed in the center of the quarry pit to prevent bed degradation, and to protect the Gilbert Road Bridge and newly planted vegetation. Additionally, the south bank (approximately 5,500 linear feet) would be armored with soil cement to prevent erosion. In the lower reaches, a drainage channel would be constructed to supply irrigation to planting areas.

Twelve new diversion and/or supply structures would be constructed to provide irrigation water for the planting areas:

- eleven structure to divert agricultural tailwater and stormwater from the Evergreen Ditch and Hennessey Drain; and
- one new well located near the GRUSP site.

Irrigation water from new and existing sources would be distributed to the planting areas by a network of lined irrigation channels and underground pipes. The planting areas would be irrigated using either an SBIN composed of a network of shallow ditches, flood irrigation, or a drip irrigation system.

Rationale for Rejecting Alternative from Further Consideration

This alternative was rejected from further consideration because initial screening based on HGM modeling concluded it would not achieve the restoration objectives set forth in the purpose and need statement.

3.3.11 ALTERNATIVE N

Non-Structural Measures

Under Alternative N the following non-structural measures would be implemented individually or in combination.

- allocation of water for restoration;
- zoning controls;
- elimination of gravel mining;
- best management practices (BMPs);
- land set-asides; and
- re-operation of upstream dams.

Rationale for Rejecting Alternative from Further Consideration

This alternative was rejected from further consideration because initial screening based on HGM modeling concluded it would not achieve the restoration objectives set forth in the purpose and need statement.

3.4 RECREATION OPTIONS

3.4.1 INTRODUCTION

The goal of the recreation component is to provide opportunities for visitors of all ages, abilities, and backgrounds to enjoy this unique resource while developing an awareness, knowledge, and understanding of desert riparian habitat and its relationship to the surrounding environment. Additionally, it presents an opportunity to acknowledge and understand the influence of the Salt River on the environment and cultures throughout the Valley's history. Visitors to potential recreation facilities along the study area reach could participate in a variety of pursuits from enjoying scenic views, picnicking with the family, learning about the habitat, or exploring the resource on foot, by bicycle, or on horseback.

Recreational components that were considered for this project have been limited to trails and a Cultural Center. More aggressive recreational components, such as recreational lakes, sporting centers, sports fields, etc., were rejected as out of harmony with the character of this project. The following section discusses the general nature of the planned trails. Section 3.4.3 discusses the Cultural Center. Later sections discuss how various trail alignments were combined with the Cultural Center to create recreation plan alternatives, referred to herein as "Recreation Options." Three options are then presented for consideration.

3.4.2 TRAILS

3.4.2.1 Description of Trail Amenities

The trails are proposed as multi-use trails, available for access by pedestrians, bicyclists, wheelchairs, and equestrians. Motorized vehicles would be prohibited, with the exception of project maintenance vehicles and motorized wheelchairs.

Access to the trails would be available to both SRPMIC Community members and also to non-Community members. Use of the trails would be limited to daylight hours and after dark lighting will not be available along the trails or at the rest stops.

The following design elements are currently anticipated for the trails:

- 12-foot wide dirt trail/path surfaced with decomposed granite, crushed aggregate or similar
- Trail lined with boulders or curbing to define the trail location. (Curbing along both sides of the trail assumed for costing purposes)
- Parking lot and trailhead with appropriate signage at major access points. For costing purposes, one such parking lot is assumed for every four trail miles.
- Mileage markers every 1/4 mile
- Plaques or similar markers or signs at significant project feature locations to educate the public relative to cultural, biological or environmental aspects of the project.
- Concrete benches approximately every quarter mile
- Rest stops spaced at approximately one per mile, each perhaps overlooking a significant project feature. Each rest stop is currently envisioned as including a 12'x12' shade structure constructed on a concrete pad, one metal picnic table, two trash receptacles, a bike stand, low height masonry wall, and a stand alone plaque or other signage to discuss a nearby project feature or to present other historical, cultural or educational material.
- As appropriate, incorporate art that highlights the cultural, historical or environmental aspects of the project into the design of such things as bike racks, rest stations, shade structures, signage, etc.
- Gates at the major access points, so that the trails can be closed at night and/or during maintenance activities.
- Guard posts or other barriers at access points to prevent unauthorized vehicular access.
- No fencing is currently contemplated.
- Signage at major street crossings, both to identify the street and to identify the trail.
- At bridged crossings, the trail will cross under the bridge to avoid conflict with vehicular traffic on the roadways. At unbridged crossings (e.g., McKellips Road), the project will include construction of a refuge island in the middle of the roadway as a zone of

protection for pedestrians. The project will not include pedestrian overpass bridges or traffic signals for pedestrian access.

Potable water is not available within the project boundaries. Therefore, drinking fountains and restrooms are not included.

Where possible, the trails have been designed to connect with the City of Mesa's existing trail system along the canals within the City of Mesa. Refer to Figure 3-10 for the City of Mesa's existing trail system.

3.4.2.2 Construction Costs for the Trails

The estimated construction cost of the trails, including the amenities described in the foregoing section and including design and construction contingencies, is approximately $270,000 per trail mile. More detailed information on trail construction costs is provided in the Appendix E of the final feasibility study report.

3.4.2.3 Operation and Maintenance Costs for the Trails

Based on City of Mesa experience with their trails, the operation and maintenance costs for the trails are anticipated to be approximately $50,000 per year per trail mile.

3.4.2.4 Trail Visitation Rates

The City of Mesa has several trails that are similar in design and use to the trails proposed for the project. There currently are no recorded data available for usage rates on the existing City of Mesa trails. Visitation estimates provided herein are based on City of Mesa Parks and Recreation staffers personal observations and estimates of trail use.

The City of Mesa Parks and Recreation staffers estimate that approximately 30 people per day will use each project trail mile in the summer (for the purposes of this section, "summer" is defined as June through September) and 45 people per day per trail mile in the winter (i.e., the rest of the year). This equates to an average usage rate for the entire year of approximately 40 people per day per trail mile.

The City of Mesa Parks and Recreation staffers also provided the following additional information about anticipated, estimated peak usage rates on the trail system. Peak days for trail usage are Saturday and Sunday. Peak hours for trail usage are estimated to be between 6 a.m. and 9 a.m. and again between 3 p.m. and 6 p.m. The table below summarizes estimated usage during different peak and non-peak periods.

Table 3-9. Estimated Trail Usage

Trail Usage Period	Visitors
Average Winter Month Usage	45 users per day
Average Summer Month Usage	30 users per day
Usage Averaged Year-Round	40 users per day
Winter Peak Days (Sat & Sun)	70 users per day
Winter Non-Peak Days (weekdays)	35 users per day
Peak Hour on Peak Day in Winter	7.8 users per hour
Non-Peak Hour on Peak Day in Winter	3.9 users per hour
Peak Hour on Non-Peak Day in Winter	3.9 users per hour
Non-Peak Hour on Non-Peak Day in Winter	1.9 users per hour
Summer Peak Days (Sat & Sun)	46.7 users per day
Summer Non-Peak Days (weekdays)	23.4 users per day
Peak Hour on Peak Day in Summer	5.2 users per hour
Non-Peak Hour on Peak Day in Summer	2.6 users per hour
Peak Hour on Non-Peak Day in Summer	2.6 users per hour
Non-Peak Hour on Non-Peak Day in Summer	1.3 users per hour

3.4.3 CULTURAL CENTER

3.4.3.1 Description of Cultural Center

The concept for the Cultural Center comes from a programming document for a "Museum and Cultural Center," as provided to the project team by SRPMIC staff ("Museum and Cultural Center Conceptual Design 20% Submittal" by David N. Sloan and Associates, StastnyBrun Architects, Inc., and Native American Design Collaborative). The programming document discusses a complex of several buildings that, taken together, comprise the Museum and Cultural Center (hereafter referred to only as the "Cultural Center"). Figure 3-11 shows the proposed layout of the Cultural Center. The individual buildings listed in the programming document are shown below with their estimated square footages.

City of Mesa Parks and Recreation Multiuse Path Master Plan

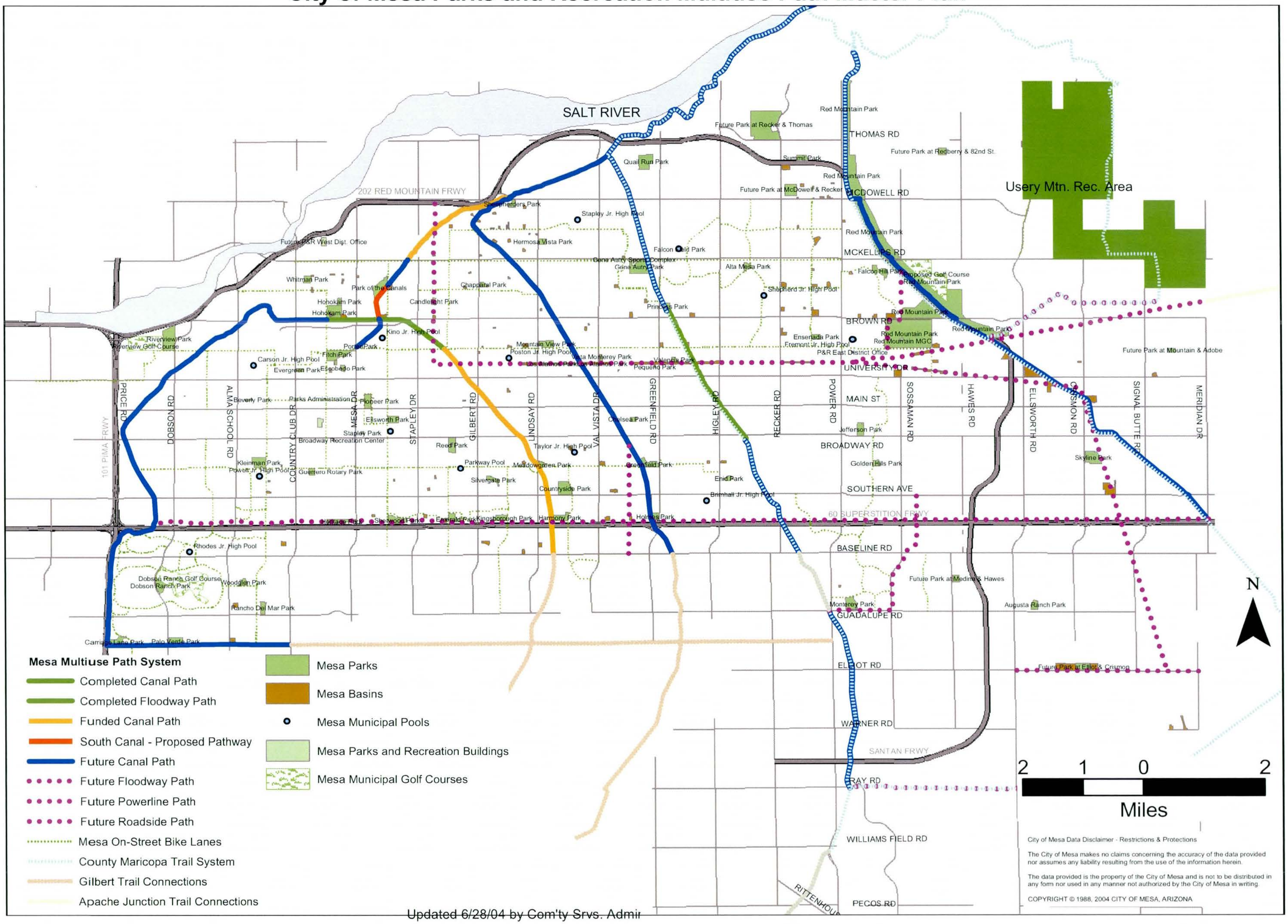


Figure 3-10

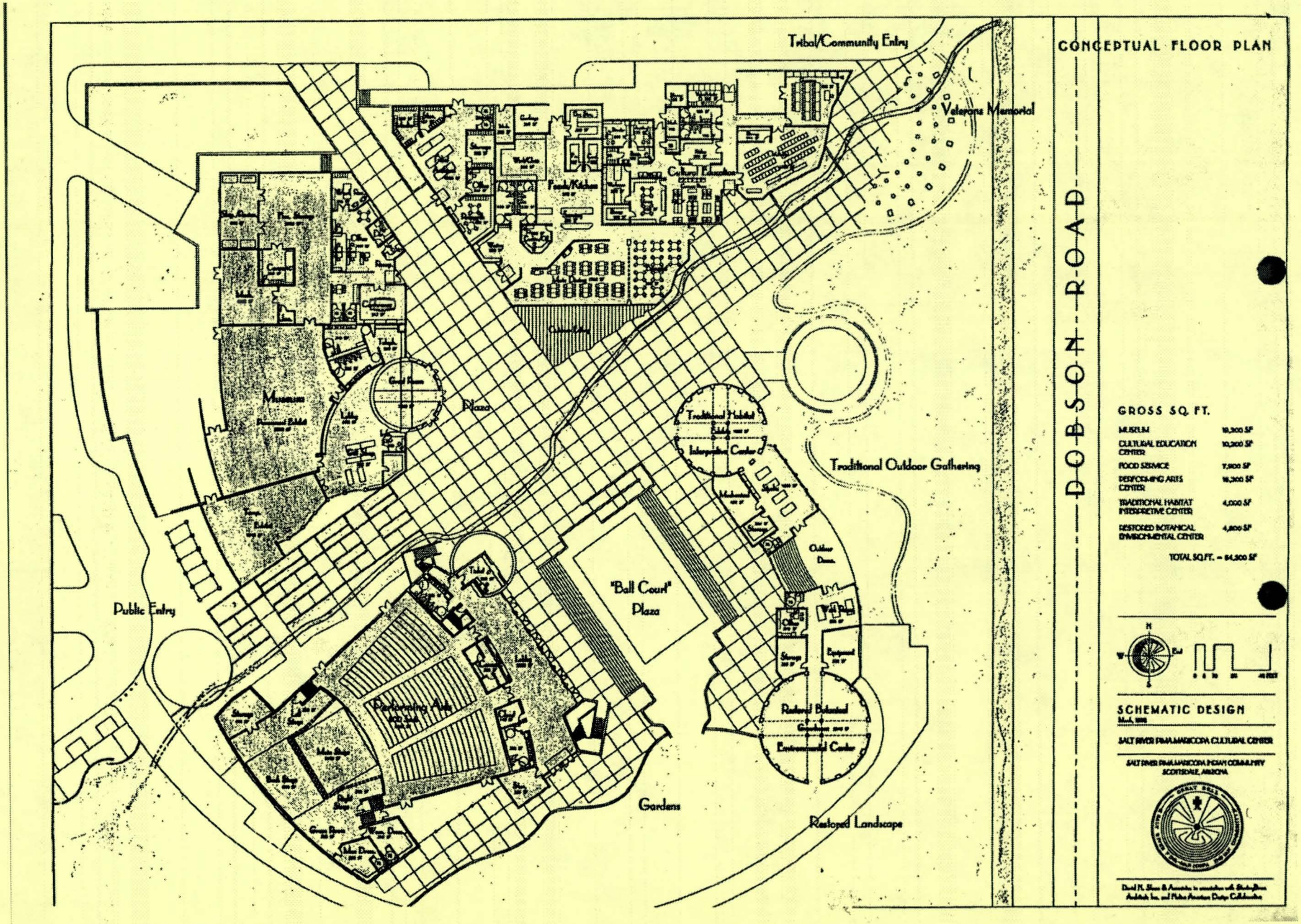

CONCEPTUAL FLOOR PLAN
Tribal/Community Entry
Veterans Memorial
DOBSON ROAD
Plaza
Museum
Traditional Outdoor Gathering
"Ball Court" Plaza
Public Entry
Performing Arts
Gardens
Restored Landscape
GROSS SQ. FT.
MUSEUM
CULTURAL EDUCATION CENTER
FOOD SERVICE
PERFORMING ARTS CENTER
TRADITIONAL HABITAT INTERPRETIVE CENTER
RESTORED BOTANICAL ENVIRONMENTAL CENTER
SCHEMATIC DESIGN
SALT RIVER PIMA-MARICOPA CULTURAL CENTER
SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY
SCOTTSDALE, ARIZONA

Figure 3-11

Table 3-10. Square Footage of Cultural Center Buildings

Buildings Included in the Programming Document	Estimated Square Footage
Museum	19,200
Cultural Education Center	10,200
Performing Arts Center	18,200
Food Services	7,900
Traditional Habitat Interpretive Center	4,000
Restored Environmental/Botanical Center	4,800
Total Square Footage	64,300

The project trail system will have ties and connections to the Cultural Center. Refer to the attached recreation option plans.

3.4.3.2 Costs and Eligibility for Cost-Sharing

Not all elements within the Museum and Cultural Center complex are eligible for cost sharing by the Corps. A list of cost-sharable items is given below with the estimated costs of each element.

Table 3-11. Cultural Center: Preliminary Estimate of Cost-Sharable Elements

Design Element	Additional Comments	Estimated Costs
Museum: Restrooms (only) in the Museum or as a stand-alone building	Restrooms are a support feature for the trail system	615SF x $100/SF = $61,500
Habitat Interpretive Center: Outdoor demonstration area only	Exact character of the outdoor demonstration area not yet determined	1050 SF x $15/SF for hardscape = $15,750
Ramadas and Outdoor Shelters	None	1 each x $15,000/ea = $15,000 (other ramadas are already built into the cost of the project trails)
Access Road and Parking	Limit cost to a small parking lot to support the trailhead, not the full cost of the parking lot for the Cultural Center	Estimated $10,000 for a small (12 cars) asphalt paved parking lot
Utilities	Portion of the overall utility installation costs for the Cultural Center to support the restrooms	Estimated $20,000 for restroom utilities
Electrical lighting	For the parking lot, restrooms and ramadas	$15,000
Miscellaneous: Picnic Tables Trash Receptacles Benches Signs	None	4 each x $2,000/ea = $8,000 8 each at $160/ea = $1,280 5 each at $600/ea = $3,000 10 each at $120/ea = $1,200
Total Estimated Construction Cost of Cost-Sharable Improvements		$150,730

As shown in Table 3-11, the construction cost for cost-sharable items at the Cultural Center are anticipated to be in the range of $100,000 - $200,000. For reference only, according to the programming document, the total construction cost of the entire Cultural Center complex is estimated to be $10,978,600.

For the purposes of this report, it is assumed that Corps participation in the Cultural Center will be limited to the elements listed in the table above and that the non-federal sponsor will provide other funding to allow the remainder of the Cultural Center to be added to the project during the Preliminary Engineering Design (PED) phase as a "betterment." The "betterment" will be entirely locally funded. The portion of the Cultural Center included in the project during the feasibility phase is limited to the cost-sharable items. The cost-sharable items (taken alone) are referred to hereafter as the "restroom/ramada facility," but it shall be understood that such term includes the parking lot and other associated improvements listed in the table above. Furthermore, where the recreation plans show a "Cultural Center," it shall be understood to mean a cost-sharable "restroom/ramada" facility that will be upgraded during PED to a Cultural Center (via a locally funded "betterment").

3.4.3.3 Operation and Maintenance Costs for the Cultural Center

The operation and maintenance costs discussed previously for the trail system ($50,000 per trail mile per year) are adequate to cover the minimal O&M costs for the restroom/ramada facility. The O&M costs for the upgraded Cultural Center are immaterial, since the upgrade to a full Cultural Center will be a "betterment" fully funded by the local sponsor. Economic justification for said "betterment" is not required in the feasibility study.

3.4.3.4 Visitation Rates for the Cultural Center

For the purposes of the feasibility study, visitation numbers will not be credited to the restroom/ramada facility as a stand-alone feature. (By itself, the restroom/ramada facility has little very "draw.") For the purposes of the feasibility study, the restroom/ramada facility is viewed as being part of the trail system, and will be justified based on the visitation numbers for the trail system.

Visitations for the upgraded Cultural Center are immaterial since economic justification of said "betterment" is not required in the feasibility study.

3.4.3.5 Location for the Cultural Center

In past iterations of this report, the Cultural Center has been shown at the southeast corner of the intersection of Dobson Road and McKellips Road, with an alternative location at the southwest corner of Gilbert Road and the Beeline Highway. The Corps has since ruled that the Cultural Center must be within the limits of the river restoration project to be eligible for cost sharing by the Corps. Therefore, the location at Dobson Road and McKellips Road has been discarded in favor of the location at the intersection of Gilbert Road and the Beeline Highway.

3.4.4 RECREATIONAL OPTIONS

Three recreation options are presented herein for consideration. Each option includes the Cultural Center location at the southwest corner of Gilbert Road and Beeline Highway and varies the trail alignments.

3.4.4.1 Option A

In Option A (Figure 3-12) , a trail on the west end of the project would connect to the City of Mesa's Riverview Park where an existing underpass under the freeway is located. It would also connect to Dobson Road at the existing Dobson Road freeway underpass. From these connection points, trail users could proceed south on Dobson Road (using existing bike paths and sidewalks within the Dobson Road right-of-way) to connect to the City of Mesa's existing trail system along the Tempe Canal. The City of Mesa's existing trail system is shown in Figure 3-10 for reference.

In Option A, a trail on the south side of the river between Gilbert Road and Val Vista Drive would serve to connect residents living north of the Red Mountain Freeway (the 202 Freeway) to the City of Mesa's existing trail system along the South Canal. At Gilbert Road, trail users could use sidewalks and bike paths within the Gilbert Road right-of-way to access South Canal to the south. At Val Vista Drive, the trail would tie in to the South Canal at the existing underpass for the canal under the freeway. Thus, connection to the South Canal trail would be complete. Option A also includes placement of a Cultural Center at the southwest corner of the intersection of Beeline Highway and Gilbert Road. A trail is included along Gilbert Road from the Cultural Center to Thomas Road. This connector trail would allow residents living south of the river to more easily access the Cultural Center and would also provide a tie between the Cultural Center and the trail along the south side of the river discussed above.

Option A would include the development of approximately 7.8 miles of trails.

3.4.4.2 Option B

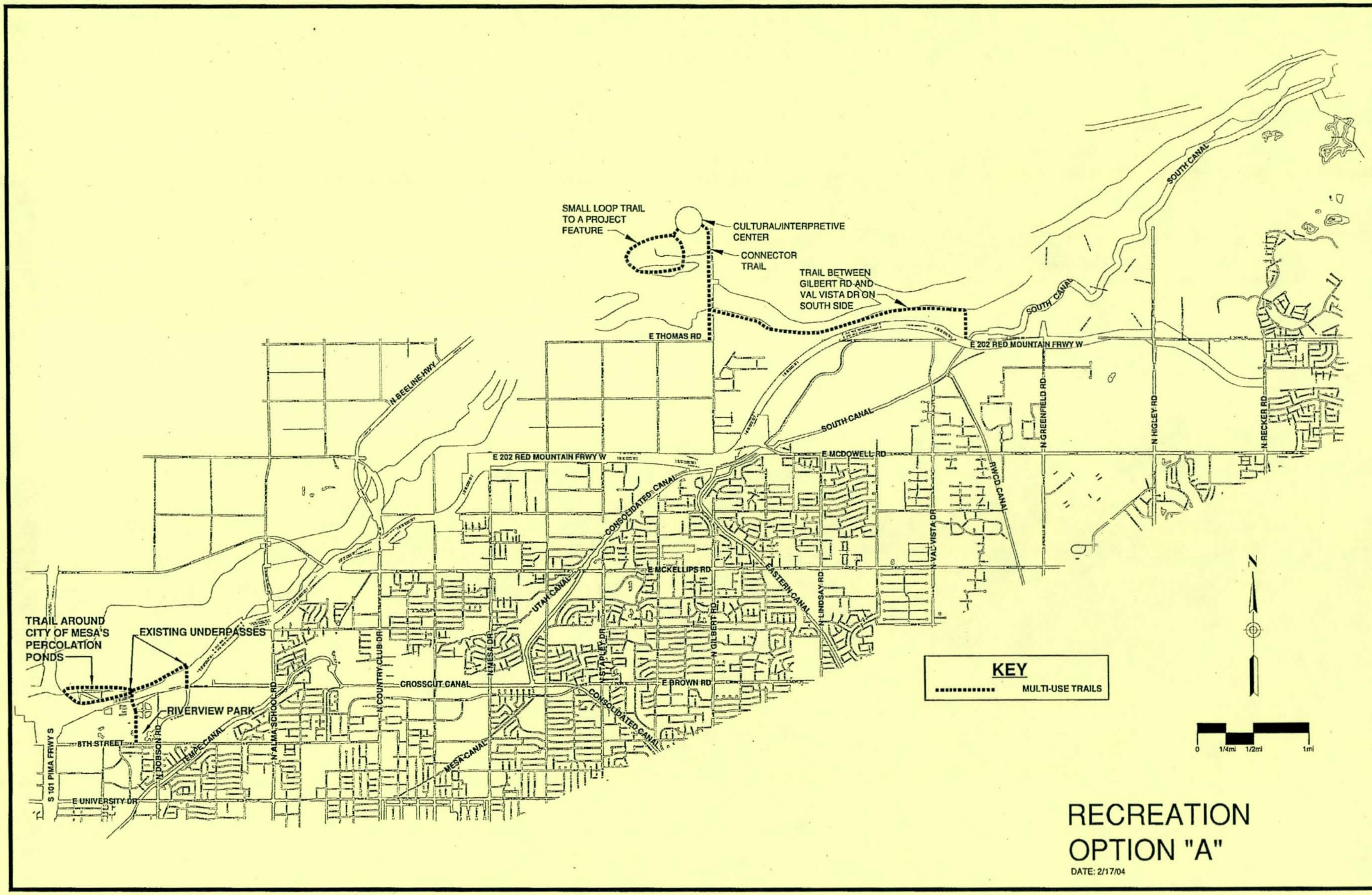
Option B is the same as Option A, with the exception that it deletes the trail on the south side of the river between Gilbert Road and Val Vista Drive (Figure 3-13). This option offers the fewest recreational opportunities of the three options that are presented, but is also the least costly.

Option B would include the development of approximately 5.1 miles of trails.

3.4.4.3 Option C

Option C includes all of the features of Option A, plus a continuous trail on the south side of the river between the Pima/Price Freeway (SR 101) and Val Vista Drive (Figure 3-14). Of the three options, this option provides the most recreational opportunities. It provides for connectivity to the City of Mesa's existing trail systems on the east and west ends of the project and for connection to the arterial street grid.

Option C would include the development of approximately 13.6 miles of trails.



RECREATION
OPTION "A"
DATE: 2/17/04

Figure 3-12

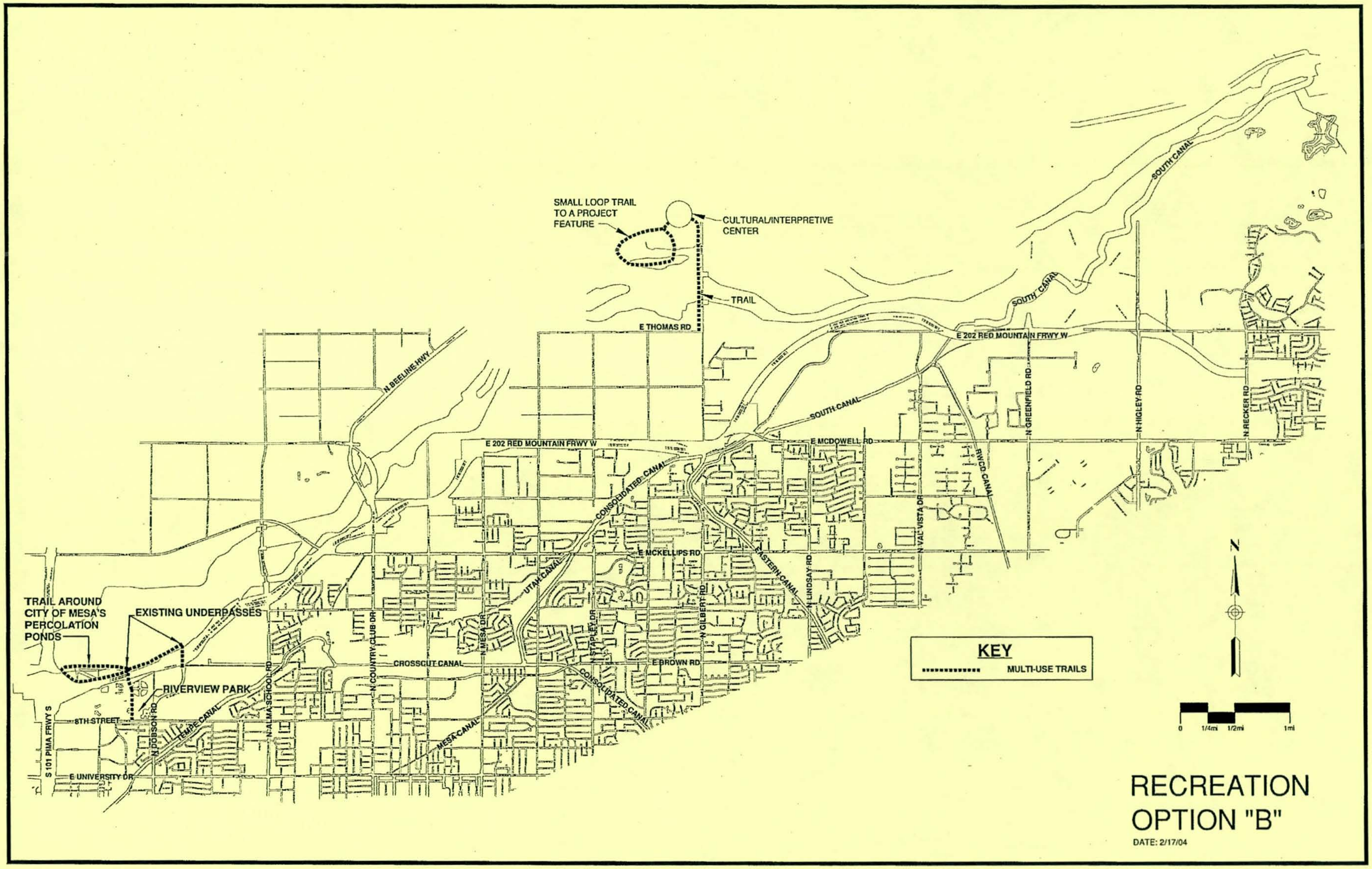
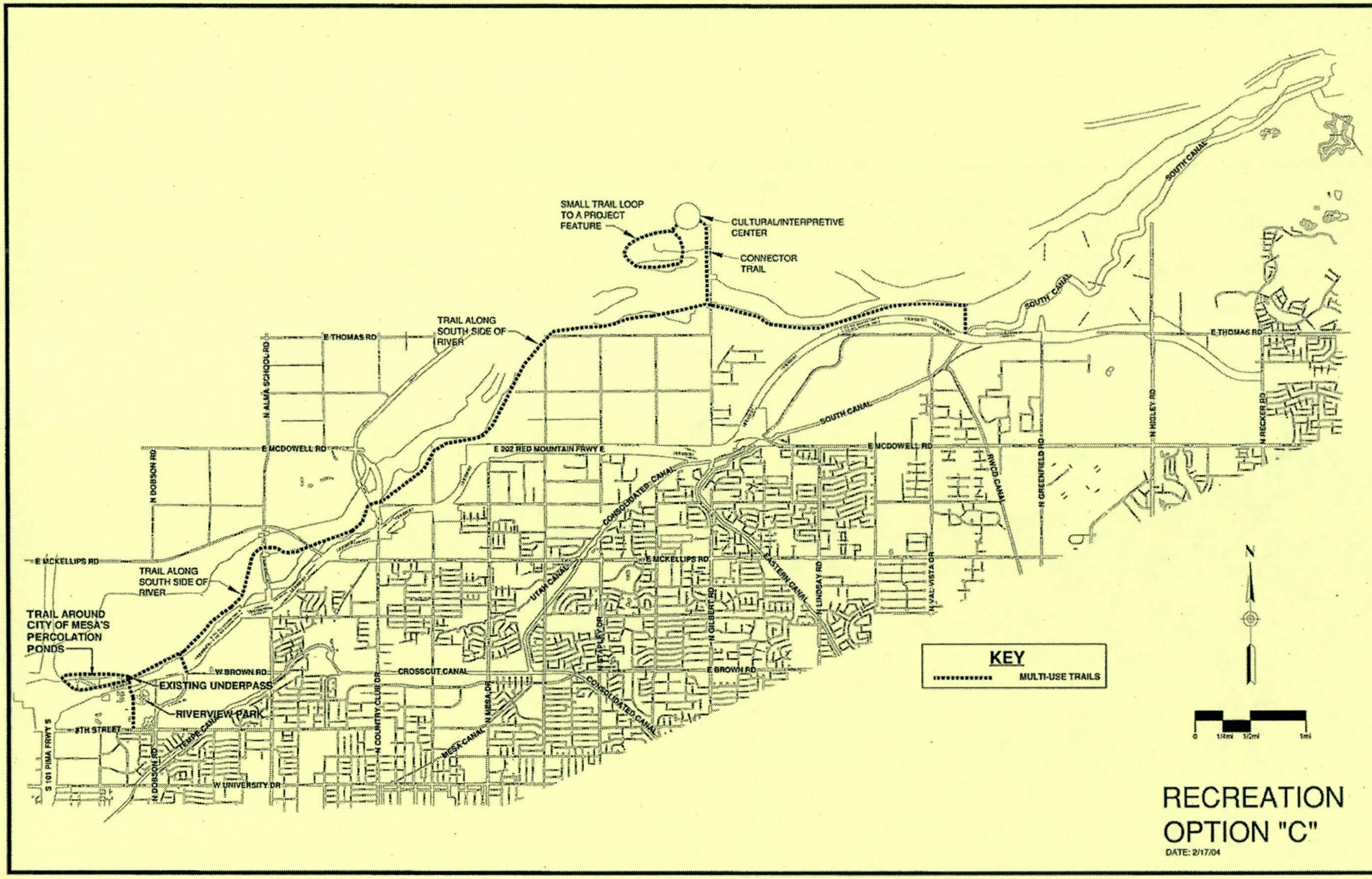

SMALL LOOP TRAIL TO A PROJECT FEATURE
CULTURAL/INTERPRETIVE CENTER
TRAIL
E THOMAS RD
SOUTH CANAL
E 202 RED MOUNTAIN FRWY W
N BEELINE HWY
E MCDOWELL RD
N GREENFIELD RD
N HIGLEY RD
N RECKER RD
RWCD CANAL
N VAL VISTA DR
CONSOLIDATED CANAL
EASTERN CANAL
E MCKELLIPS RD
N LINDSAY RD
UTAH CANAL
N GILBERT RD
N STAPLEY DR
N MESA DR
N COUNTRY CLUB DR
N ALMA SCHOOL RD
CROSSCUT CANAL
E BROWN RD
MESA CANAL
TEMPE CANAL
N DOBSON RD
TRAIL AROUND CITY OF MESA'S PERCOLATION PONDS
EXISTING UNDERPASSES
RIVERVIEW PARK
8TH STREET
E UNIVERSITY DR
S 101 PIMA FRWY S
KEY
MULTI-USE TRAILS
N
0 1/4mi 1/2mi 1mi
RECREATION OPTION "B"
DATE: 2/17/04

Figure 3-13


SMALL TRAIL LOOP TO A PROJECT FEATURE
CULTURAL/INTERPRETIVE CENTER
CONNECTOR TRAIL
TRAIL ALONG SOUTH SIDE OF RIVER
TRAIL ALONG SOUTH SIDE OF RIVER
TRAIL AROUND CITY OF MESA'S PERCOLATION PONDS
EXISTING UNDERPASS
RIVERVIEW PARK
E THOMAS RD
E MCDOWELL RD
E 202 RED MOUNTAIN FRWY E
E MCKELLIPS RD
W BROWN RD
E BROWN RD
8TH STREET
W UNIVERSITY DR
N ALMA SCHOOL RD
N DOBSON RD
N COUNTRY CLUB DR
N MESA DR
N STAPLEY DR
N GILBERT RD
N LINDSAY RD
N VAL VISTA DR
N GREENFIELD RD
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CONSOLIDATED CANAL
UTAH CANAL
EASTERN CANAL
RWCD CANAL
CROSSCUT CANAL
MESA CANAL
TEMPE CANAL
KEY
MULTI-USE TRAILS
N
0 1/4mi 1/2mi 1mi
RECREATION OPTION "C"
DATE: 2/17/04

Figure 3-14

3.4.5 COST/BENEFIT ANALYSIS

The Corps has performed a cost/benefit analysis that is presented in Appendix E of the final feasibility study report. Based on this analysis Option B was selected as the preferred recreation option.

3.5.6 CONCLUSION

Option B was selected by the SRPMIC Tribal Council as the preferred recreation option to be incorporated into the restoration project.

CHAPTER 4. AFFECTED ENVIRONMENT

This chapter provides a description of the existing conditions within the Va Shly'ay Akimel project study area. The information presented comprises the environmental baseline for determining the nature and magnitude of environmental impacts of the proposed action and alternatives. For this project, the study area is defined as an area extending between the Pima Freeway and Granite Reef Dam along the Salt River. The width of the project study area is 1 mile to either side of the river's thalweg, or the centerline of the drainage flow within the river channel, for a total width of 2 miles.

4.1 GEOLOGY AND TOPOGRAPHY

4.1.1 INTRODUCTION

This section describes the topography and geologic conditions of the Va Shly'ay Akimel study area. This section is based on the analysis contained in the geotechnical appendix to the *Va Shly'ay Akimel Environmental Restoration Study, Salt River Pima-Maricopa Indian Community and City of Mesa, Maricopa County, Arizona* (U.S. Army Corps of Engineers 2003).

4.1.2 REGIONAL GEOLOGY AND TOPOGRAPHY

The study area is located in the eastern portion of Maricopa County, north of the City of Mesa boundaries. The study area is characterized by relatively flat terrain. Slopes in the study area range from 0–2 %, and alluvial soils occur within the river floodplains.

The project area is in the Phoenix basin of the Salt River Valley. The area is geomorphically located within the Gila Lowland Section of the Sonoran Desert Subprovince, a part of the Southern Basin and Range Physiographic Province. This province is characterized by broad, gently sloping, connected alluvial valleys (basins) bounded by moderately high, rugged, northwest- to southeast-trending mountains (ranges). During the late Miocene epoch (Tertiary period), the mountain ranges were extensively dissected, uplifted, and downdropped by northwest- to southwest- and east- to west-trending sub-parallel normal faults.

Extensive volcanic activity accompanied the faulting. From the late Miocene until the late Pliocene, the ranges deeply eroded and filled their downdropped areas (basins) with sediments, which were later consolidated into sedimentary rocks. From the end of the Pliocene until recent (Holocene) time, the basins, including the Salt River Valley, filled with unconsolidated and occasional semi-consolidated sediment eroded from the ranges. The thickest accumulations of Valley alluvium formed during the early to middle Quaternary period.

The alluvium of the Salt River Valley is in the final stages of development, as evidenced by the numerous low-lying isolated hills (inselbergs) that project above the valley surfaces. These hills represent peaks of former mountain ranges that are now almost completely buried by alluvial material. The mountain ranges that border the project area consist mostly of Tertiary-age sedimentary and volcanic rocks that lie unconformably upon an ancient Precambrian igneous and metamorphic basement complex. The complex is composed predominantly of igneous granite and diorite, metamorphosed schist, gneiss, and volcanic rock. The Tertiary rocks are made up of volcanic basalt, andesite, rhyolite, sedimentary sandstone, siltstone, and conglomerate.

The Phoenix basin consists of Quaternary sediments that constitute the valley fill. These consist mostly of poorly to well-consolidated (cemented) and unconsolidated gravel, sand, silt, and clay, representing several environments and ages of deposition. The total thickness of the alluvial material ranges from near 0 feet along the mountain fronts to nearly 10,000 feet under the valley interior. The valley fill materials tend to be of a coarser consistency near the mountain fronts and finer in the interior of the valley. Near the Salt River, the valley fills have been eroded as the river formed terraces during its evolution.

4.1.2.2 Local Geology and Topography

The Va Shly'ay Akimel project area extends east and west along the Salt River, which flows west into the Phoenix basin from the Superstition and Goldfield mountain ranges. The Salt River floodplain is located within the gentle, flat slopes of the basin. The study area extends west from Granite Reef Dam to the Pima Freeway (SR 101).

The predominant surface materials within the Va Shly'ay Akimel project area consist of Quaternary-age river sediment deposited as alluvium and terraces and, to a lesser extent, sheetwash-deposited alluvium and slope-deposited colluvium. Thick layers of alluvium and terrace have accumulated within the major streams, tributaries, and floodplains of the Salt River. Streambed alluvium and terraces are flanked, covered, and underlain by thinner layers of wind- and sheetwash-deposited alluvium and bedrock colluvium.

Quaternary sediments consist of:

1) Salt River Valley alluvium and terraces — unconsolidated to well-cemented gravel and boulders interbedded with irregular silt, sand, and gravel lenses; and

2) Colluvium — loose- to well-cemented silt, sand, clay, and gravel.

Salt River Valley terrace deposits lie exposed above the Salt River channel in locations throughout the project area. The terraces consist of thick, well-cemented to non-cemented sand and gravel and are considered older than the alluvium within the confines of the Salt River. However, contacts between the two types of deposits are gradational at depth, which means they are undifferentiated and both remain of Quaternary age. The terrace and alluvial deposits in turn overlie thick Tertiary sedimentary and volcanic rocks beneath the basin and interface with Tertiary rocks along mountain ranges and inselbergs. The very thick Precambrian basement complex underlies basin terrace and alluvium at maximum depths of greater than 3,300 feet.

4.1.2.3 Soils

The interior floor of the Salt River Valley is comprised of thick layers of alluvium. The U.S. Department of Agriculture categorizes the soils in the vicinity of the river channel in a group known as the hyperthermic torrifluvents association, which are well-drained to excessively well-drained soils which exist on nearly level or gently sloping surfaces. These soils are often sandy to gravelly, but may include lenses of finer particles. They are often redistributed by water flows in active channels.

As defined by the Farmland Protection Act, approximately 3,262 acres of prime farmland exist within the project boundaries. Effects to the prime and unique farmland are discussed in the "Geology and Topography" section in Chapter 5.

4.1.2.4 River Topography

The Salt River is characterized by scour-and-fill events, floods, and channel shifts. The Salt River once was characterized by meandering flows throughout the river system. More recently, however, urban development in the region has changed the Salt River from a meandering channel to a straight channel with high banks in several reaches. A large groundwater retention/recharge basin is located within the Salt River in the central portion of the study area.

The Salt River channel has shifted within the floodplain several times from the 1880s to the present — meandering on the north side of the floodplain during some periods and on the south side during others. Channel shifts have distributed alluvial material across the entire width of the floodplain. The alluvium deposited by the river consists of cobbles, sands, silts, and clays from numerous tributary streams within the watershed.

Scour-and-fill events over time have degraded the river in some areas and improved it in others. The scour-and-fill transportation of sediment has produced numerous thick deposits within the fluvial system: cobble lag surfaces, sand sheets (macro-forms), channel sidebars, mid-channel bars, point bars, and overbank deposits. Many of these deposits have been disturbed in recent years by intensive mining for sand and gravel. Mining activity alters later transportation events by removing and compacting material, thereby reducing the amount of sediment transported and loosening other sediments. In addition, sand pits serve as depositional traps for fine sediments.

Sediment transported in a scour-and-fill setting tends to move in waves or pulses, rather than at a constant rate over time. In essence, slugs of sediment are periodically moving downstream during flow events. Floodflows are probably the most important events in the transportation of sediment, and have the highest potential to move material. During a flood, the bulk of the sediment is moved as bedload; but there is also movement of sediment as wash load, in solution and suspension. Prior to the damming of the Salt River, smaller flow events moved sediment (fine sands, silts, and clays) by incising downward into the larger slugs of sediment found in the channel. However, the amount of sediment moved in these smaller events is small in comparison with the amount of material moved during a flood.

Within the study area, the geomorphic characteristics of the river channel have been significantly affected by human encroachment. Historically, the river channel actively migrated, changing channel configuration in response to river flow events (i.e., peak discharge and duration). However, the construction of levees and road crossings have restricted the potential channel width and confined the lateral migration of the river channel. Currently, approximately 12 miles of the river have been altered by the construction of levees along the left and right channel banks (approximately 45% of the total bank length) (West 2002). Additionally, other factors such as gravel mining operations have substantially changed channel planform and geometry. Mining and associated upstream and downstream bed degradation have resulted in the creation of steeper, less stable, channel banks with a higher erosion potential, leading to the gradual widening of the stream channel.

4.1.2.5 Gradient

The longitudinal profile or gradient of the stream channel shows a change in elevation of approximately 140 feet between Granite Reef Dam and the Pima Freeway. This constitutes a vertical drop of approximately 2 feet per 1,000 feet of channel length. However, there are number of local variations in channel profile and planform associated with human encroachment. In particular, historic and current gravel mining activities within the project area have lowered the channel invert elevation in areas subject to mining, and increased the upstream channel gradient. These changes in the longitudinal channel profile have resulted in up steam headcutting as the channel tries to re-establish a more stable profile. If left unchecked, erosion and headcutting associated with mining activities may result in the undermining of existing infrastructure such as the Gilbert Road Bridge. Additionally, because sediments are trapped by the gravel mining pits, downstream sediment supplies are reduced resulting in downstream channel bed and bank erosion (West 2002).

4.1.2.6 Faulting and Seismicity

Faults in central Arizona are generally short, discontinuous, normal faults, some of which have been interpreted to displace Quaternary formations. Most fall within the Jerome-Wasatch Structural Zone, an approximately 47-mile-wide band that extends from Utah into Mexico. In Utah, the zone is associated with current earthquake activity and displays evidence of abundant Quaternary faulting. In Arizona, the zone includes the Main Street Fault in the northwest corner of the state and the Verde Fault, located approximately 56 miles north of the Va Shly'ay Akimel study area. Both faults are considered to be potentially active.

The proposed project is located in Zone 1 of the Seismic Zone Map of the Contiguous States, an area of low seismicity. Approximately 30 earthquakes with maximum epicentral intensities between II and VI on the Modified Mercalli Intensity Scale (MM) have occurred within this seismic zone from 1870 through 1980. The seismic historical record for the last 124 years indicates that only one major damaging earthquake in the region has occurred. This 1887 earthquake was centered in Sonora, Mexico, which is outside Seismic Zone 1.

The 7.2-MM Sonora earthquake was located more than 255 miles from Tempe, Arizona, and expressed 31 miles of surface rupture with approximately 10 feet of normal displacement, causing rockfalls in the project study area. The most recent (1974) events, located northeast of the study area, recorded Richter magnitudes of only 2.5 and 3.0.

4.1.2.7 Subsidence

Available information suggests that subsidence in the project area has not occurred. Ground failure in the form of (pumping) subsidence and earth-fissures has occurred in other areas of the Phoenix Basin. The closest ground failure occurrences to the project study area are near Luke Air Force Base, west of the study area, where 1–3 feet of subsidence has been measured and exhibits the shape of a 2-mile-diameter "bowl" depression.

Earth fissures and subsidence are both produced by groundwater (pumping) withdrawal, whereby ground (soil) compresses (subsides) because it has lost the support of water within its pores. Earth fissures develop when the soil subsides differentially and pulls apart.

The Phoenix area will continue to be affected by subsidence because of groundwater overdraft, principally where groundwater withdrawal is most severe.

4.1.3 REGULATORY SETTING

Topography and geomorphologic resources and issues related to geotechnical hazards are primarily under local jurisdiction. The local grading plans and ordinances contain policies for the protection of geologic features and avoidance of geologic hazards. Many local jurisdictions adopt the Uniform Building Code or adopt local building codes to ensure that structures meet minimum safety standards. Building codes in each jurisdiction establish standards for construction depending on soil conditions, slopes, and the potential for ground movement and faulting.

4.2 HYDROLOGY AND WATER RESOURCES

4.2.1 INTRODUCTION

The following discussion characterizes the hydrology and water quality conditions of the Va Shly'ay Akimel study area. The information presented below is based largely on the following reports:

- Va Shly'ay Akimel, Salt River, Arizona—Draft Feasibility Report and Draft Environmental Impact Statement (U.S. Army Corps of Engineers 2003)
- Tres Rios Feasibility Study, Salt River, Arizona (U.S. Army Corps of Engineers 2000)

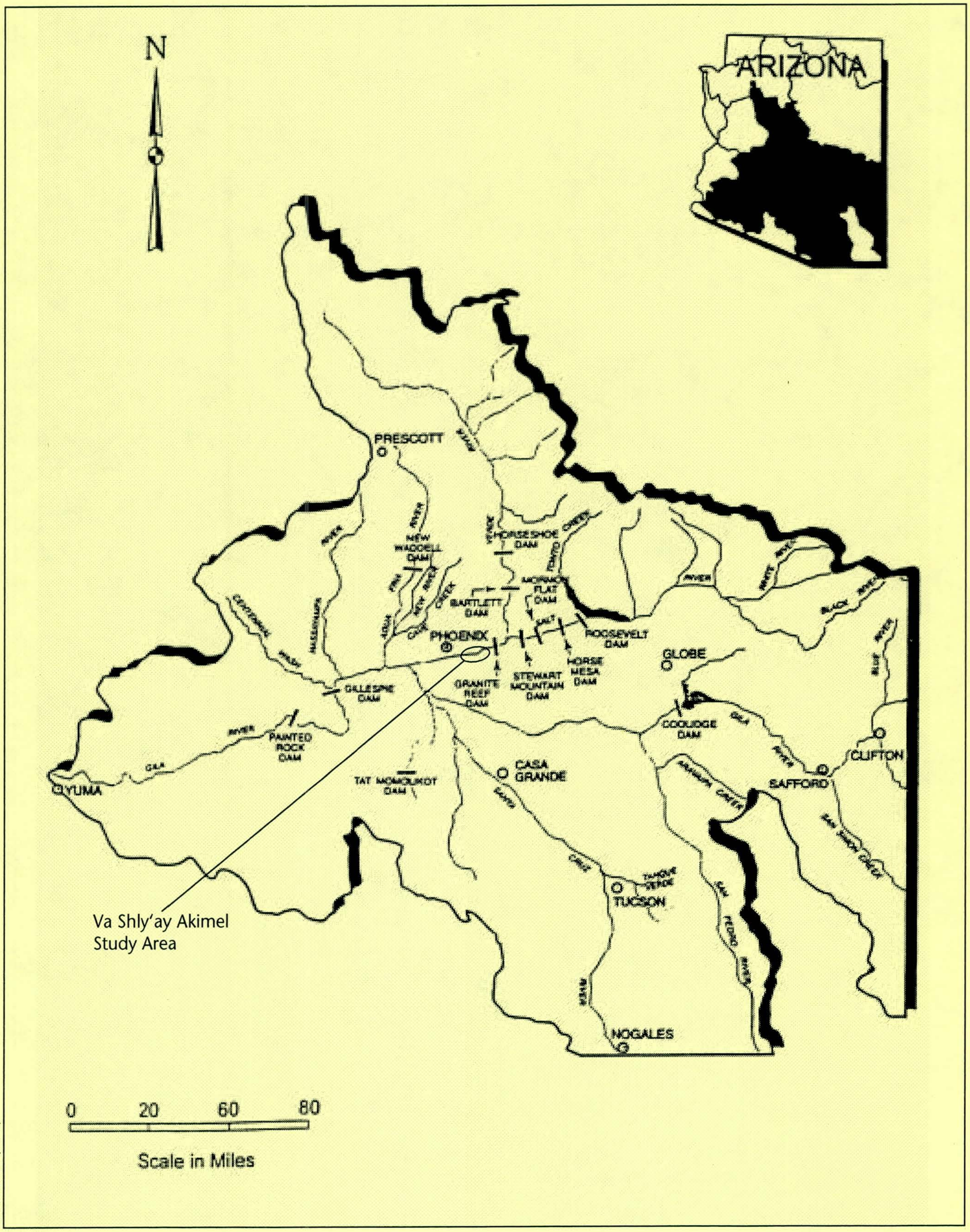
In addition, a number of reference materials, cited in the text below, were used to characterize the relevant hydrologic and water quality conditions in the study area.

4.2.2 REGIONAL HYDROLOGY AND SURFACE WATER RESOURCES

4.2.2.1 Background

The Salt River drains 14,500 square miles of mountainous desert terrain in central and eastern Arizona (Figure 4.2-1) and is the largest tributary to the Gila River. The river rises in the White Mountains of eastern Arizona and flows generally westward to its junction with the Verde River, a northern tributary that drains the edge of the Colorado Plateau near Flagstaff, Arizona. From this junction near the City of Mesa, the Salt River flows westward across the broad Salt River Valley to its confluence with the Gila River, about 14 miles west of the Phoenix Sky Harbor airport. The Phoenix metropolitan area is near the center of the Gila River basin and lies within the lower Salt River Valley. After the junction with the Salt River, the Gila River continues westward and joins the Colorado River near Yuma, Arizona.

Annual average rainfall in the lower Salt River Valley is approximately 8 inches; rainfall at the highest elevations of the watershed ranges up to 14 inches annually (U.S. Geological Survey 1991). Rainfall is less than the evapotranspiration rate in all months of the year. Precipitation is derived primarily from two types of weather systems: summer thunderstorms and regional storms. Summer thunderstorms in July and August develop from the flow of subtropical air masses from the Gulf of Mexico. These two months are responsible for the majority of the total annual rainfall. Regional storms from the Pacific Ocean generate gentle, widespread showers during the fall and winter months. Summers are hot, with daily temperatures exceeding 100° F from mid-June through August. Mean daily temperatures in the summer range from 65° F to 104° F. The relative humidity is low, ranging from approximately 20% to 50%. Winters are mild, with mean daily temperatures ranging from 35° F to 70° F.



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Jones & Stokes

Figure 4.2-1
Gila River Basin

4.2.2.2 Dam System

During the 20th century, the Phoenix area has changed from an agricultural region to an urban region, resulting in significant changes in the physical characteristics of the rivers in the area. Agricultural and urban activities have given rise to an intricate network of structures associated with the river used for irrigation, drainage, erosion protection, and flood control. Numerous upstream dams on the Salt and Gila Rivers have radically altered the natural hydrologic regime of the rivers (Table 4.2-1). The Salt River Project (SRP) operates seven dams within the Salt River watershed. Six of these dams are operated as storage reservoirs; the Granite Reef dam is a diversion dam and does not have storage capacity. Stored water is allocated for hydropower, municipal and industrial supply, and agriculture. Modifications to the Theodore Roosevelt Dam also include an allocation for flood control. The total space for water-supply storage behind these dams is approximately 1.9 million acre-feet (ac-ft), with an additional 560,000 ac-ft for flood control. Modified Theodore Roosevelt Dam is the largest facility and receives drainage from approximately 5,800 square miles. The Verde River is the principal tributary and watershed of the Salt River (6,700 square miles). Its flows are partially controlled by Horseshoe Dam (located furthest upstream) and Bartlett Dam (approximately 25 miles upstream of the confluence with the Salt River), which provide an additional 310,000 ac-ft of storage. New Waddell Dam is located on the Agua Fria River northwest of Phoenix and downstream of the project study area.

Table 4.2-1. Major Dams and Reservoirs in the Gila River Basin

Dam	River	Reservoir	Date of Origin	Storage (acre-feet)
Waddell	Agua Fria	Lake Pleasant	1927	165,000[a]
Bartlett	Verde	Bartlett Lake	1939	178,000
Horseshoe	Verde	Horseshoe Lake	1949	109,000
Stewart Mountain	Salt	Saguaro Lake	1930	70,000
Mormon Flat	Salt	Canyon Lake	1925	58,000
Horse Mesa	Salt	Apache Lake	1927	245,000
Granite Reef	Salt	None	1908	0
Roosevelt	Salt	Roosevelt Lake	1911	1,600,000[b]
Coolidge	Gila	San Carlos Lake	1928	1,222,000
Painted Rock	Gila	Painted Rock Lake	1959	2,500,000

[a] Indicates original storage capacity before modifications that are presently underway to expand capacity.

[b] Black pers. comm.

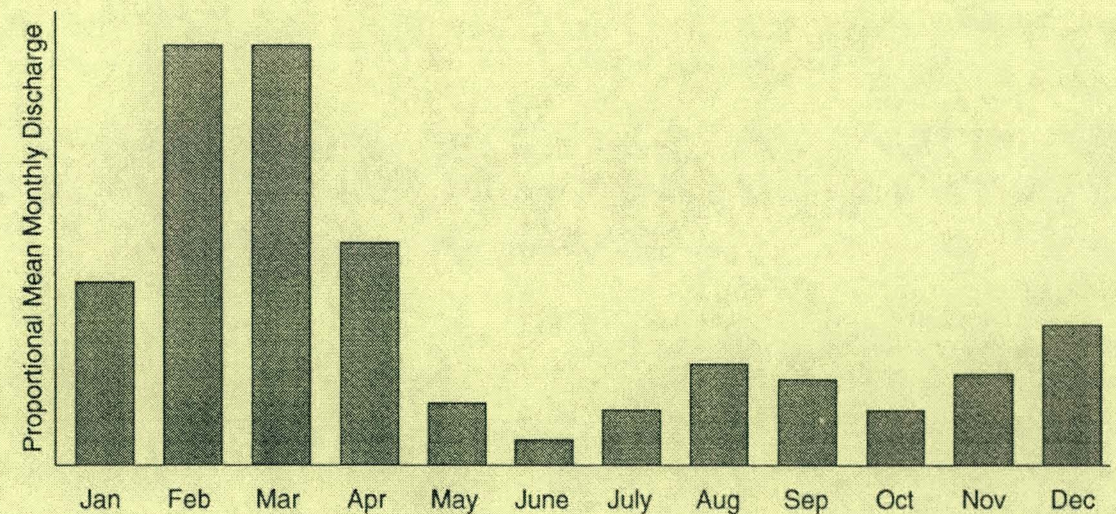
Source: Graf et al. 1994

The dams have significantly altered the natural hydrologic regime of the lower Salt River and have changed both the magnitude and timing of flows. The SRP primarily releases water from, reservoirs to meet shareholder water demands, but also releases water for other purposes including minimum flow requirements, power generation, and flood-control. The system of dams has eliminated perennial flow and steady, high winter flows. Since Bartlett Dam began operating on the Verde River in 1938, the lower Salt River has contained water only as a result of controlled or uncontrolled releases from Granite Reef Diversion Dam. Granite Reef Diversion Dam is located about 3 miles downstream of the Salt-Verde confluence, and is the most downstream SRP dam. The purpose of this facility is to divert upstream reservoir releases into the Arizona Canal (for the area north of the Salt River), and the South Canal (for the area south of the Salt River). The canals crisscross the Phoenix metropolitan area for water delivery to agricultural, municipal, and industrial uses. There are no releases during climatically drier years, such as the period between 1942 and 1964, and the Salt River is dry during those times except for stormwater runoff, groundwater emergence, and effluent.

Before 1938, an average of 413,000 ac-ft of water flowed through the channel annually (U.S. Army Corps of Engineers 1997). The estimated pre-development, average annual watershed yield was about 1,250,000 ac-ft (U.S. Geological Survey 1991). Since 1965, the channel has carried an average of only 293,000 ac-ft of water per year, with less than 10,000 ac-ft in almost three-fifths of the years (U.S. Army Corps of Engineers 1997). Hydrologic modeling used to develop a water-control plan for Modified Theodore Roosevelt Dam indicates that water would have spilled over Granite Reef Diversion Dam in only 34 of 105 years under the current configuration of dam operations (U.S. Army Corps of Engineers 2000). The resulting frequency of spills is approximately once every 3 years.

When water is spilled over Granite Reef Diversion Dam, the flow is typically sustained for several days or more, and of significant magnitude. Since 1965, there have been about two releases per year, and they have lasted an average of 22.5 days, with a peak mean daily flow of 13,960 cubic feet per second (cfs). The median predicted spill pattern at Granite Reef Diversion Dam has a peak discharge of 28,000 cfs, a 5-day average flow rate of 15,000 cfs, and a 10-day average flow rate of 10,000 cfs (U.S. Army Corps of Engineers 2000).

Little data exist to document the pre-development, seasonal flow fluctuations in the Salt River. In the pre-settlement era prior to 1900, the river was one of the few perennially watered riparian areas of the Sonoran desert, with highly productive cottonwood, willow, and mesquite habitats. Analyses of pre-development conditions indicate that Salt River streamflow infiltrated and recharged groundwater upstream of Indian Bend Wash near Scottsdale. Groundwater discharged to the channel to provide perennial baseflow in downstream sections of the channel (U.S. Geological Survey 1991). Under natural conditions, flows peaked in late winter (February and March), supplied by storms and snowmelt (Figure 4.2-2). Flows were lowest in June, averaging only 6% of the mean high flows in February. Data for 1965 through 1993 show flows occurring most frequently during March and April and least frequently during July and August, much like the natural flow pattern. In normal years, or years with minimal downstream releases, the system of dams upstream of the study area effectively delays the flows by 1 month. However, this is not the case in years with large flow events (1993) or wet years (1983). This delay becomes



SOURCE:
Graf et al. 1994

Figure 4.2-2
Proportional Natural Mean Monthly Discharge of the Salt River

insignificant, however, in light of the length of periods without flow in a river that is perennial under natural conditions.

4.2.2.3 Flood Hazards

During periods of serious flood potential, large volumes of water are released from upstream dams and may cause flood damage in the Phoenix metropolitan area. Damaging floods with flows exceeding 100,000 cfs occurred in the lower Salt River in 1978, 1980, 1983, and 1993. These floods resulted in damages to residences and agricultural areas in and around the study area. Environmental managers have sought a clearer understanding of river forms and processes that are now partly natural but significantly modified. Figure 4.2-3 shows the limits of the 100-year floodplain within the study area. In general, the designated 100-year floodplain is narrowly confined within the limits of the channel banks and ranges in width from several hundred feet to over 1 mile, depending on the location. Significant problems related to flooding within the study area include large floodflows that can:

- cause damage to agricultural and residential areas in and around the study area;
- destroy habitat through inundation and scouring effects; and
- erode landfills, adding sediment, pollutants, and debris to the study area.

The magnitudes of peak annual discharges on the Salt River are comparable to those of peak flows before Bartlett Dam began operating, but high flows have occurred less frequently since 1938 (Figure 4.2-4). The mean peak annual discharge was 32,000 cfs before 1938, and has been 16,500 cfs from 1938 to the present (Jones & Stokes 2000). This apparent reduction in flood magnitude results from the frequency of low-flow years. Since 1938, the peak discharge has been greater than 10,000 cfs in only 1/4 of the years, whereas before 1938, flows exceeded 10,000 cfs in 2/3 of the years. Upstream dams have exacerbated the high-flow conditions that have occurred by delaying the release of runoff into the river. Prior to damming, a peak annual discharge greater than 100,000 cfs occurred in only 1 year on record, while three such flows have occurred in the past 16 years. Table 4.2-2, presented on the next page, shows estimated flow values for variable frequency and duration flows within the Salt River at Granite Reef Dam and downstream in the Phoenix metropolitan area at Central Avenue (U.S. Army Corps of Engineers 1997).

Table 4.2-2. Inundation-Duration Frequency Values for the Salt River

	Frequency (Years)						
Duration	500	200	100	50	20	10	5
Discharge (cfs) Exceeded for Specified Duration, Salt River at Central Avenue[(1)]							
Peak	240,000	202,000	166,000	135,000	87,000	53,000	20,200
1 Day	190,000	145,000	100,000	70,000	40,000	21,000	8000
3 Day	100,000	75,000	60,000	40,000	22,000	11,000	3500
5 Day	70,000	55,000	40,000	29,000	15,000	7000	2100
10 Day	46,000	33,000	25,000	18,000	10,000	5200	1500
30 Day	25,000	19,000	15,000	10,000	5300	2700	800
60 Day	14,000	9000	7000	5000	2800	1400	(0)[(2)]
Discharge Exceeded for Specified Duration, Salt River at Granite Reef Dam							
Peak	250,000	210,000	175,000	150,000	100,000	60,000	22,000

(1) Discharges exceeded for specified frequencies, with durations greater than or equal to 1 day, are approximately equal throughout the Rio Salado Project reach. Central Avenue is used as a reference location.

(2) During the 5-year event, the upstream release from the Salt River Project reservoirs does not last for 60 days. A flow rate of approximately 200 ft^3/s is exceeded for 53 days during this event. Results are based upon simulation of Balanced Hydrographs.

Source: U.S. Army Corps of Engineers 1997

The peak 100-year flood flow at Granite Reef Dam is 175,000 cfs, slightly larger than what would occur in downstream reaches due to channel infiltration. The data also indicates that the 5-year frequency flow produces measurable flow in the channel downstream of Granite Reef Dam, but the channel would remain dry in the Phoenix area due to upstream storage in the watershed and channel infiltration.

Although flooding is a natural and even vital process in natural riparian systems, it is of particular concern in downstream reaches of the Salt River because of the prevalence of saltcedar, an exotic nuisance species. Saltcedar is very effective at spreading into disturbed areas and can generally establish itself more rapidly than native riparian species with one exception. If flooding occurs during spring when cottonwood and willow are dispersing seeds, native vegetation can outcompete saltcedar. As an example of this process, after the 1993 flood, additional vegetation established itself in the river downstream of Phoenix. The Flood Control District of Maricopa County (FCDMC) applied for a Section 404 permit to resume channel clearing. The permit was denied because of habitat removal concerns expressed by the Arizona Game & Fish Department (AGFD).

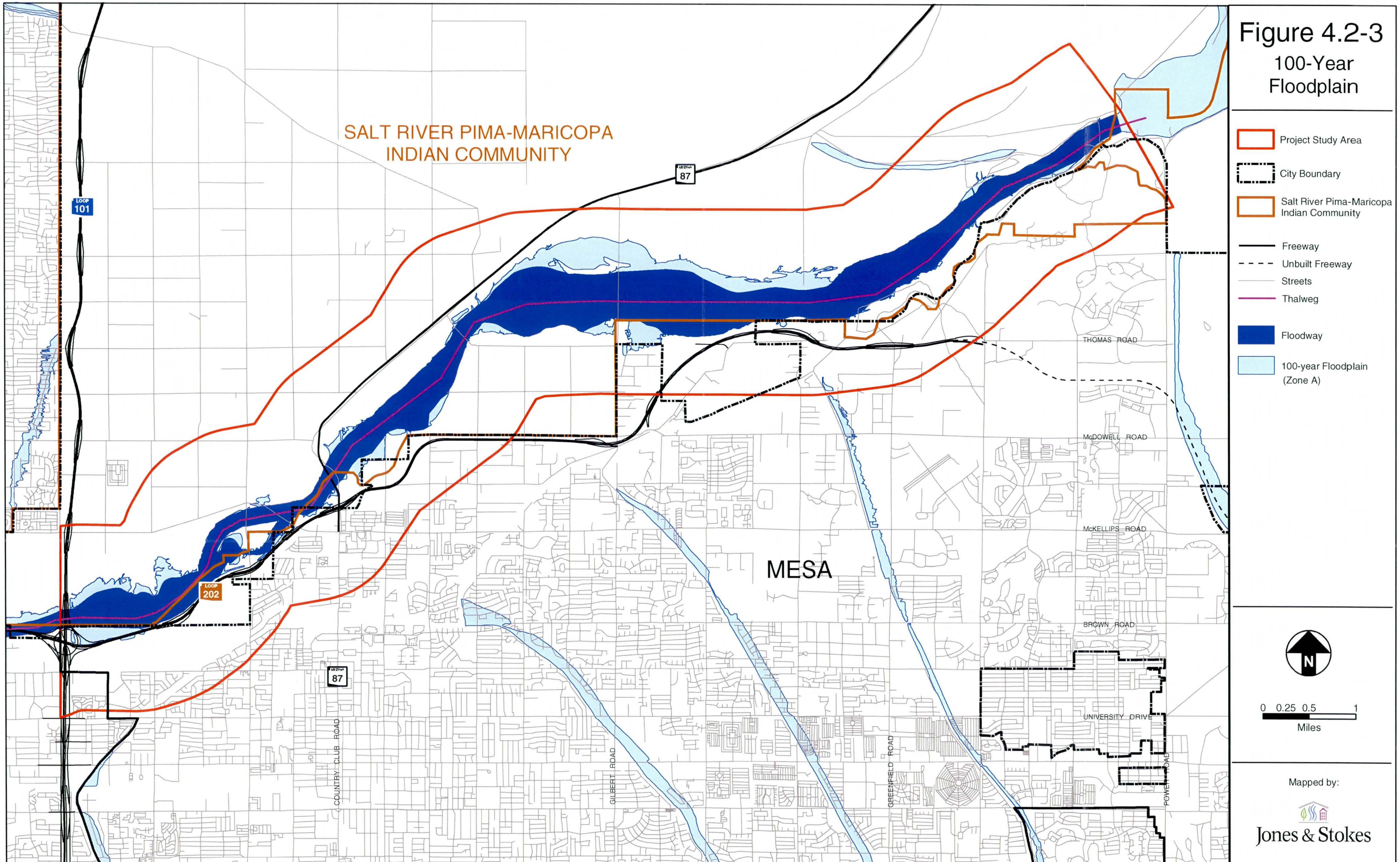
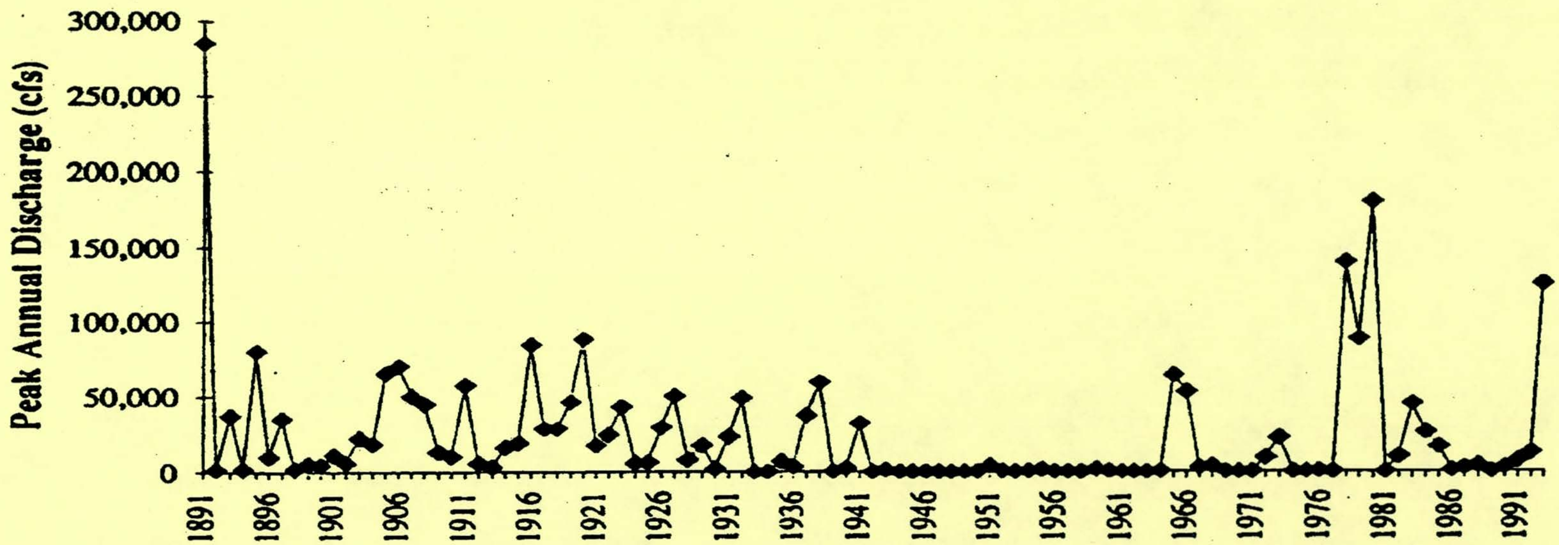


Figure 4.2-3
100-Year Floodplain
Project Study Area
City Boundary
Salt River Pima-Maricopa Indian Community
Freeway
Unbuilt Freeway
Streets
Thalweg
Floodway
100-year Floodplain (Zone A)
SALT RIVER PIMA-MARICOPA
INDIAN COMMUNITY
MESA
THOMAS ROAD
McDOWELL ROAD
McKELLIPS ROAD
BROWN ROAD
UNIVERSITY DRIVE
COUNTRY CLUB ROAD
GILBERT ROAD
GREENFIELD ROAD
POWER ROAD
LOOP 101
LOOP 202
87
N
0 0.25 0.5 1
Miles
Mapped by:
Jones & Stokes



Source: Graf, et al 1994

Jones & Stokes

Figure 4.2-4
Annual Peak Flow of the Salt River for Major Releases from Granite Reef Dam, 1891-1993 (data from the Salt River Project)

4.2.2.4 Local Hydrologic Characteristics

The study area is located upstream of several other planned restoration projects, including the first phases of the Rio Salado Project and the Tres Rios Project. The City of Mesa, which has experienced rapid growth and residential development in recent years and has highly urbanized land-use areas, borders the south channel. The area to the north of the channel consists largely of undeveloped land owned by the Salt River Pima-Maricopa Indian Community. Numerous small, ephemeral drainage channels located along the north side of the channel discharge localized stormwater runoff to the Salt River from the nearby hills. The Buckhorn Mesa Project in the City of Mesa serves to consolidate and direct stormwater drainage to the Salt River through a single discharge channel immediately upstream of Granite Reef Dam (Flood Control District of Maricopa County 2002). The Buckhorn Mesa Project consists of four earthen dams with interconnecting floodways. Anecdotal information and hydrologic studies conducted for the initial phases of the Rio Salado Project (U.S. Army Corps of Engineers 1997) indicate that local stormwater drainage is rarely sufficient to generate continuous flow within the Salt River channel. For example, modeling results for predicted 10-year frequency flood events in the much larger Indian Bend Wash basin (peak discharge of 9,000 cfs) indicate that flows would be reduced to 1,500 cfs at Mill Avenue and 140 cfs at Central Avenue, and flows would completely infiltrate into the channel substratum shortly downstream (U.S. Army Corps of Engineers 1997).

4.2.3 GROUNDWATER

This section provides a brief overview of the hydrogeology, depth to groundwater, and direction of groundwater flow in the Salt River Valley. The Salt River Valley lies within the basin and range physiographic province and is characterized by broad alluvial valleys separated by rugged mountains. The valley is underlain by a wide variety of unconsolidated to variably consolidated sedimentary deposits that are several thousand feet thick in places. The sediments include unconsolidated clay, silt, sand and gravel, caliche, gypsum, mudstone, siltstone, sandstone, conglomerate, and anhydrite. Discontinuities in lateral lenses and interbedded deposits may exist in older units where high-angle faults exist. Groundwater recharge of aquifer units within the lower Salt River Valley occurs primarily as rainfall-induced subsurface influx from the mountain–valley fringe; rainfall on the valley floor is generally insufficient to contribute to groundwater recharge (U.S. Geological Survey 1991).

The Arizona Department of Water Resources (ADWR) regulates groundwater in Arizona and has identified the groundwater basin underlying lower Salt River Valley as the Phoenix Active Management Area (AMA). The Phoenix AMA comprises two distinct but interconnected alluvial groundwater basins: West Salt River Valley (WSRV) and East Salt River Valley (ESRV). These two units are divided by subsurface geologic outcroppings located near Priest Road in Tempe. Both basins generally comprise three separate hydrogeologic aquifer-layer units. The U.S. Bureau of Reclamation (USBR), the U.S. Geological Survey (USGS), and ADWR have independently identified these units, although the descriptions and nomenclature used by these agencies differ slightly. The three hydrogeologic units are: (1) the Lower Alluvial Unit (LAU), (2) the Middle Alluvial Unit (MAU), and (3) the Upper Alluvial Unit (UAU). Groundwater within the aquifer units is generally unconfined. The Salt River flows over the

UAU and was once the most important source of groundwater recharge for this unit. Composed predominantly of gravel and sand, the UAU ranges from 100 to 400 feet thick under the Salt River. The unit is thinnest near mountain fronts and bedrock outcrops, such as Tempe Butte and lower Papago Park. Water within the UAU is legally referred to as sub-flow to differentiate it from groundwater in the MAU and LAU. Historically, surface flows from streams and washes provided most of the water that recharges the UAU. Presently, the minor recharge sources, such as seepage from canals and irrigated land, underflow along major streams, and rainfall, have become more important.

Depth to groundwater has fluctuated greatly since development of the Salt River Valley began in the late 1890s (Table 4.2-3). Initially, diversion of water from the river for irrigation led to a rise in the water table. Canal seepage locally raised the water table as much as 20 feet above the natural water table. As development proceeded, groundwater became an important water source for agriculture. More than 75% of the pumped groundwater in the Salt River Valley is now used for agriculture. Drought conditions and pumping between 1895 and 1905 caused a decline in the well levels of 8–20 feet in the Mesa-Tempe area. The water table declined steadily from the 1930s into the 1960s as a result of increased pumping. The magnitude of declines varied spatially, from a few feet in some places to a few hundred feet in others. Where shallow bedrock forces water to the surface, depth to groundwater is only 10–30 feet greater than in the early 1900s.

Table 4.2-3. General Depths (Feet) to Groundwater near the Lower Salt River

Year	Granite Reef Dam to McKellips Road	McKellips Road to Mill Avenue	Mill Avenue to I-10	I-10 to 23rd Avenue	23rd Avenue to 91st Avenue	91st Avenue to Agua Fria River
1900	0–40	0–10	0–40	ND	ND	ND
1913	10–50	0–10	0–10	0–10	0–10	0–10
1945	50–150	0–50	0–10	10–50	10–50	0–10
1952	100–140+	20–80	40–60	40–60	20–40	<20–40
1964	ND	ND	ND	80–100	60–80	40–60
1972	ND	ND	ND	60–80	40–60	<20–40
1986	190–250	90–140	10–60	ND	ND	ND

ND = no data.

Sources:
1900 and 1986: Thomsen and Miller 1991
1913 and 1945: McDonald et al. 1947
1952: Wolcott 1952
1964 and 1972: U.S. Bureau of Reclamation 1976

During the 1980s, pumping of groundwater declined in the Salt River Valley. Data for seven wells along the Salt River for 1987 through 1992 indicate that while recent groundwater levels have not exhibited a distinct upward or downward trend, they have fluctuated considerably. Depth to groundwater decreases downstream, from an average of approximately 260 feet near Granite Reef Dam to less than 10 feet near Buckeye. For the period from 1987 to 1992, upstream water levels fluctuate the most from year to year, on average 7–19 feet, and exhibit the greatest range in levels.

The groundwater flow direction is predominantly east to west in both the ESRV and WSRV, although withdrawals have affected the flow of groundwater and even reversed its direction from historical patterns in some cases. In the ESRV, groundwater flows from the Salt River towards cones of depression located north of the Santan Mountains, east of Mesa, and in the Scottsdale–Paradise Valley area. In the WSRV, groundwater flows from the Salt River toward a major cone of depression near Luke Air Force Base, approximately 15 miles west of Phoenix (Figure 4.2-5). To a lesser extent, groundwater also flows in a northwestward direction toward a second cone of depression in the Deer Valley area. Drawdown in the Deer Valley and Queen Creek areas in the 1940s and 1950s caused groundwater to flow away from the Salt River rather than toward it. The Deer Valley low persisted into the 1980s, at which time the extensive low near Luke Air Force Base in the WSRV became more prominent. Before these pumping effects began, the movement of water toward the river channel and flow within the channel created a mound of groundwater under the channel, which was accessed by a variety of riparian plants. Deflecting flow away from the river contributes to the water-table decline near the river and reduces the groundwater mound.

4.2.4 WATER QUALITY

4.2.4.1 Contaminants

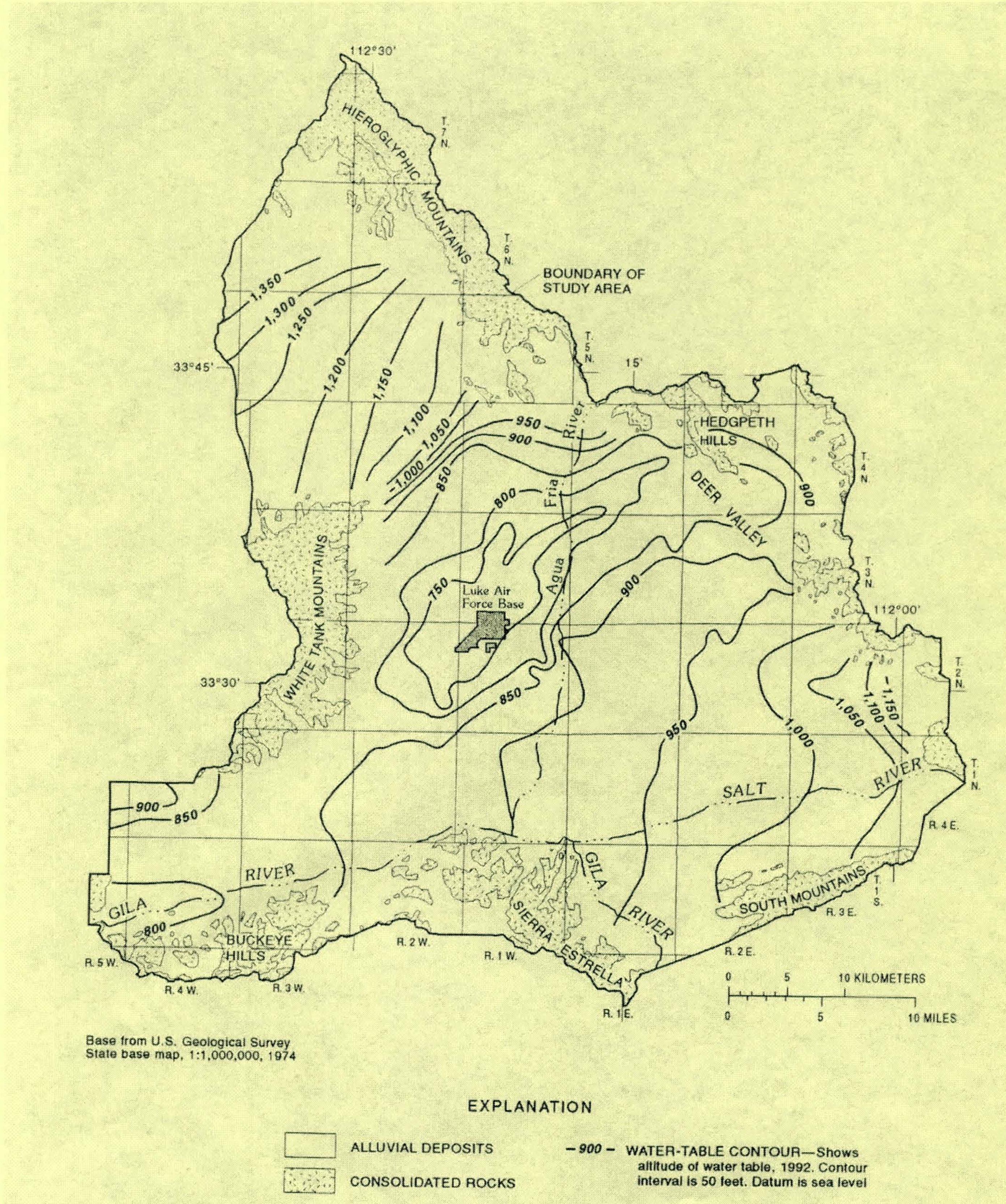
Surface-water and groundwater contaminants include naturally occurring and artificial (human-made) substances that can be introduced into a system from a variety of sources. Federal agencies (primarily the U.S. Environmental Protection Agency [EPA]) and state agencies establish water quality standards, which vary by water use (e.g., drinking water, irrigation, recreation). Contaminants in the surface waters and groundwater of Arizona fall into seven categories: volatile organic compounds (VOCs), pesticides, metals, nutrients, ions, microorganisms, and radiological substances (Table 4.2-4).

Table 4.2-4. Types of Water Contaminants in the Lower Salt River

Contaminant Category	Principal Contaminants	Typical Sources	Potential Health Impacts
Volatile organic compounds (VOCs)	Organic solvents Trichloroethene (TCE) Tetrachloroethylene (PCE) 1,1,1 Trichloroethane (TCA) Chloroform 1,1 Dichloroethane (DCE) 1,1 Dichloroethane (DCA) Benzene	Landfills Underground storage tanks Airports High technology industry	Carcinogen
Pesticides	Dibromochloropropane (DBCP) Ethylene dibromide (EDB)	Agriculture (soil fumigants) Urban runoff	Toxics Carcinogen
Metals	Arsenic Barium Boron Chromium Copper Iron Lead Manganese Selenium Zinc	Landfills Mines Metal finishing Natural origin	Toxics Carcinogen
Nutrients	Nitrate	Agriculture (fertilizers) Wastewater treatment Septic tanks Industrial manufacturing	Methemoglobinemia (blue-baby disease)
Ions	Total dissolved solids (TDS) Sulfate Chloride Fluoride	Mines Agriculture Natural origin	Taste, hardness Laxative effect Toxics
Micro-Organisms	Fecal coliform	Septic tanks Wastewater treatment	Infectious disease
Radiological		Mines Natural origin	Carcinogen

Source: Graf et al. 1994

Similar quality issues exist for all water sources in the lower Salt River, namely contamination by VOCs and various metals, ions, nutrients, and herbicides. As previously discussed, surface water naturally provides the main source of recharge for groundwater. Shallow groundwater in other reaches of the river often emerges in the channel, creating surface flows. Effluent from



Jones & Stokes

Figure 4.2-5
Groundwater Elevations in the Salt River Valley

wastewater treatment plants (WWTPs) and other industries contributes to both surface and subsurface flows. Thus, contaminants do not remain in one part of the system and may affect all water sources.

The most prevalent water contaminants in the lower Salt River area are VOCs, organic solvents widely used by both small and large industries and airports and often found in landfills. VOCs are the primary contaminants associated with federal Superfund sites and State of Arizona Water Quality Revolving Assurance Fund (WQARF) sites, and are most frequently present in water as a result of improper disposal of industrial solvents, degreasers, and other compounds. Major disposal practices that have led to groundwater contamination include injection of waste into dry wells, disposal in surface impoundments that leak dumping into dry washes, unregulated landfilling, and leaking of underground storage tanks. Water quality violations cited by the Arizona Department of Environmental Quality (ADEQ) show the presence of VOCs in groundwater in areas near every reach of the lower Salt River, especially in the central Phoenix area (Jones and Stokes Associates 2000).

Metals as contaminants are not as extensively distributed as VOCs. Possible sources of metal contamination include landfills, mines, metal finishing, and natural origins. When water quality exceeds water quality standards, it frequently appears to be linked to the remobilization of contaminated sediments during higher-than-normal flows. Although metals appeared in some of the Salt River Project groundwater wells, their concentrations did not exceed the maximum allowable limits. The exact sources and extent of contamination of surface waters by mercury and other metals remains unclear, but it can be assumed that sediments play an important role in their distribution.

Several ions and nutrients also exceed maximum allowable levels in groundwater, surface water, and effluent in the study reach. Nitrates are added to the hydrologic system from a variety of sources, including runoff from agricultural fertilizer, animal feed-lot wastes, and subsurface domestic septic leachate, and ranged from 2 to 172 milligrams per liter (mg/1) in SRP-operated wells throughout the valley in 1989 (Jones and Stokes Associates 2000). Near the Salt River, wells in five out of six reaches exceeded the EPA standard. Historically, nitrate levels have increased as a result of leaching of irrigated soils and sewage seepage. Wells in all reaches of the river exceeded recommended concentrations of bicarbonate and chloride, 90 mg/1 and 250 mg/1, respectively. Groundwater from an extensive 103 square-mile area of the basin located generally north of the Salt River and between Phoenix and Glendale exceeds EPA's Maximum Contaminant Level water-quality standard of 45 mg/l (U.S. Geological Survey 1997). Boron presents another potential danger to plants and is present at problematic levels in wells in the lower four reaches of the river. Boron is found naturally in the Salt River waters, but various sources contribute to elevating levels in groundwater: WWTPs; municipal sewer systems, which in some areas employ heavy use of boric acid to control cockroaches; and leaching from irrigated fields that receive wastewater or sludge.

Total dissolved solids (TDS) probably warrant the least concern among all contaminants. Historically, TDS concentrations in surface waters and groundwater exceed the recommended standards for irrigation waters (500 mg/1), ranging between 500 and 5,000 mg/l. The irrigation that has been conducted over a long period in the valley has produced little long-term change in the chemical quality of the groundwater since 1900. TDS concentrations in both the groundwater and surface water of the Salt River increased during the first half of this century, peaking around 1950 at 3,500-4,000 mg/l. More recent data show that TDS concentrations have declined since then, probably as a result of groundwater recharge. Data from the SRP wells suggest that TDS poses the greatest danger to plants in the lower reaches of the river. In 1989, TDS concentrations in SRP wells ranged from 230 to 3,670 mg/l, with a median of 910 mg/1. TDS concentrations are generally lower in the surface waters of the Salt and Verde Rivers and averaged 552 mg/1 and 282 mg/1, respectively, in 1989 above Granite Reef Dam. These concentrations are significantly lower than historical measurements. TDS levels in the Salt River at low flow were 1,850 mg/1 in 1900, 2,490 mg/l in 1912, 2,900 mg/1 in 1930, and 3,500 mg/l in 1943. TDS concentrations on average vary with the amount of flow. For example, during the 1978–80 floods, TDS concentrations in the Salt and Verde Rivers ranged between 100 and 900 mg/1 at lower flows and between 200 and 500 mg/1 at higher flows. Although TDS in surface waters and groundwater may cause problems for salt-sensitive crops and other plants, the present concentrations do not significantly differ from more natural conditions along the Salt River.

Urban stormwater runoff also has the potential to generate discharges of contaminants of concern. The USGS in cooperation with FCDMC have conducted specialized studies of contaminants in urban stormwater runoff in Maricopa County (U.S. Geological Survey 1995a, U.S. Geological Survey 1995b). Based on data collected in 1993 through 1994, stormwater could degrade water quality with oil and grease, pesticides, dissolved trace metals, and ammonia (U.S. Geological Survey 1995a). The highest levels of aquatic toxicity were detected in watersheds that receive drainage from residential and commercial land uses. Streamflow samples from the Salt River were not toxic. Ammonia, lead, and zinc loads that were discharged in stormwater were also found to accumulate in channel-bed sediments. Toxicity of bed materials was detected in undeveloped drainage basins and developed basins. Naturally occurring levels of zinc, and copper to a lesser extent, may be responsible for sediment toxicity in undeveloped areas. Recoverable concentrations of zinc and cadmium were most correlated with sediment toxicity from bed material in developed drainage basins. Previous sampling conducted in 1991 and 1992 was evaluated to identify differences in contaminant loading patterns (U.S. Geological Survey 1995b). The data indicated that loading was most directly correlated with the percentage of impervious land area and commercial or industrial land uses. Localized areas in the Cities of Chandler, Mesa, Paradise Valley, and Peoria appeared to contribute a large proportion of the total loads evaluated. These areas were typically impervious in excess of 40% of the total area and contained high-density commercial, industrial, or residential development. A national assessment of stormwater quality from 11 major municipal areas indicated that contaminant-loading stormwater runoff per unit land area was generally better than other areas (U.S. Geological Survey 1994). Compared to other municipalities, contaminant loading in Phoenix from residential, commercial, and industrial drainage basins ranked fourth, second, and third lowest, respectively.

4.2.4.2 Potential Water Quality Stressors

The Water Quality Technical Committee (WQTC) for the first phases of the Tres Rios Project identified 10 categories of stressors that could affect the quality of the surface waters and groundwater in the Salt River Valley (Tres Rios River Management Committee–Water Quality Technical Committee 1998). These stressors are described below, and Table 4.2-5, which follows, shows the relationship between these stressors and pollutants of concern.

Table 4.2-5. Relationships between Pollutants of Concern and Stressors

Pollutants of Concern	Stressors									
	Floodflows	Stormwater Regulated by NPDES	Unregulated Stormwater	Agricultural Stormwater Runoff	Agricultural Drainage	CAFO Runoff	WWTP Discharges	Landfill Leachate	Groundwater Inflow	Sand and Gravel Releases
Sediments/Solids	M	M	M	M	M	M	NA	NA	NA	M
Inorganic Contaminants										
Beryllium	DG	EE	EE	DG	DG	DG	NE	DG	DG	DG
Boron	DG	M/P	M/P	DG	DG	DG	NE	DG	EE	DG
Copper	DG	M	M	P	P	NA	P	P	EE	DG
Cyanide	DG	M	M	DG	DG	DG	NE	DG	DG	DG
Mercury	DG	EE	EE	P	P	DG	EE	P	DG	DG
Nitrate	DG	M/P	M/P	P	M	M	P *	DG	M/P	DG
Selenium	DG	M/P	M/P	DG	DG	DG	EE	DG	EE	DG
Thallium	DG	M	M	DG	DG	DG	NE	DG	DG	DG
Organic Contaminants										
Bromodichloromethane	NA	NA	NA	NA	NA	NA	P	NA	NA	NA
Bromoform	NA	NA	NA	NA	NA	NA	P	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA	NA	P	NA	NA	NA
Dibromochloromethane	NA	NA	NA	NA	NA	NA	P	NA	NA	NA
Pesticides										
Chlordane	DG	EE	DG	DG	DG	DG	NE	DG	DG	NA
DDD	DG	EE	DG	P	P	DG	NE	DG	DG	NA

Pollutants of Concern	Stressors									
	Floodflows	Stormwater Regulated by NPDES	Unregulated Stormwater	Agricultural Stormwater Runoff	Agricultural Drainage	CAFO Runoff	WWTP Discharges	Landfill Leachate	Groundwater Inflow	Sand and Gravel Releases
DDE	DG	EE	EE	P	P	DG	EE	DG	DG	NA
DDT	DG	EE	DG	DG	DG	DG	EE	DG	DG	NA
Diazinon	DG	DG	DG	DG	DG	DG	M	DG	DG	NA
Dieldrin	DG	EE	DG	DG	DG	DG	EE	DG	DG	NA
Lindane	DG	EE	DG	DG	DG	DG	M	DG	DG	NA
Toxaphene	DG	EE	DG	DG	DG	DG	EE	DG	DG	NA
Other parameters										
Dissolved Oxygen	NA	DG	DG	P	P	M	P	NA	NA	NA
Total Dissolved Solids	NA	DG	DG	P	M	M	P	M	M	NA

* Less for WWTPs with NdeN.

M = major source of given pollutant of concern

P = probable source of given pollutant of concern

M/P = potential to be a major to probable source of a given pollutant of concern

EE = exceedance extrapolated for given pollutant of concern using Middle Gila Watershed study data

NE = no exceedance for given pollutant of concern using Middle Gila Watershed study data

DG = data gap

NA = not applicable

Source: Tres Rios River Management Committee—Water Quality Technical Committee 1998

Floodflows

Floodflows are the releases from upstream dams. The flows vary in quantity from minor flows in the channel to the projected 100-year floodflows. Both minor and flood flows associated with dam releases are controlled by the dam spillgates. Floodflows transport substantial amounts of sediment that originates from tributary flows entering the Salt and Gila Rivers from upstream portions of the river channels and from erosion in the study area. Substantial scouring of the Salt River channel occurs during floodflows and is partially related to levee maintenance activities, channelization projects, and removal of material for gravel mining operations (U.S. Geological Survey 1995c). Floodflows erode landfills in and adjacent to the river, adding trash and debris to the materials transported by the flow. Much deposition of sediment and landfill materials occurs in the riparian areas in the Tres Rios study area (Jones and Stokes Associates 2000).

The floodflows can contain pollutants of concern derived from tributary stream inflow, erosion of sediments, and landfills. Large quantities of water in floodflows can dilute the concentration and transport the contaminants through the study area to downstream areas. There is very little information, however, on the chemical constituents in floodflows.

Stormwater Runoff

Stormwater flows enter the Salt River through storm drains, and many sources of urban- and industrial-site runoff in the Phoenix metropolitan area are regulated as part of the National Pollutant Discharge Elimination System (NPDES) stormwater permit program (described below under "National Pollutant Discharge Elimination System Stormwater Discharge Permits" in Section 4.2.3). In Maricopa County, the Cities of Mesa, Scottsdale, Phoenix, Tempe, and Glendale have interconnected and shared drainage systems and cooperate with the FCDMC to implement provisions of a municipal NPDES stormwater permit. The FCDMC conducts stormwater monitoring at 16 locations throughout Maricopa County. However, urban areas with populations of less than 100,000 (e.g., Cashion, Tolleson, Avondale, Laveen) are not required by current regulations to obtain stormwater permits or perform stormwater quality monitoring. These communities will be required to obtain permits and conduct stormwater monitoring by 2003, and the FCDMC will also be responsible for these activities. The quality of water from storm drains varies depending on the length of time between storm events, the amount of flow, and the source of stormwater runoff. If long periods pass between storm events, pollutants accumulate in greater amounts before they are washed away by runoff. In this case, concentrations of pollutants are greater than when runoff events are more frequent. The amount of flow also affects concentrations. During high stormwater-runoff periods, the concentrations of pollutants are diluted by the quantity of flow. The concentration of pollutants also changes during a flow event. *First flush* is a term used to describe the initial flow in a runoff event, when the concentrations are generally the greatest.

Stormwater runoff often contains a significant amount of sediment that is washed from undeveloped land and other sources, as well as chemical contaminants or pollutants. The types of chemical pollutants will vary depending on the land uses within the particular drainage area.

Potential water quality impacts associated with runoff from industrial sites are projected to be minimal because the compliance requirements of stormwater NPDES permits require each industrial site to have a stormwater pollution prevention plan (SWPPP). Runoff from turf areas has the potential to contain pesticide and fertilizer residuals. Runoff from paved areas can contain hydrocarbon products, metals, and anything spilled on the pavement.

Unregulated Stormwater Runoff

There are many areas where stormwater is not collected in a drainage system and the runoff flows overland or in streets until it flows into the river channels. This type of stormwater runoff is referred to as unregulated because the quality of runoff is not subject to NPDES stormwater permit program requirements. The pollutants of concern in unregulated stormwater runoff could include sediment and a variety of chemical components, depending on the land use of the area generating the runoff.

Agricultural Stormwater Runoff and Irrigation Tailwater

Agricultural land uses can be the source of agricultural stormwater runoff. Most of the agricultural stormwater runoff is from fields, but it can also originate from equipment yards. In most cases, the agricultural runoff from fields and equipment yards is collected in the irrigation drainage canals adjacent to fields and equipment yards and then discharged to the river channels. In some locations where the farm fields are near river channels, the stormwater runoff can flow directly into the river channels. The agricultural stormwater runoff from fields can contain large amounts of sediment because plowing and cultivation break up the soil surface and make the soil susceptible to erosion. The field stormwater runoff can contain pollutants of concern associated with agriculture, such as nitrates (from fertilizers), pesticides, and herbicides.

Past irrigation practices often resulted in the application of excess irrigation water, which was drained from fields into drainage canals and released into the rivers. Discharges of excess irrigation water, or tailwater, are not regulated and their quality is not monitored. Water conservation rules restricting irrigation water use have resulted in a substantial reduction in farm-field drainage but have not eliminated it.

Concentrated Animal-Feeding Operations

Concentrated animal-feeding operations (CAFOs) can produce very poor quality discharges if the site drainage is not controlled. Animal wastes can drain from the site into storm drains or irrigation systems, including both water supply laterals and drainage canals. The principal pollutant of concern from such operations is nitrate. Bacterial pathogens and other microbiological pollutants, biochemical oxygen demand (BOD), total suspended solids, and nutrient loads can also be generated at a CAFO site. CAFO sites are not located within the Salt River channel, however, uncontrolled runoff from CAFO operations can enter the Salt River through canals and storm drainage systems.

Regulations are in place to require control of CAFO discharges by means of an agricultural general permit of the Arizona Aquifer Protection Permit program (Arizona Administrative Code, Title 18, Chapter 9, Article Z [R18-9-201 to 203]). CAFO discharges are also regulated through NPDES permits under the Clean Water Act. The Natural Resources Conservation Service (NRCS) has a pilot program to provide funding to control CAFO discharges at selected sites.

Wastewater Treatment Plant Discharges

All WWTPs that discharge to surface waters are required to have NPDES permits that include requirements to monitor the quality of the effluent prior to discharge. There are several WWTPs with discharge permits for the Salt River. Discharges from the City of Mesa Northwest Water Reclamation Plant near SR 101 infiltrate into the Salt River bed. During winter, reclaimed water from the WWTP is discharged to the Salt River. When hydrologic conditions permit, the flow from the plant can continue downstream beyond the study area. Groundwater monitoring data collected near the plant indicate that contaminant concentrations are relatively low and that the soil is effective at degrading potential contaminants of concern (Fox et al. 2001). Dissolved organic carbon (DOC) concentrations were reduced from 5–7 mg/l to less than 1 mg/l within 12 to 24 months of travel time in the groundwater plume emitted from the discharge. The majority of trace organic compounds were reduced in concert with DOC, and nitrate and DOC levels were lower than ambient background groundwater conditions.

Sand and Gravel Mining

Sand and gravel mining operations use pumped groundwater to sort and wash the aggregate materials. These mining operations are usually in the river channels or adjacent to the channels on the riverbanks. Before being pumped for use in these operations, the groundwater flows through materials similar to the mining aggregate. It is therefore expected that the mining will not result in any significant change in the chemical constituent concentrations in the water. Mining can greatly increase the sediment load in the water, however, and mining operations located within waters of the United States are required to have Section 404 permits and Section 401 water quality certification to minimize impacts on water quality. The major water quality impact results when there is an accident that releases water from a mining site or when the site is inundated during flood events in the river and stockpile material is transported downstream. During a flood, any sediment generated by sand and gravel mines is overwhelmed by the sediment transported by the floodflow. Currently, there are active sand and gravel mining operations in the Salt River.

4.2.5 REGULATORY SETTING

This section describes the federal and local agencies that have jurisdiction over water projects on rivers in the study area and that provide for flood protection in the study area. This section also presents information on the federal flood insurance program and pertinent water quality regulations.

4.2.5.1 Agency Jurisdiction

Several governmental agencies have administrative interests in the lower Salt and lower Gila Rivers. Upstream dams were built by or are operated by USBR, the U.S. Bureau of Indian Affairs, and the Salt River Project. The U.S. Army Corps of Engineers (Corps) built and operates a major flood control structure downstream of the study area. In Maricopa County, where the entire study area is located, municipalities have direct interests in management of the rivers, and the FCDMC is the primary entity providing for flood protection.

U.S. Army Corps of Engineers

Since its original legislative mandate in 1927 for flood-related work in the United States, the Corps has acquired significant responsibility for flood control and related efforts on the lower Salt River. Although the Corps has not built local channel facilities along the lower Salt River, the agency has constructed Painted Rock Dam to protect irrigation works on the lower Gila River from inundation and channel erosion. The dam, begun in 1957 and completed in 1960, can store 2.5 million ac-ft of water, with controlled releases of up to 22,000 cfs. The Corps has several proposed projects related to the lower Salt River. Although it is not known which, if any, of the projects may eventually be completed, they represent an indication of the Corps' interest in the study area.

U.S. Bureau of Reclamation

USBR has primary responsibility for the development and delivery of water resources. The 1902 Reclamation Act was intended to provide federal investment (with subsequent repayment by users) and expertise in the development of water resources, primarily in the western states. The Reclamation Reform Act of 1982 brought about significant adjustments in USBR's operating methods, recognized leasing, and changed payment procedures.

Salt River Project

Until the mid-20th century, the SRP was primarily a water storage and delivery agency for agricultural users. After World War II, however, the Phoenix urban area grew rapidly, and the mission of the SRP changed focus. In 1903, the local community included fewer than 20,000 people; by 1967, the population had grown to 800,000; and in 1994, the population approached 2 million. To accommodate the shift from an agricultural to an urban emphasis, the SRP adjusted to address urban water delivery issues, and it became a major component of the regional electrical power grid. The SRP operates the seven major dams upstream of the metropolitan area on the Salt River, and therefore must be taken into account in any plans for managing river flows and floods through the urban area. The SRP also owns land parcels in and near the river channel.

Flood Control District of Maricopa County

The FCDMC is also a primary agency involved with the management of the lower Salt River and the portion of the Gila River included in the present study. Although Maricopa County had undertaken some flood control efforts on a relatively small scale before the early 1980s, widespread, coordinated projects became much more common after the Arizona State Legislature mandated the formation of county flood control districts. The FCDMC builds various flood control structures, often in cooperation with other agencies, such as the Arizona Department of Transportation (ADOT) and the NRCS. In addition, the FCDMC manages floodplain development by delineating floodplains and administering regulations for floodplain users. The FCDMC coordinates the participation of the county in the National Flood Insurance Program, administered by the U.S. Department of Housing and Urban Development, as established by congressional action in 1968 and revised in 1973. The availability of federally insured loans and other federal assistance related to floodplains depends on adherence to federal and state rules and regulations as administered by the FCDMC. In exercising its responsibilities, the FCDMC has completed 32 projects and structures within Maricopa County, including vegetation clearing projects, levee construction, bank stabilization, and channel improvements.

Municipalities and Indian Communities

The municipalities of Mesa, Tempe, and Phoenix and the Salt River Pima-Maricopa and Gila River Indian Communities have direct interests in the lower Salt River because the stream flows directly through their jurisdictions. Tempe has committed itself to an ambitious effort to convert 5 miles of the Salt River channel and adjoining areas into a variety of land uses ranging from habitat reconstruction to intensive commercial and residential activities. In 1989, the City of Tempe adopted the Tempe Rio Salado Master Plan to guide the development under the general direction of the City of Tempe Community Development Department. ADOT, in work associated with the Red Mountain Freeway on the north bank of the river, channelized the stream from the Hohokam Expressway (roughly the alignment of 48th Street) and Mill Avenue, and the FCDMC extended the project upstream to McClintock Drive, a short distance upstream from Indian Bend Wash (a Corps project). The channel design includes grade control structures to limit scour, channel migration, and degradation, and the general capacity of the channel is 250,000 cfs. The expected 100-year flood for the reach after the completion of improvements to Roosevelt Dam is 160,000 cfs.

Federal Emergency Management Agency

Congress, alarmed by increasing costs of disaster relief, passed the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. The intent of these acts is to reduce the need for large public-funded flood control structures and disaster relief by restricting development on the floodplain.

The Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program to provide subsidized flood insurance to communities that comply with FEMA regulations that limit development in floodplains. FEMA issues flood insurance rate maps for communities participating in the program. These maps delineate flood hazard zones in the community and are updated as flood control improvements are implemented.

4.2.5.2 Water Quality Regulations

Clean Water Act

Placement of dredged or fill materials into waters of the United States is regulated under Section 404 of the Clean Water Act, which is administered by the Corps. Under the act, the state must issue or waive Section 401 water quality certification for the project to be permitted under Section 404. Water quality certification requires the evaluation of water quality considerations associated with dredging or placement of fill materials into waters of the United States.

The EPA requires states to identify and establish beneficial uses and water quality objectives for surface and groundwater resources. The Arizona Department of Environmental Quality (ADEQ) is the responsible agency and the water quality standards are established in the Arizona Administrative Code, Title 18, Chapter 11. Numerical and narrative water quality objectives are established to protect designated uses. The Salt River from the location of the Phoenix 24th Street WWTP extending downstream to the confluence with the Gila River is classified as an effluent dependent water body under Title 18 and ADEQ regulates effluent discharges within this reach on a site-specific basis.

Section 303(d) requires states to identify water resources that are impaired by contaminants and failing to meet ambient surface water quality objectives. The applicable regulations require development of a Total Maximum Daily Load (TMDL) program for 303(d) listed water bodies. TMDL programs identify sources of the contaminants, available assimilative capacity of the water body that would result in water quality objectives being met, and allocates the allowable daily load to dischargers within the watershed. The TMDL implementation plan is then developed to regulate and control the loading of contaminants in the watershed. The Salt River is listed as being impaired by chlordane, DDT metabolites, pH, and toxaphene in the lower reach of the channel extending from near the Phoenix Sky Harbor Airport to the confluence with the Gila River (Arizona Department of Environmental Quality 1998). The TMDLs for these constituents are proposed to be developed before 2007.

National Pollutant Discharge Elimination System Discharge Permits

Established by Section 402 of the Clean Water Act, NPDES is the primary federal program that regulates point-source discharges to waters of the United States. The EPA granted the State of Arizona primacy on December 5, 2002. The state program is called the Arizona Pollutant Discharge Elimination System (AZPDES) program and is administered by the Arizona Department of Environmental Quality, Water Quality Department in Phoenix, Arizona.

In 1992, the EPA promulgated rules for a General Industrial Storm Water Permit under the NPDES, which requires property owners to file a notice of intent to discharge stormwater runoff to waters of the United States from specified industrial activities, including mining. The permit requires dischargers to eliminate non-stormwater discharges to stormwater systems, develop and implement a SWPPP, perform inspections of stormwater pollution prevention measures, and monitor water quality. In 1998, EPA transferred permittees previously covered by the 1992 permit to EPA's multi-sector general permit, which was issued in 1995. Multi-sector permits are currently required for municipalities with populations greater than 100,000. Phase II of the NPDES rules, which were adopted in 2003, requires municipalities with populations greater than 10,000 to develop and implement multi-sector permits.

In 1992, the EPA promulgated rules for a General Construction Storm Water Permit under the NPDES, which will require landowners to file a notice of intent to discharge stormwater runoff to waters of the United States from land disturbances of more than 5 acres. The permit generally requires dischargers to eliminate non-stormwater discharges to stormwater systems, develop and implement a SWPPP, and perform inspections of stormwater pollution prevention measures. The grading that would occur as part of this project would be more than 5 acres, and therefore a SWPPP will be required. These requirements have been incorporated into the AZPDES permit program.

Safe Drinking Water Act

Water quality standards for drinking water are established and regulated by the federal Safe Drinking Water Act of 1986. The maximum contaminant levels, which apply to metals and other toxic compounds in drinking water, are subject to revision, and additional compounds may be added. The Arizona Safe Drinking Water Program is administered by the ADEQ, except for Underground Injection Control permits, which are still issued by the EPA Region 9 office in San Francisco, California.

4.3 BIOLOGICAL RESOURCES

This section contains a summary of biological resources located or potentially occurring in the Va Shly'ay Akimel project study area. Information was derived from published and unpublished reports, Jones & Stokes' file information, and field surveys.

For the purpose of this report, the project study area includes a 14-mile-long section of the Salt River within the Salt River Pima-Maricopa Indian Community (SRPMIC) and the City of Mesa, Arizona, located between the Pima Freeway (SR 101), and Granite Reef Dam (Figure 1-2). The study area extends 1 mile to either side of the thalweg, or center of the river channel, for a total width of 2 miles.

Field surveys were conducted in March 2002 and March 2003 by Jones & Stokes biologists. The objectives of the surveys were to map cover types, to identify biological resources, and to describe existing conditions in the project study area. Cover types were mapped on black and white aerial photographs (scale 1"=500') taken in January 2001 and were then digitized using ArcInfo version 8.1. The minimum mapping unit for most cover types was 10 acres, with a 1-acre minimum mapping unit observed for sensitive cover types (e.g., riparian and wetland habitats).

Ten special-status wildlife species are considered to have the potential to occur in the project study area and are evaluated in this study. No special-status plants (other than protected native plants) or fish have been recorded in or are expected to occur in the project study area. The area could potentially support the desert tortoise and Mexican garter snake. The scientific and common names of plants and wildlife discussed in this section are listed in Appendix C.

4.3.1 ENVIRONMENTAL SETTING

Historically, the project study area supported significant biological resources including extensive riparian and marsh habitats. Urban development, diversion of water to support agriculture, and domestic livestock grazing have eliminated or altered most of the natural vegetation communities that occupied the project study area leaving only scattered remnants of the original vegetation communities. Modifications of the river system, such as damming and flow diversion, currently allow no natural flow through the project study area except during flood events. Vegetation communities in the project study area have been highly modified from their original state and currently contain a mosaic of degraded natural communities and manmade artificial communities.

A classification system was developed for this study based on several sources, including a list of cover types supplied to Jones & Stokes by the U.S. Army Corps of Engineers, Jones & Stokes file information, and recent publications (Brown 1982, Szaro 1989). The classification system categorized habitat types in the project study area by the type of vegetation cover. Table 4.3-1, which follows, summarizes the mapped cover types and subtypes in the project study area and characteristics of each. This section describes the important biological communities that occur in the project study area and their characteristic vegetation and wildlife. The general locations of these cover types are shown in Figure 4.3-1.

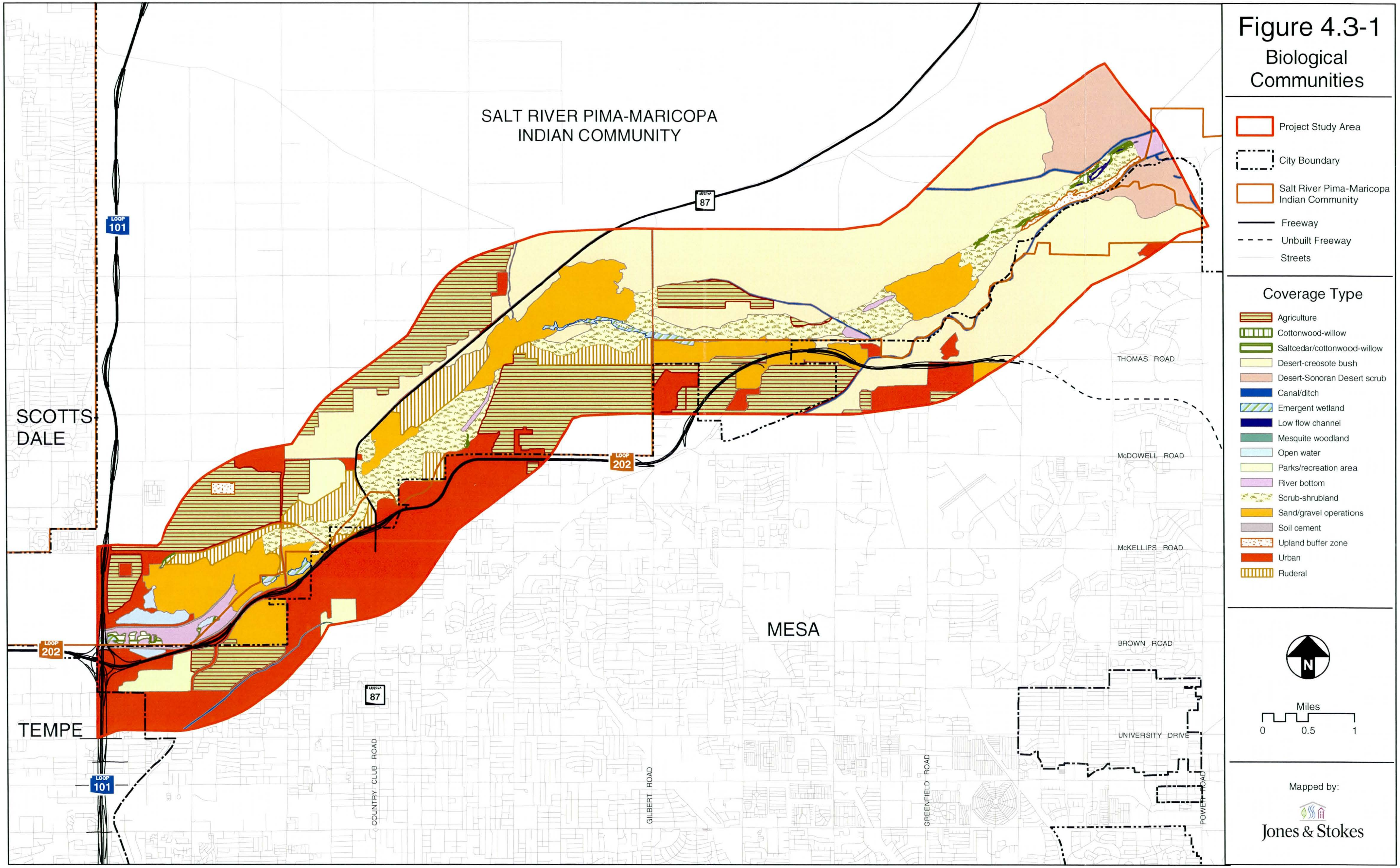


Figure 4.3-1
Biological Communities
Project Study Area
City Boundary
Salt River Pima-Maricopa Indian Community
Freeway
Unbuilt Freeway
Streets
Coverage Type
Agriculture
Cottonwood-willow
Saltcedar/cottonwood-willow
Desert-creosote bush
Desert-Sonoran Desert scrub
Canal/ditch
Emergent wetland
Low flow channel
Mesquite woodland
Open water
Parks/recreation area
River bottom
Scrub-shrubland
Sand/gravel operations
Soil cement
Upland buffer zone
Urban
Ruderal
N
Miles
0
0.5
1
Mapped by:
Jones & Stokes
SALT RIVER PIMA-MARICOPA
INDIAN COMMUNITY
SCOTTSDALE
TEMPE
MESA
LOOP 101
LOOP 202
87
THOMAS ROAD
McDOWELL ROAD
McKELLIPS ROAD
BROWN ROAD
UNIVERSITY DRIVE
COUNTRY CLUB ROAD
GILBERT ROAD
GREENFIELD ROAD
POWER ROAD

Table 4.3-1. Cover Types Present within the Va Shly'ay Akimel Project Study Area

Major Cover Type	Subtype	Description	Extent in Acres	Percentage of Project Study Area
Agricultural Lands	Irrigated Pasture	Used for cattle grazing	187.3	1%
	Citrus	Orange groves	554.7	3%
	Fallow/Ruderal Field	Plowed fields not used for at least a year.	618.6	4%
	Unclassified Agriculture	Plowed and unplanted at the time of the survey.	1901.7	11%
Cottonwood-willow Forest	Young cottonwood-willow forest	Dominated by native trees, generally with saltcedar in the understory.	40.2	<1%
	Saltcedar/ cottonwood-willow forest	Dominated by saltcedar with scattered native species.	31.2	<1%
Desert Areas	Creosote bush/white bursage	Dominated by Creosote bush and white bursage	5,226.4	30%
	Sonoran desert scrub	Dominated by Creosote bush, saguaro, cholla, and paloverde	782.1	4%
Ditch/Canal	None	Aqueducts and major ditches	167.4	1%
Emergent Wetlands	None	Dominated by Cattails, with scattered tules	73.0	<1%
Low Flow Channel	None	Low flow channels in the active channel	16.9	<1%
Open Water	Groundwater recharge basin	City of Mesa recharge basins near SR 101.	91.7	<1%
	Sand/gravel operation ponds	Permanent ponds associated with active sand/gravel operations	11.8	<1%
Parks and Recreation Areas	None	Golf courses and parks	279.6	2%
River Bottom	None	Unvegetated river bottom covered mostly with cobbles.	251.8	1%
Scrub-Shrublands	None	Dominated by ironwood, triangle leaf bursage and creosote.	1,419.0	8%

Major Cover Type	Subtype	Description	Extent in Acres	Percentage of Project Study Area
Sand-Gravel Operations	None	Operations within the active channel	1,961.6	11%
Soil Cement	None	Soil cement on the active slopes of the channel	34.0	<1%
Upland Buffer Zone	None	Newly established shrubs and scrub dominated by a mixture of native and non-native shrubs	86.5	<1%
Urban	None	Residential, industrial, or transportation	2,999.7	17%
Ruderal	None	Disturbed areas not associated with agricultural clearing, mostly weedy herbaceous species.	699.5	4%

4.3.2 COVER TYPE DESCRIPTIONS

4.3.2.1 Agricultural Lands

Vegetation

Agricultural lands are common in the project study area occupying 19% of the total area. Generally, agricultural uses include irrigation for cattle grazing, orchards (citrus), and crops such as cotton, small grains, and assorted vegetables.

Wildlife

Agricultural lands in general have low to moderate wildlife value. The composition and structure of commercially produced agricultural croplands lack the diversity of more productive wildlife habitats.

Plants important for wildlife food and shelter are often absent or reduced to rows at the edges of the fields. While these fencerows provide corridors for animals to move from place to place, many are isolated and fragmented, greatly reducing the wildlife value. Small mammals such as mice, voles and rats frequent such fencerows and may forage on crops such as alfalfa and small grains. The abundance of small mammals using these edge habitats serves to attract larger predators, including medium-sized mammals such as coyote, gray fox, and bobcat, as well as avian predators (e.g., red-tailed hawk, northern harrier, American kestrel, barn owl, and great horned owl). Bird species favoring open habitats such as killdeer, mountain plover, greater roadrunner, mourning dove, white-winged dove, horned lark, and various ground-feeding granivorous sparrows and finches will forage in agricultural fields.

4.3.2.2 Cottonwood-Willow Forest

Vegetation

Cottonwood/willow forest is uncommon in the project study area occupying less than 1% of the total project study area. This cover type is representative of high-quality riparian habitat in Arizona. Riparian habitats are defined as habitats or ecosystems that are associated with adjacent bodies of water (rivers, lakes, or streams) or are dependent on the existence of perennial or ephemeral surface or subsurface water drainage. They are further characterized by having diverse assemblages of plant and animal species in comparison with adjacent upland areas.

Recruitment of most woody riparian vegetation in the southwest has been shown to correlate with high flows followed by a year or more without high flows. Water availability in the project study area is regulated largely by upstream irrigation diversion dams. Because of the modification of the Salt River system, groundwater elevations have been lowered and this has contributed to the decline in riparian extent and cover. These same conditions have also favored the establishment and dominance of non-native saltcedar. The vegetation structure of most stands of cottonwood/willow within the project study area show evidence of disturbed and early successional conditions consistent with past histories of water diversion, infrequent severe floods, and land clearing. These plant species are also found in narrow, linear strands of vegetation oriented in the main direction of water flow that may occur in riverine flood channels and along the banks of streams. An example of cottonwood/willow habitat can be found near the City of Mesa Wastewater Treatment Plant (Mesa WWTP), where return flows permit re-establishment of riparian vegetation.

Of the total project study area acreage, 1% consists of cottonwood/willow habitat (Figure 4.3-1). In terms of height, basal area, and density, Fremont cottonwood and Goodding's willow are the dominant canopy species in the cottonwood/willow associations in the project study area, along with saltcedar. The cottonwood/willow riparian habitat is patchy in the project study area and much of the original stands of this habitat have been replaced by the invasive and non-native saltcedar.

For the purpose of this report, riparian habitat was separated into two subtypes; young cottonwood/willow forest, and saltcedar/cottonwood/willow forest based on differences in species dominance within each subtype. Both subtypes support varying combinations of cottonwoods, willows and saltcedar in the canopy.

The saltcedar/cottonwood/willow subtype in the project study area is dominated by dense stands of saltcedar with scattered cottonwoods or willows in the canopy. Saltcedar has been labeled an "extreme" phreatophyte because of its ability to tap and exploit deep water tables (Duncan et al. 1993). Saltcedar is also highly salt tolerant and has been shown to thrive on groundwater with a high concentration of salt (Duncan et al. 1993). This ability to disperse highly concentrated salt excretions provides saltcedar with a competitive advantage over native plants, such as willows and cottonwoods (Duncan et al. 1993). In contrast, the cottonwood/willow forest subtype is characterized by small, generally young, native trees with a canopy dominated by cottonwoods and willows. This type also commonly has saltcedar, desert broom, marsh fleabane, and desert willow as associates in the canopy or understory.

Wildlife

Cottonwood/willow forest, although uncommon in the project study area, stands out as the most important remnant wildlife habitat in the area. Cottonwood/willow supports the densest and most diverse wildlife communities in valleys and deserts. The diversity of plant species and growth forms provide a variety of foods and microclimate conditions for wildlife. Cottonwoods and willows provide substantial nesting support for large birds, such as great blue heron, red-tailed hawk, American kestrel, western screech owl, great horned owl, and northern flicker.

Although saltcedar has displaced large amounts of riparian and other vegetation along the Salt River, the remaining riparian habitat still provides high wildlife value, especially for resident and migratory birds. Great blue heron, great egret, western yellow-billed cuckoo, and black-crowned night-herons are also known to roost in the cottonwood/willow vegetation and would then forage in nearby habitats.

The remaining cottonwood/willow habitats are especially important for resident and migratory neotropical songbirds because these and other native riparian habitats have high wildlife value and have substantially declined throughout the western United States. Many bird species use cottonwood/willow habitats in the project study area, including Anna's hummingbird, ash-throated flycatcher, black phoebe, dusky flycatcher, western wood pewee, western kingbird, tree swallow, house wren, Bewick's wren, verdin, Lucy's warbler, yellow warbler, yellow-rumped warbler, and red-winged blackbird.

The most common mammals in cottonwood/willow habitats in the Salt River Valley area are the cactus mouse, deer mouse, and western harvest mouse. White-throated woodrat, hispid cotton rat, coyote, and bobcat are also common in these cottonwood/willow habitats (CH2M HILL et al. 1997).

Some of the common reptiles occurring in this same area include the tree lizard, earless lizard, side-blotched lizard, desert spiny lizard, western whiptail, banded gecko, desert blackheaded snake, common kingsnake, banded sand snake, and western diamondback rattlesnake. The tree lizard, which has been characterized as a terrestrial riparian lizard (Omart et al. 1988), is among the most common species observed in the cottonwood/willow and saltcedar trees in the vicinity (CH2M HILL et al. 1997).

Many native wildlife species, especially riparian-dependent or riparian/marsh-dependent birds (e.g., southwestern willow flycatchers [discussed in more detail below under "Special-Status Species"], summer tanager, and western yellow-billed cuckoo) require large tracts of native riparian trees and shrubs for cover, nesting, and foraging.

4.3.2.3 Desert Areas

Vegetation

Desert areas are the most common cover type in the project study area occupying 34% of the total area. They are characterized by relatively undisturbed arid lands in the project study area. For the purpose of this study, desert areas were separated into two subtypes: creosote bush/white bursage, and Sonoran desert scrub. The creosote bush/white bursage subtype is characterized by mostly creosote bush with scattered white bursage and other small shrubs in the canopy. This community type is variable from monotypic stands of creosote bush to a more diverse canopy in the transition zone between it and Sonoran desert scrub. Sonoran desert scrub is uncommon in the project study area, and is only present in the uplands near Granite Reef Dam. Characteristic species are typically more diverse and include creosote bush, saguaro, yellow paloverde, cholla, and barrel cactus.

Wildlife

Desert areas in the project study area are likely to support some bird species that will not occur in other habitat types in the region. This wildlife habitat type is used by many bird species, including mourning dove, white-winged dove, Lucy's warbler, Bell's vireo, Abert's towhee, elf owl, Gila woodpecker, verdin, and house finch. Other avian desert specialists including curve-billed thrasher, phainopepla, canyon towhee, and black-throated sparrow, which favor the Sonoran desert scrub and cholla cactus habitats (Phillips et al. 1964, Witzeman et al. 1997). Mammals that use this habitat include coyote, gray fox, bobcat, pocket gopher, black-tailed jackrabbit, desert cottontail, and cactus mouse. Reptiles often found in desert habitat include earless lizard, side-blotched lizard, desert spiny lizard, western whiptail, gopher snake, common kingsnake, banded sand snake, and western diamondback rattlesnake.

4.3.2.4 Ditch/Canal

Vegetation

Ditches and Canals in the project study area occupy 1% of the total area. These features include large aqueducts such as the Arizona Canal and the Southern Canal, and several smaller ditches used for the transportation of irrigation water.

Wildlife

Ditches and canals, as they occur in the project study area, offer moderate to low wildlife value. These features are only rarely lined with any vegetation that could serve as corridors or cover for wildlife. The larger concrete-lined aqueducts serve as marginal foraging and loafing areas for several species of waterfowl including mallard, common merganser, and American coot. During field surveys, belted kingfisher, osprey, and black phoebe were observed foraging in the vicinity of the larger aqueducts.

4.3.2.5 Emergent Wetlands

Vegetation

Emergent wetlands are uncommon in the project study area, occupying less than 1% of the project study area on lands in the floodplain of the Salt River near the Mesa WWTP, near the Granite Reef Dam, and in scattered areas around gravel mining operation ponds that have been abandoned or are not routinely cleared of vegetation. Emergent wetlands in the project study area are dominated by obligate wetland species including cattails, tule, dock, and knotweeds.

Wildlife

Emergent wetlands support high-quality wildlife habitat, and support a large diversity of wildlife species. In addition, the federal- and state-listed Yuma clapper rail has historically been recorded in small numbers in the emergent wetlands found along the Salt River above and below Phoenix (Monson and Phillips 1981). Other species known to occur in emergent wetland habitat in the project study area include great blue heron, black-crowned night-heron, cinnamon teal, black-bellied whistling duck, mallard, northern pintail, western sandpiper, spotted sandpiper, and marsh wren (Jones & Stokes 2000).

Many other migratory waterfowl, shorebirds, and wading birds are expected to use emergent wetlands in the project study area. Terrestrial wildlife species expected to use the emergent wetlands include bobcats, raccoons, coyotes, muskrats, and ground squirrels.

4.3.2.6 Low-Flow Channels

Vegetation

Low-flow channels in the Salt River have been almost entirely eliminated, occurring in less than 1% of the project study area near the Granite Reef Dam. Vegetation, when present, consists of Bermuda grass, salt heliotrope, and sedges.

Wildlife

Although, low-flow channels within the project study area can attract waterfowl and migatory birds, because of their small size and poor quality these channels do not represent a significant value to wildlife. .

4.3.2.7 Open Water

Vegetation

Open water habitat is uncommon in the project study area, occupying less than 1% of the total area. For the purpose of this report, the open water cover type was separated into two subtypes: sand/gravel operation ponds and groundwater recharge basins. Vegetation is lacking within the sand/gravel operation ponds. The groundwater recharge basins, located north of the Mesa WWTP adjacent to the SR 101/202 interchange, contain a variety of submerged aquatic plant species. The basins are shallow but remain flooded most of the year through a constant input from the Mesa WWTP.

Wildlife

Open water habitat along the Salt River has high wildlife value. The open water habitat supports large numbers of water birds that feed or breed in the area. For example, during the 4-5 March 2002 and 2003 field reconnaissance, large numbers of water birds were observed feeding and roosting in several large open water features adjacent to the Pima Freeway (SR 101), including 12 species of ducks. Mallard and cinnamon teal are known to nest near open water habitats of Maricopa County (Witzeman et al. 1997), and may nest within the project study area. Aquatic snakes, amphibians, and turtles are likely to occur in some of the open water habitats.

Fish

Few quantitative and comprehensive inventories of fish species have been undertaken on the Salt River system (CH2M HILL et al. 1997). Fifteen native fish species and 29 introduced fish species have been recorded in the Salt River and Phoenix Canal systems (Marsh and Minckly 1982). Fish habitat in the region has been altered because of elevated nutrient levels in the WWTP effluent discharge. This has resulted in abundant growths of algae and emergent aquatic and submergent vegetation. Dissolved oxygen levels in the water column vary widely. If native fish species are still present in the Salt River system, their occurrence would likely be limited by low dissolved oxygen levels (CH2M HILL et al. 1997).

4.3.2.8 Parks and Recreation Areas

Vegetation

Parks and recreation areas occupy 2% of the project study area and include turf-covered lands used for activities such as golf and other recreation activities. These areas generally contain non-native ornamental trees and shrubs.

Wildlife

Parks and recreation areas, as they occur in the project study area, offer moderate wildlife value. Parks and golf courses planted with non-native ornamental trees and shrubs provide some foraging and roosting habitat for resident and migrating birds, and smaller manmade ponds may support waterfowl and fish. Wildlife species occurring in parks and recreation areas are expected to be similar to those found in urban areas and in close association with human activity. The rock dove, European starling, house finch, and house sparrows are among those species known to be common in parks and recreational areas.

4.3.2.9 River Bottom

Vegetation

The river bottom cover type was located in 1% of the total project study area. This cover type is largely unvegetated and is characterized by cobble in the active channel of the Salt River.

Wildlife

River bottom habitat provides low wildlife value because the vegetation is sparse or grows in clumps, but the habitat is used by many wildlife species for foraging or sunning. Many species of snakes and lizards use cobble habitats for sunning during the morning and evening. Cobble habitats often trap small fish and amphibian tadpoles as the river water recedes during spring or summer. These small fish and tadpoles then become prey for water birds (e.g., herons, egrets, and gulls), raccoons, skunks, and aquatic snakes.

Quailbush, found in the river bottom habitat, is used by many birds, mammals, and reptiles for feeding and cover. Many of the wildlife species that use river bottom habitat are also found in habitats associated with of sand/gravel operations.

4.3.2.10 Scrub-Shrublands

Vegetation

Scrub-shrublands are present within the active channel of the river and occupy 8% of the project study area. They are dominated by combinations of burro brush, rabbit brush, quailbush, saltbush, and occasionally by creosote bush. Many of these areas have been highly disturbed from Off-Highway Vehicle (OHV) traffic and mining activities and contain little or no vegetation cover. If the total vegetation cover was less than 10%, the area was mapped as unvegetated river bottom; if water was present, it was mapped as low flow channel.

Wildlife

Scrub-shrublands as they occur in the project study area, offer moderate wildlife value. The shrub and scrubland vegetation provides foraging and resting cover for small and medium-sized mammals, snakes and lizards, and various terrestrial birds including Gambel's quail, greater roadrunner, loggerhead shrike, curve-billed thrasher, and verdin.

4.3.2.11 Sand/Gravel Operations

Vegetation

Sand/gravel operations are common in the project study area, occupying 11% of the total area. Next to water diversion, these operations appear to be a large factor contributing to habitat alteration within the historic river channel. Because these operations are characterized by a large amount of disturbance in the active channel, vegetation is mostly lacking, but includes mostly weedy non-native species that tend to colonize quickly after disturbance.

Wildlife

Sand/gravel operations provide low wildlife value because the areas tend to be characterized by high human activity and disturbance from the operation of heavy equipment. Because the vegetation is sparse, there is little foraging or resting cover for wildlife species. Many of the wildlife species that use sand/gravel operations are also found in river bottom habitat.

4.3.2.12 Upland Buffer Zone

Vegetation

The upland buffer zone is uncommon in the project study area, occupying less than 1% of the project study area. A mixture of non-native and native species on the upper terrace and floodplain of the river characterize the upland buffer zone. Within the project study area, the presence of upland buffer zone is highly variable depending on the level of disturbance from urban, agricultural, and industrial uses. Typical species associated with this zone include mesquite, rabbit brush, acacia, blue paloverde, creosote, saltcedar, and tree tobacco.

Wildlife

The upland buffer zone supports many of the wildlife resources of the desert habitats, and provides low to moderate wildlife value because of its lack of abundance and its proximity to disturbed habitats. Although the upland buffer zone area supports good plant diversity and structure, it is not an abundant habitat type within the project study area.

4.3.2.13 Urban Areas

Vegetation

Urban areas are common in the project study area occupying 17% of the total area. Major land uses include residential, commercial and industrial uses. Generally, non-native ornamental plants and small patches of turf dominate urban areas.

Wildlife

Urban areas have low wildlife value because they provide minimal cover and food sources. Wildlife species often using urban areas include northern mockingbird and mourning dove, in addition to those species known to be common in parks and recreational areas. Urban areas tend to support wildlife species with high tolerances to human activity and disturbance. Medium-sized mammals adapted to take advantage of urban areas include opossum, raccoon, striped skunk, and coyote.

4.3.2.14 Ruderal

Vegetation

Ruderal areas are common in the project study area occupying 4% of the total area. These areas are characterized by a highly disturbed surface with little or no vegetation cover. Characteristic species found in this habitat include introduced annual plant species, including London rocket and filaree, and scattered native shrubs (saltbush, creosote, and burro brush) and non-native shrubs, including Russian thistle.

Wildlife

Ruderal areas have low wildlife value because they provide minimal cover for foraging and resting. Because of the open nature of ruderal areas, raptors such as white-tailed kite, red-tailed hawk, and American kestrel are commonly found hunting in these habitats.

One raptor species able to utilize the flatter ruderal habitats is the western burrowing owl. Until the early eighties, western burrowing owl was common along the north bank of the Salt River, however housing and industrial development, and high OHV use in former western burrowing habitat have made it increasingly uncommon in Maricopa County. (Witzeman et al. 1997.) Three western burrowing owls were observed in ruderal habitat in the project study area during the March 2002 field reconnaissance. None were seen during the March 2003 field reconnaissance.

4.3.3 HGM MODELING RESULTS

As part of the plan formulation process, the Corps selected the Hydrogeomorphic (HGM) assessment modeling method to quantify the anticipated habitat benefits that would be gained or lost by implementing each of the proposed ecosystem restoration alternatives for the Va Shly'ay Akimel project area. Although HGM was originally developed as a tool for classifying and evaluating wetlands, it has been recognized that the functional approach of this method is also applicable to areas associated with aquatic habitats that may not be wetlands, such as many riparian systems. HGM consists of a classification phase and an assessment phase. It groups wetland or riparian systems on the basis of three criteria: 1) geomorphic setting, 2) water source, and 3) hydrodynamics, chosen because these criteria are assumed to fundamentally influence how the systems function. "Geomorphic setting" refers to the landform and position of the wetland system in the landscape (e.g., a depression in the middle of a watershed). "Water source" refers to the primary water source that supports the system (e.g., precipitation, overbank flooding, or groundwater). "Hydrodynamics" refers to the level of energy and the direction that water moves in the system (e.g. the level of energy in a riverine floodplain is generally higher than in an isolated wetland and its movement is generally downstream). The resulting riverine wetland subclasses used for this project are all associated with low gradient perennial and ephemeral river systems in Arizona.

HGM assessment areas are called Partial Wetland Assessment Areas, or PWAAs. The basic difference between a PWAA and a vegetation cover type is that a PWAA has a functioning hydraulic connection to the ecosystem. For example, a mesquite bosque that is now separated from the river by a levee and therefore is no longer inundated by large flood events, is still a mesquite cover type but is not a PWAA. The dominant vegetative cover types used within the PWAAs included cottonwood/willow, emergent wetland, mesquite, scrub-shrub (Lower Sonoran Desert) and river bottom. River bottom was defined as the active channel and included pool/riffle aquatic areas, and open areas characterized by sand, cobble, and/or gravel. Table 4.3-2, which follows, identifies the baseline PWAAs incorporated in the HGM analysis for this project.

The assessment phase of HGM evaluates the ability of a wetland system to perform a number of functions. In HGM, functional value is defined in terms of Functional Capacity Units (FCUs). An FCU considers both quality (how well a particular wetland performs a particular function) and quantity (acreage of the wetland).

Table 4.3-2. PWAA Description

	Baseline Acres (TY0)
Farms and Croplands - Dairy, Cotton, and Alfalfa	249.7
Existing Buffer Zones - Mesquite, Ironwood, Rabbit brush, Quailbush, Cat-claw Acacia, Paloverde, and Creosote	0
Existing Cottonwood-Willow Forests in the Active Channel	69.5
Desert Areas - Bare Earth, Cacti, Rabbit brush, Acacia	961.9
Ditches	56.5
Existing Mesquite Woodlands - on the Terraces and in the Active Channel	4.1
Newly Planted Upland Buffer Zones - Mesquite, Ironwood, Triangle Bursage, Rabbit brush, Quailbush, Cat-claw Acacia, Paloverde, and Creosote	0
Newly Planted Cottonwood-Willow Forests in the Active Channel	0
Newly Planted Mesquite Woodlands - on the Terraces and in the Active Channel	0
Newly Developed Open Water Areas in the Active Channel	0
Newly Developed River Bottom Areas in the Active Channel - Largely Unvegetated (Includes Emergents)	0
Newly Planted Scrub-Shrublands in the Active Channel	0
Existing Open Water Areas in the Active Channel - Inactive Sand and Gravel Operations	100.5
Parks and Recreation Areas	9.6
Existing River Bottom Areas in the Active Channel - Largely Unvegetated (Includes Emergents)	334.6
Existing Sand and Gravel Operations/Extractions in the Active Channel	1,651.6
Existing Scrub-Shrublands in the Active Channel - Rabbit brush, Quailbush, Ironwood, and Saltbush	2,057.1
Existing Soil Cement Areas on the Slopes of the Active Channel	33.9
Existing Residential, Industrial and Transportation Avenues	341.6
TOTAL	5,870.6

The quality of the wetland system's functional performance is measured in terms of a Functional Capacity Index (FCI). An FCI is the ratio of the functional capacity of a wetland under a particular existing, or predicted, condition (rated 0 to 1) and the functional capacity of a wetland under highest sustainable conditions (rated 1). In other words, an FCI indicates how well a particular wetland area actually performs a particular function, compared to how the "best wetland" of the region would perform that same function. The FCI value is then multiplied by the acreage of the PWAA to determine the FCUs provided by the PWAA for a particular function. Ten functions were analyzed for the Va Shly'ay Akimel project. Annualized FCUs (AAFCUs) for each function were calculated by summing FCUs across all years in the period of analysis and dividing the total by the number of years in the life of the project. Finally, for each alternative, an average of all AAFCUs of all functions was computed by adding the AAFCUs together and dividing by the number of functions (10). The resulting number was then used to compare how the functional capacity or quality of the study area ecosystem would change over time with different alternatives. Existing conditions in the Va Shly'ay Akimel study area were estimated to have a total of 812 AAFCUs (averaged across all functions). Assuming no project is implemented at Va Shly'ay Akimel, the total FCUs are expected to decline to 709 units in 20 years and to 705 units in 50 years.

The HGM analysis report is included as an appendix to the feasibility study.

4.3.4 SPECIAL-STATUS SPECIES

Special-status animals are species in the following categories:

- animals listed or proposed for listing as threatened under the federal Endangered Species Act (ESA) (50 CFR 17.11 [listed animals] and various notices in the Federal Register [proposed species])
- animals listed or proposed for listing as endangered under the federal Endangered Species Act (ESA) (50 CFR 17.11 [listed animals] and various notices in the Federal Register [proposed species])
- animals that are candidates for possible future listing as threatened or endangered under the federal ESA (66 FR 54808, October 30, 2001)
- wildlife species of special concern to the AGFD (Arizona Game and Fish Department 1996)

The following discussions and Table 4.3-3, which follows, summarize the habitat requirements and distribution of the ten special-status wildlife species that potentially occur in the project study area: lowland leopard frog, desert tortoise, Mexican garter snake, bald eagle, peregrine falcon, Yuma clapper rail, cactus ferruginous pygmy owl, western yellow-billed cuckoo, southwestern willow flycatcher, and lesser long-nosed bat. No special-status species have been recorded in the project study area (CH2M HILL et al. 1997).

Table 4.3-3. Special-Status Species That Could Occur or Are Known to Occur in the Va Shly'ay Akimel Study Area

Species	Status* Federal/State	Arizona Distribution	Habitat Requirements	Reasons for Decline	Potential for Occurrence in the Study Area
Lowland leopard frog *Rana yavapaiensis*	--/WC	Occurs below 5,500 feet in elevation, south and west of Mogollon Rim.	Permanent streams, generally avoids ponds; prefers streams with willows and cottonwoods or emergent vegetation.	Predation and competition from non-native fish and amphibians and from stream alteration and flow diversion	The project study area is in the lowland species' geographic range. Areas along the Salt and Rivers appears to be suitable habitat, but there are no recent records.
Desert tortoise *Gopherus agassizii*	--/WC	Occurs across much of Arizona's Sonoran Desert, including the Phoenix area.	Desert areas from 300 to 900 feet with sandy loam to gravelly soils for digging dens; favors cactus scrub habitats with high densities of annual blooms in spring for feeding.	Loss of habitat from urban development, habitat alteration and direct mortality from off-road vehicle use, cattle grazing, and predators, respiratory disease	Small sections of the upland areas in the project study area appear to be potential habitat; could potentially occur in the project study area.
Mexican garter snake *Thamnophis eques*	--/WC	Occurs in permanent marshes in south-central and southeastern Arizona.	Strongly aquatic, and feeds on aquatic animals, including fish and amphibians.	Loss of wetland habitats and because of competition and predation from non-native fish and bullfrogs	Suitable wetland habitat is present along the Salt River; could potentially occur in the project study area.

Species	Status* Federal/State	Arizona Distribution	Habitat Requirements	Reasons for Decline	Potential for Occurrence in the Study Area
Bald eagle *Haliaeetus leucocephalus*	T/WC	Nesting occurs along the Verde and Salt Rivers; also nests along the Agua Fria and Gila Rivers; wintering occurs along rivers and lakes where suitable habitat occurs.	Occurs along large rivers and lakes for nesting and wintering; requires large trees, cliffs, or pinnacles for nesting.	Human disturbance at nesting and wintering sites; loss of suitable nesting sites, and pesticides	Not known to nest in the project study area, although individuals occur in the area as winter visitors and migrants; observed foraging along the rivers in the project area. Open water, marshes, constructed wetlands, and fields in the project study area are suitable foraging habitats.
Yuma clapper rail *Rallus longirostris yumanensis*	E/WC	Occurs in cattail and bulrush marshes along the Colorado River; the lower Gila and Salt Rivers below the Verde/Salt River confluence; and Picacho Reservoir.	Marsh and riparian habitats.	Loss and fragmentation of river marshes; toxic levels of heavy metals, such as selenium, could also have contributed to the species' decline	Salt River support suitable habitat; known to occur in areas of suitable habitat along the Gila River.

Species	Status* Federal/State	Arizona Distribution	Habitat Requirements	Reasons for Decline	Potential for Occurrence in the Study Area
Southwestern willow flycatcher *Empidonax trailii extimus*	E/WC	Nests in dense willow riparian habitats along the lower Big Sandy River, lower Santa Maria River, Bill Williams Delta, upper Gila River, Grand Canyon, and middle Salt River; historically nested along the Salt, Gila, and Agua Fria Rivers.	Riparian forest and scrub habitats.	Has declined for variety of reasons, including habitat loss and fragmentation from flood control projects, development, and intensive grazing; brown-headed cowbird nest parasitism could also have contributed to the species' decline	Habitat quality along the Salt River is considered marginal, because the cottonwood-willow habitat is narrow and fragmented, although still considered suitable for the species; no nesting southwestern willow flycatchers have been observed, although migrating birds have been observed.
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	--/WC	Summer resident only in central and southern Arizona.	Nests in mature cottonwood-willow riparian forests; saltcedar can be a component of their habitat.	Degradation and loss of mature riparian habitat.	Salt and Gila Rivers support suitable habitat; known to occur in areas of suitable habitat along the Gila River.
Cactus ferruginous pygmy owl *Glaucidium brasilianum cactorum*	E/WC	Historically occurred as far north as the confluence of the Salt and Verde Rivers.	Occurs in dessert scrub and riparian areas with mature cottonwood and willows; nests in cavities created by woodpeckers.	Loss of habitat from urban development; competition from other cavity-nesting birds	The are no recent records from the project study area, but small amounts of habitat which could support this species do occur in the project study area.

Species	Status* Federal/State	Arizona Distribution	Habitat Requirements	Reasons for Decline	Potential for Occurrence in the Study Area
Lesser long-nosed bat *Leptonycteris curasoae yerbabuenae*	E/WC	Summer resident of central and southeastern Arizona.	Roosts colonially in large numbers; feeds on agave and saguaro flower nectar and pollen.	Has declined because of human disturbance at breeding and roosting sites and habitat loss; the population appears stable	Habitat quality appears to be low in the project study area; no systematic surveys have been conducted in the project study area; this species was recorded upstream of the Salt River/Gila River confluence, north of the Salt River.

* Status explanations:

Federal

E = listed as endangered under the federal Endangered Species Act.

T = listed as threatened under the federal Endangered Species Act.

-- = no listing.

State

WC = wildlife species of concern in Arizona (Arizona Game & Fish Department).

4.3.4.1 Federally Listed Species

Of the ten special-status species with the potential to occur in the project study area, bald eagle, Yuma clapper rail, cactus ferruginous pygmy owl, southwestern willow flycatcher, and lesser long-nosed bat are federally listed and the western yellow-billed cuckoo is a Candidate for listing.

Bald Eagle

The bald eagle was reclassified as Threatened under the federal ESA in 1995. In July 1999, the bald eagle was proposed for delisting. Bald eagles nest in large trees near lakes and streams, and hunt for waterfowl and fish in wetlands and along rivers and lakes. Bald eagles have been reported nesting along the Salt River east of Phoenix since the 1930s (Witzeman et al. 1997). Bald eagles do not nest in the project study area, although they occur in the area as winter visitors and migrants (Benham-Blair Associates 1980). Bald eagles have been observed foraging along the rivers in the project study area (CH2M HILL et al. 1997). The open water marsh in the project study area may be suitable foraging habitat for bald eagles.

Yuma Clapper Rail

The Yuma clapper rail is federally listed as endangered under the federal ESA and is on the draft review list of the wildlife of special concern in Arizona (Arizona Game and Fish Department 1996). This inland clapper rail occurs in cattail, sedges, and bulrush marshes along the Colorado River, the lower Gila and Salt Rivers below the Verde/Salt River confluence, and Pichacho Reservoir (Arizona Game and Fish Department 1996, Eddelman and Conway 1998). This species has declined because of the loss and fragmentation of river marshes. Toxic levels of heavy metals, such as selenium, could also have contributed to the species' decline (Arizona Game and Fish Department 1996). The Yuma clapper rail is known to occur as a rare and local summer resident in cattail marshes in the Salt River south and west of Phoenix (Witzeman et al. 1997). There is sufficient habitat for this species to occur within the project study area.

Cactus Ferruginous Pygmy-Owl

The cactus ferruginous pygmy-owl is federally listed as endangered under the federal ESA. Historically, the cactus ferruginous pygmy-owl occurred as far north as the confluence of the Salt and Verde Rivers. This species occurs in desert scrub, mesquite bosques, and Sonoran riparian deciduous woodland areas with mature cottonwood and willows. This small owl nests in cavities created by woodpeckers. The species has declined because of urban development, reduction of suitable habitat, and competition from other cavity-nesting birds (Arizona Game and Fish Department 1996, Arizona Game and Fish Department 2001a). No observations of cactus ferruginous pygmy-owls have been recently recorded within 50 miles of the project area (CH2M HILL et al. 1997, Witzeman et al. 1997).

Southwestern Willow Flycatcher

The southwestern willow flycatcher is federally listed as an endangered species under the federal ESA and is on the draft review list of wildlife of special concern in Arizona (Arizona Game and Fish Department 1996). The southwestern willow flycatcher prefers nesting in dense willow riparian habitats and is also found in areas of saltcedar in the Sonoran Life Zone (e.g., the lower Big Sandy River, lower Santa Maria River, Bill Williams Delta, upper Gila River, Grand Canyon, and middle Salt River). Historically, the southwestern willow flycatcher nested along the Salt, Gila, and Agua Fria Rivers (CH2M HILL et al. 1997). Recent statewide surveys indicate that most sites are occupied by fewer than five nesting pairs, which has raised concern over their population status in Arizona. This species has declined for a variety of reasons, including habitat loss and fragmentation resulting from flood control projects, development, and intensive grazing. Brown-headed cowbird nest parasitism may also have contributed to the species' decline (Arizona Game and Fish Department 1996). This species is currently considered an uncommon transient in Maricopa County, with only a few historic summer records (Witzeman et al. 1997). With an area estimation of more than 70 acres of willow, cottonwood/ willow, and willow/saltcedar habitat in the project study area, there is potential for this species to occur.

Western Yellow-billed Cuckoo

This species a candidate for listing as threatened under the federal ESA. In Arizona, the western yellow-billed cuckoo is found locally in streamside cottonwood and willow groves, and prefers to nest in willow or mesquite thickets (Arizona Game and Fish Department 2001b). As many as 13 cuckoo territories were found within the project study area during recent surveys on adjacent project study areas. These territories occurred within or adjacent to the cottonwood/willow riparian areas. The western yellow-billed cuckoo is considered an uncommon local summer resident (Witzeman et al. 1997).

Lesser Long-Nosed Bat

The lesser long-nosed bat is federally listed as endangered under the federal ESA. This bat is a summer resident of central and southeastern Arizona. It roosts colonially in large numbers, occupying mines and caves at the bases of mountains. The lesser long-nosed bat is found in habitats that support agaves, yuccas, saguaros, and organ pipe cacti (Harvey et al. 1999), and feeds mainly on agave and saguaro flower nectar and pollen. The lesser long-nosed bat population has declined because of human disturbance at breeding and roosting sites and habitat loss; however, the population appears stable (Arizona Game and Fish Department 1996). There are records for this species from the Phoenix area, so it could potentially occur in the project study area.

4.3.5 OTHER SENSITIVE SPECIES

Of the ten special-status species with the potential to occur in the project study area, lowland leopard frog, desert tortoise, Mexican garter snake, and peregrine falcon are considered by the State of Arizona to be species of special concern.

Lowland Leopard Frog

The lowland leopard frog was classified as a Category 2 Candidate species in 1988. In 1996, the USFWS changed listing status of "Federal Candidate" species. This classification formerly included three subclassifications: Federal Candidate Category 1, Category 2, and Category 3. During this administrative action, all references to "Category" designations were dropped. All former Category 1 species were now identified as Candidate Species. Species previously listed as a Federal Candidate Category 2 or 3 species were no longer considered Federal candidate species, and so no longer had any Federal protection under "Candidate" listing (Federal Reg., Feb. 28, 1996). In 1996 the USFWS classified all former Category 2 species as "Species of Concern." The lowland leopard frog was listed as wildlife of special concern in Arizona by the AGFD in 1996.

The lowland leopard frog occurs below 5,500 feet in elevation, south and west of the Mogollon Rim (Arizona Game and Fish Department 1996). This species is restricted to permanent streams, and it generally avoids ponds or other aquatic habitats. It usually occurs in streams with willows and cottonwoods or emergent vegetation (bulrushes and cattails) (Stebbins 1954). The central Arizona population appears to be healthy, but the lowland leopard frog has disappeared from the lower Gila River and lower Colorado River system. This species probably has declined for a variety of reasons, including predation and competition from non-native fish and amphibians and from stream alteration and flow diversion (Arizona Game and Fish Department 1988, 1996).

Desert Tortoise

The desert tortoise is listed as wildlife of special concern in Arizona (Arizona Game and Fish Department 1996) and is a federal species of concern. This tortoise occurs across much of Arizona's Sonoran Desert, including the Phoenix area. The Sonoran Desert tortoise population in the Tucson and Phoenix areas has declined because of urban and agricultural development, road construction, wildfires, illegal collection, and use of off-road vehicles in unauthorized areas (Arizona Game and Fish Department 1996).

Mexican Garter Snake

The Mexican garter snake is listed as wildlife of special concern in Arizona (Arizona Game and Fish Department 1996) and is a federal species of concern. This species occurs in permanent marshes in south-central and southeastern Arizona. It is strongly aquatic and feeds on aquatic animals, including fish and amphibians. This garter snake has declined because of the loss of wetland habitats and competition and predation from non-native fish and bullfrogs (Arizona Game and Fish Department 1996).

Peregrine Falcon

The peregrine falcon is on the draft review list of the wildlife of special concern in Arizona (Arizona Game and Fish Department 1996). Peregrine falcon occurs in small numbers, and is found nesting on cliffs throughout the state. It is found sparsely in migration, and occasionally winters along the Colorado River. The Arizona population of peregrine falcon declined in the 1950s and 1960s and the rest of the U.S. due to DDT contamination. Additionally, increased development forced the peregrine falcon to nest in sub-optimal habitat. (Arizona Game and Fish Department 1998b.) Since the late 1970s, the peregrine falcon has been increasing in the Phoenix area, and is known to nest on cliffs along the Salt River east of the project study area (Phillips et al. 1964, Witzeman et al. 1997.)

4.3.6 FISH AND WILDLIFE COORDINATION ACT

The Fish and Wildlife Coordination Act (FWCA) provides the basic authority for the USFWS' involvement in evaluating impacts to fish and wildlife from proposed water resource development projects. It requires that fish and wildlife resources receive equal consideration to other project features. It also requires that federal agencies that construct, license, or permit water resource development projects must first consult with the USFWS (and the National Marine Fisheries Service in some instances) and state fish and wildlife agency regarding the impacts on fish and wildlife resources and measures to mitigate these impacts. Full consideration is to be given to USFWS recommendations (http://www.fws.gov/r9dhcbfa/fwca.htm).

4.3.6.1 Planning Aid Letter

At the request of the Corps, the USFWS has completed a Planning Aid Letter (PAL) dated June 11, 2002 that represent their preliminary evaluation of potential environmental effects and habitat benefits associated with the proposed project. This PAL was developed based on coordination with the Arizona Game and Fish Department, literature research, file reviews and the Corps' Section 905(B) Analysis. A copy of this letter can be found in the FWCA appendix to this EIS (Appendix D).

4.3.6.2 FWCA Report

The USFWS issued a FWCA Section 2(B) report representing their evaluation of the project pursuant to the Fish and Wildlife Coordination Act. Within this report, the USFWS provides comments, including recommendations, on portions of the project that are related to biological resources. This report can be found in Appendix D.

4.3.7 BIOLOGICAL ASSESSMENT

In accordance with Section 7 of the ESA, the Corps has entered into consultation with the USFWS on the impacts of the proposed project on the bald eagle, southwestern willow flycatcher, Yuma clapper rail, cactus ferruginous pygmy-owl, and California brown pelican. As part of the consultation process, the Corps has completed a Biological Assessment, a copy of which can be found in Appendix F. A copy of the Section 7 concurrence letter issued by the USFWS is also included in Appendix F.

4.3.8 SAFE HARBOR AGREEMENT AND CANDIDATE CONSERVATION AGREEMENT

As part of follow-on activities related to the proposed project, the Corps and the project sponsors (SRPMIC and the City of Mesa) will be completing a Safe Harbor Agreement in relation to the southwestern willow flycatcher and Yuma clapper rail, and a Candidate Conservation Agreement in relation to the yellow-billed cuckoo. Information regarding these types of agreements is available on the USFWS website, www.fws.gov.

4.4 CULTURAL RESOURCES

4.4.1 REGULATORY SETTING

There are two principal methods of locating cultural resources. Before starting a project, a records and literature search is conducted at any number of repositories of archeological site records. The search may show that an archeological, or historical survey had been conducted and some cultural resources were identified. That information may be enough to proceed with the significance evaluation stage of the project. If a conclusion is reached that (1) no previous survey had been done, or (2) a previous survey was either out of date or inadequate, the project cultural resources expert, an archeologist, will need to carry out a pedestrian surface survey to determine if any cultural resources are within the proposed project boundaries.

After a cultural resource(s) has been identified during a survey or record and literature search the Federal Agency overseeing the undertaking embarks on a process that involves determining if the cultural resource is eligible for listing in the National Register of Historic Places (National Register). Section 106 of the National Historic Preservation Act mandates this process. The Federal Regulation that guides the process is called 36 CFR 800. For a cultural resource to be determined eligible for listing in the National Register it has to meet certain criteria. The resource has to be either minimally 50 years old or exhibit exceptional importance. After meeting the age requirement, cultural resources are evaluated according to four criteria: a, b, c, and d. The National Register criteria for evaluation as defined in 36 CFR 60.4 are:

> 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 have yielded, or may be likely to yield, information important in prehistory or history.

After a cultural resource has been determined eligible for inclusion in the National Register it is accorded the same level of protection as a property that is included. It then becomes formally known as a "historic property" regardless of age. Historic property status may be applied to individual cultural resources or to a group of cultural resources that are united by a theme or context. The combined historic properties are then designated as either a historic or archeological "district" and the individual elements are called contributors.

Local prehistory and history are summarized here in order to provide a context for further discussion of the known archaeological and historical remains within the project area. The prehistoric overview is summarized from Doyel (1991), and the historic era from Furlong

(1997), Mesa Unified School District (1978), and Zarbin (1997). Other sources are cited as appropriate.

4.4.2 EARLY PREHISTORIC CULTURES

The earliest evidence of man in Arizona dates to the Paleoindian period, beginning near the end of the last Ice Age about 11,000 years ago. Big game was abundant in the wetter, cooler climate of that period, and early human cultures adopted a mobile, hunting- and gathering-based lifestyle. Paleoindian artifacts have been found in southeastern Arizona associated with the remains of mammoth and other extinct Ice Age fauna (Haury et al. 1959). However, no such discoveries have been made in the Salt River Valley.

The subsequent Archaic period, dating between approximately 7000 B.C. and A.D. 150, was characterized by fluctuating climatic conditions, with alternating periods of increased and decreased moisture. Changes in environmental conditions led to changing subsistence strategies for Archaic period populations, with a decrease in big-game hunting and increasing reliance on small game and gathered foods such as fruits, nuts, seeds, and berries. Mobility remained important so that small groups could utilize seasonally-available resources in diverse environmental settings.

The Archaic tradition in southern Arizona is best-known from sites in and around the Tucson basin, and in the river valleys of southeastern Arizona (Mabry 1998). Bruce Huckell (1984:205–209; 1994:3–5) proposes three temporal subdivisions for the Southwestern Archaic. The Early Archaic period (ca. 7000–4800 B.C.) is characterized by simple flaked stone and ground stone tools consistent with a hunting and gathering economy. The Middle Archaic (ca. 4800–1500 B.C.) artifact assemblage is more diverse, and includes several types of projectile points as well as the first appearance of deeply-worn basin metates and stone pestles used for crushing and pounding plant foods. The Late Archaic (ca. 1500 B.C.– A.D. 150) was a transitional period tied to the introduction of maize into the Southwest from Mesoamerica. Mabry (1998:87) suggests that agriculture had spread across the Southwest by about 900 B.C., and that the earliest agricultural villages were established by about 800 B.C. Hunting and gathering remained important, but the adoption of agriculture led to the development of sedentary village life and a host of technological and social innovations associated with this new lifestyle. Evidence from in and around the Phoenix basin suggests Middle and Late Archaic use of the uplands surrounding the valley (Hackbarth 2001; Wright 2002), but relatively few Archaic remains have been found on the valley floor adjacent to the Salt River.

4.4.2.1 The Hohokam

Sometime after about A.D. 100, the Hohokam culture became a recognizable entity in the river valleys of central and southern Arizona. The origins of this sedentary agricultural society are a subject of continuing debate (summarized in Crown 1991), but recent evidence suggests an *in situ* development out of Archaic period patterns (Mabry 1997; Whittlesey 1995) rather than immigration of a Mesoamerican group (Haury 1976). Hohokam villages were typically located along or near large permanent streams, and were supported by extensive agricultural fields and intricate canal systems. This new settlement/subsistence system was accompanied by the widespread adoption of ceramic technology, pithouse architecture, cremation of the dead, and a variety of other distinctive traits reflected in the archaeological record. The Hohokam are best known from intensive studies at the very large site of Snaketown, along the Gila River about 20 miles south of Phoenix (Gladwin et al. 1937; Haury 1976). The Hohokam chronology established at Snaketown is still in use today, although starting and ending dates—particularly towards the early end of the sequence—remain controversial. A summary of the Hohokam chronology, applying Dean's (1991) dates to the basic Snaketown sequence, is provided in Table 4.4-1. This is followed by a brief discussion of the major characteristics of each period and phase in the Salt River Valley, summarized from Doyel (1991). (It should also be noted that most archaeologists familiar with the Hohokam chronology make a broad distinction between the Classic period and all earlier periods by referring to the Pioneer, Colonial, and Sedentary periods collectively as "the pre-Classic.")

Table 4.4-1. Hohokam Chronology

Period	Phase	Probable Time Range (Years A.D.)
Pioneer	Red Mountain	? to ca. 300
	Vahki	ca. 300 to 500
	Estrella	500s
	Sweetwater	600s
	Snaketown	700s
Colonial	Gila Butte	ca. 775 to 850–900
	Santa Cruz	850–900 to 950–1000
Sedentary	Sacaton	950–1000 to 1100–1150
Classic	Soho	1200 to 1300–1350
	Civano	1300–1350 to ca. 1500

Source: Dean 1991.

4.4.2.2 Pioneer Period (?–ca. 775)

This initial period of Hohokam development appears to involve an *in situ* transition from the Late Archaic lifestyle to a more sedentary, agriculture-dependent way of life. Ceramics first appeared during the Red Mountain phase, and the early plainware assemblages grew to include redwares, red-on-gray, and red-on-buff types. Pithouse architecture became more varied, and villages developed more complex and formal layouts. Burial patterns shifted from predominantly inhumation to predominantly cremation. Hunting and gathering remained important, but the Hohokam also experimented with complex water control systems that made large-scale irrigation agriculture possible. The Snaketown phase, at the end of the Pioneer period, was "a time of rapid change and growing cultural complexity" (Doyel 1991:247) as red-on-buff pottery replaced the earlier red-on-gray styles, ceramic vessel forms and designs became more diverse, and irrigation systems expanded to make new lands available for settlement and farming. The presence of ceramic figurines, slate palettes, carved stone bowls, and other ritual or ceremonial items suggest growing social complexity during the Pioneer period. The presence of shell jewelry manufactured from species found in the Gulf of California, and trade goods from Mesoamerica and areas to the north and northeast, also indicate that the Hohokam were active participants in a regional exchange network.

4.4.2.3 Colonial Period (ca. 775–950/1000)

This period saw a tremendous expansion in the number, size, type, and complexity of Hohokam sites in and around the Phoenix basin. Villages were generally organized into house clusters centered on public plazas. Large caliche-capped trash mounds, communal pit ovens called *hornos*, and formal cremation cemeteries were also present. Many of the largest villages contained ballcourts, large oval depressions with earthen embankments believed to be associated with a Mesoamerican-derived game. Many smaller villages and limited-use sites associated with subsistence activities were also established during this period. Canal systems were expanded, and there was an increase in the use of dry-farming techniques away from irrigable lands. Red-on-buff ceramic design styles, and trade items such as macaws and copper bells, reflect a strong Mesoamerican influence, although trade with other cultures in northern and eastern Arizona also remained important. By the end of the Santa Cruz phase, Hohokam sites had been established in a wide variety of environmental settings throughout central and southern Arizona. Outlying sites with Hohokam-like characteristics, as far away as the Payson and Prescott areas, may reflect the incorporation of local cultural traditions into the Hohokam interaction sphere.

4.4.2.4 Sedentary Period (950/1000–1100/1150)

This period witnessed an intensification of patterns established during the preceding Colonial period. New villages were established, older villages grew in size, new ballcourts and canals were constructed, and the Hohokam seem to have reached new heights of social and economic complexity reflected in increased, possibly hierarchical distinctions between sites. Red-slipped plainwares, not manufactured since the Pioneer period, also made a reappearance, and the large caliche-capped trash mounds at some villages appear to have evolved into deliberately-constructed "platform mounds" that served as a form of public architecture possibly associated with ceremonial activities. Based on the size and number of villages, the complexity of the settlement/subsistence system, and the extent of Hohokam influence and interaction across a broad region, this period appears in some ways to represent the greatest florescence of the Hohokam culture. Compared to the Colonial period, however, there were relatively few changes in material culture, and Sacaton phase red-on-buff pottery designs are generally less well-executed than earlier styles.

4.4.2.5 Classic Period (1200–ca. 1500)

The Sedentary-to-Classic period transition, while not well understood, appears to have been a time of fundamental changes possibly related to environmental stress. Detailed climatic reconstructions indicate that the Salt River underwent a period of "marked and rapid variation" in streamflows between about A.D. 1200 and 1355 (Nials et al. 1989:69). This would have created difficulties in the operation and maintenance of the irrigation systems upon which the Hohokam were, by then, heavily dependent. It is also known, however, that broad-scale changes in demography, social organization, regional interaction, technological innovations, and sociopolitical systems occurred across most of the prehistoric Southwest during this same time period (Cordell and Gumerman 1989; Gumerman 1994). Environmental factors, while undoubtedly of major importance, should therefore not be considered the only potential agents of change in the Hohokam area.

Most of the familiar Hohokam traits disappeared or underwent radical changes during the Classic period. Many large villages occupied throughout earlier periods (including the site of Snaketown) were abandoned, while others remained viable and even grew in size. New villages were also established, often on the outer edges of expanding canal systems (Howard 1991:5.19). Dispersed, rural populations and small villages aggregated into very large communities, usually located close to the Salt River or some other major stream. Pithouses were largely replaced by surface structures of adobe or masonry arranged in walled compounds or roomblocks. Red-on-buff pottery declined in favor of redwares and polychromes, and inhumations from this period often outnumber cremations. Platform mounds replaced ballcourts as the principal form of public architecture and as the probable focus of integrative and ceremonial activities. Exchange and interaction patterns appear to shift from a Mesoamerican focus to a more northern and eastern orientation, particularly towards the Mogollon culture of upland eastern Arizona and western New Mexico. The appearance of Mogollon-like ceramic and architectural traits in the Hohokam area is often attributed to the Salado culture. The Salado were initially thought to have represented a peaceful "invasion" of the Hohokam homeland by Mogollon peoples (Haury 1945), but recent research suggests that the Salado phenomenon is linked to increased regional interaction, possibly based on a new religious ideology, rather than to the rise of a new culture or the dominance of one culture over another (Crown 1994).

The Classic period has traditionally been divided into two phases, the Soho and the Civano (Dean 1991; Haury 1976). The Hohokam culture, for reasons that may include both environmental and sociopolitical factors, declined throughout the Civano phase and died out by about A.D. 1450. Several recent archaeological projects have nevertheless found evidence for a third phase, termed the Polvorón, following the Civano phase. The Polvorón was a period of decreased population and socioeconomic reorganization for the Hohokam, marked in part by a reversion to pithouse architecture, abandonment or limited reoccupation of Civano phase sites, and a more dispersed settlement pattern (Chenault 2000; Sires 1984). The Polvorón phase is not well-dated, but it appears to fall somewhere between about A.D. 1350 and 1450. This implies that the Civano phase was both earlier and shorter in duration than is suggested by the traditional Hohokam chronology. In any event, the Hohokam had ceased to exist as a cultural entity sometime prior to A.D. 1500.

4.4.2.6 The Protohistoric/Early Historic Period

Little is known about Native American use of the Salt River Valley and adjacent areas during the Protohistoric period, between the Hohokam collapse at about A.D. 1450 and the first extended Spanish explorations of southern Arizona just prior to 1700. The Spanish encountered large groups of Pimas and related peoples in the Tucson Basin and in the Gila River valley south of Phoenix (Doelle 1981), but the Phoenix Basin appeared to have been essentially abandoned. Limited evidence for a very late Hohokam or very early Pima presence has recently been found near Sky Harbor Airport (Bostwick et al. 1996), but no large, permanent settlements are known in this area until the arrival of Anglo settlers in the late 1860s (Luckingham 1989). The Salt River Valley may have served as a buffer zone between the agricultural Piman groups to the south and west, and the hunting-and-gathering Yavapai and Apache groups to the north and east. The Apache, in particular, had a long history of raiding Piman villages, and the Phoenix area may have been a "no man's land" between these warring groups (Hackenberg 1974:132).

4.4.2.7 The Historic Period

Permanent Euroamerican occupation of the eastern Salt River Valley began with the small Hispanic settlement of San Pablo near the base of Tempe Butte in the late 1860s (Furlong 1997). A few years later, Charles T. Hayden established a Salt River crossing, a store, and a flour mill on the river's south bank. This location, first known as Hayden's Ferry, represents the founding of modern-day Tempe. By the end of the nineteenth century, Tempe was home to a normal school predecessor of today's Arizona State University—and was bisected by the Maricopa and Phoenix Railroad, completed in 1887 to link Phoenix with the transcontinental Southern Pacific line at Maricopa (Myrick 1980:498–502). A spur line from Tempe to Mesa was completed in 1895. Thus, early Tempe was important as a farming community, a center for higher education, and as a hub in the regional transportation system. Completion of Roosevelt Dam in 1911 tamed the Salt River and further facilitated settling in the area. Tempe's population consisted of only about 3,000 people as late as 1941. However, following World War II, population boomed with the advent of air conditioning and the influx of veterans attending college on the GI Bill. Subsequent decades saw continued growth, and Tempe's population today exceeds 160,000.

East of Tempe, other communities emerged on both sides of the Salt River. A location known variously as McDowell Crossing, Rowe's Station, and Maryville was established on the north side of the Salt River in the late 1860s (Adams et al. 1992; Granger 1983:388). In 1877, Mormon colonists from the Little Colorado River Valley passed through Maryville and established a new farming community, known as Lehi, on the south side of the river. A later group settled on the higher terrace south of Lehi, establishing the town of Mesa. Maryville was abandoned by 1880, but the Mormon towns thrived with the construction of new irrigation canals. By 1940, Mesa was well-known not only for its rich fields of cotton, alfalfa, lettuce, cantaloupes, grains, dates, and citrus, but also for the presence of an elaborate Mormon temple—one of only seven in the world at that time (Work Projects Administration 1940:350–351). Mesa's population has grown from slightly over 7,000 in 1940 to over 421,000 today.

The Salt River Pima-Maricopa Indian Reservation was established in 1879. The Pimas had migrated into this area from the middle Gila River valley, where upstream diversion of the water by Euroamerican farmers in the 1870s dried up the river and forced the native people to abandon their fields and homes (Spicer 1962). The Salt River provided a more reliable source of water, with no significant upstream users to deplete the flow. Despite the injustices done to them, the Pima traditionally maintained good relationships with Euroamerican groups. In addition to farming their own land, for instance, they assisted the Mormon immigrants in Lehi and Mesa in exchange for a portion of the land, and they provided much of the manual labor for other farmers and settlers in the eastern Salt River Valley. The reservation remains predominantly rural and agrarian today, although it is increasingly hemmed in by urban sprawl. Commercial leases and casinos now supplement Tribal income from the traditional agricultural sources.

Water management has always played a major role in the history of the Salt River Valley, and the present project area is no exception. Some of the earliest historic sites in the vicinity are irrigation canals branching off the Salt River: the Utah Ditch, constructed in Lehi in 1877; the Mesa Canal, built in 1879; and the Tempe Canal, begun in 1871 with numerous later extensions and branches (Aguila 1998). In the early twentieth century, a series of storage dams was constructed on the Salt and Verde rivers, beginning with Roosevelt Dam in 1911 and concluding with Horseshoe Dam in 1946. Controlled releases from the reservoirs were then diverted into canals by Granite Reef Diversion Dam, built just below the confluence of the Salt and Verde rivers in 1908. Two principal canals headed at Granite Reef: the Arizona Canal on the north, and the South Canal on the south. The Arizona Canal was originally dug between 1883 and 1885 to supply water to the north half of the Salt River Valley; it remains the longest (47 miles) and northenmost canal bringing Salt River water to the Phoenix area today (Aguila 1998). The South Canal (sometimes called the Southern Canal) was built between 1906 and 1908 to provide a unified head for all other canals south of the Salt River. These other canals—including the Consolidated Canal and the Tempe Canal—originally headed farther downstream, but these heads were repeatedly damaged by flooding, necessitating frequent repair and reconstruction. The South Canal provided a single, stable head for all existing and future canals irrigating lands south of the Salt River (Aguila 1998). More recently, the Hayden-Rhodes Aqueduct of the Central Arizona Project crossed the Salt River just below Granite Reef Diversion Dam. This aqueduct brings Colorado River water to central and southern Arizona for municipal, industrial, and agricultural uses.

4.4.3 EXPECTED SITE TYPES WITHIN THE PROJECT AREA

Because the Salt River was the only permanent water source in the Salt River Valley, human activities have been concentrated along and near the river for thousands of years. Thus, a broad range of prehistoric and historic resources is known to occur within the project area.

The project area includes, minimally, cultural remains dating from the earliest portion of the Hohokam sequence to the late historic period. For example, the Red Mountain Site, AZ U:10:2 (ASU), is the type site for the Red Mountain phase (ca. A.D. 1–300), which represents a poorly understood transition between the Archaic period and the Vahki phase of the Pioneer period (Morris 1969). This site is still partially intact (Aguila 1998:31), and as one of the oldest known

Hohokam sites in the Salt River Valley it could contain crucial information about the early human cultures of this area. The project area also includes very late (fifteenth century) Hohokam sites, several of which have platform mounds (e.g., AZ U:9:102 [ASM] in Hackbarth et al. 1995). A broad range of other Hohokam sites—canals, limited-activity areas, farmsteads, small and large villages (some with ballcourts), etc.—are also known to exist within the project area. Known historic sites include late nineteenth century and early twentieth century Pima and Euroamerican settlements, canals, roads, and structures.. The very early transitional period represented at the Red Mountain site suggests a pre-Hohokam occupation in the area that may not have been recognized as such by earlier researchers, or that may be buried under later alluvium or obscured by later Hohokam occupations. Recent discoveries of large, complex Archaic period agricultural villages in the Tucson Basin (Mabry 1997) have prompted a debate over whether such sites might exist in the Salt River Valley as well. The irrigable lower terraces adjacent to the Salt River in the eastern portion of the valley (e.g., the Lehi area and portions of the Salt River Pima-Maricopa Indian Reservation) would be likely locales for such sites.

An understanding of project area physiography is important to these patterns, so the pertinent data are briefly reviewed here. Apart from the dry riverbed itself, the project area landscape is dominated by four discrete alluvial terraces that flank the river. These terraces appear to have resulted from Late Cenozoic depositional episodes that were uplifted by tectonic action, and were later eroded through by the rejuvenated river (Péwé 1978). The terraces are listed and described in Table 4.4-2, and should be understood as representing a progression from the lowest, youngest, siltiest soils closest to the river (the Lehi Terrace) to the highest, oldest, most caliche-indurated soils farthest from the river (the Sawik Terrace). These terraces, their relationships, and their distinctive characteristics were crucial factors in both prehistoric and historic land use within the project area. In particular, the presence of good agricultural soils on the Lehi Terrace, and topographic conditions favorable for canal construction, would help determine the type and extent of settlement in the area for many centuries.

Table 4.4-2. Salt River Terraces within the Project Area

Name	Height Above River	Description
Lehi Terrace	5–20 ft	Silty/loamy Holocene soils closest to the river; excellent agricultural soils
Blue Point Terrace	10–80 ft	Gravel and cobbles slightly cemented with caliche. Dissected/ eroded terrace remnant, exposed only upstream from the Lehi area.
Mesa Terrace	10–220 ft	Caliche-indurated gravels, well-exposed except where covered by granitic alluvium from the Usery Mountains. Forms well-defined escarpment in northern Mesa; lower and less prominent in Tempe and on the north side of the river.
Sawik Terrace	50–235 ft	Heavily calichified gravel deposits, fragmentary and only intermittently exposed, most prominently near Granite Reef Dam. Decreases in height to the west, with westernmost portion buried by alluvium.

The archaeological data reveal a strong correlation of Hohokam canals and habitation sites with the edge of the Mesa Terrace. This natural escarpment provided a means, with careful engineering, of "lifting" water to the top of the terrace (i.e., contouring a channel along a horizontal distance such that the channel reaches the mesa top at a lower elevation than the channel's head). This allowed the Hohokam to irrigate new lands 50 feet or more above the riverbed. This patterning suggests high archaeological sensitivity, and a good potential for additional unrecorded sites, along the upper edge of the Mesa Terrace.

The Lehi Terrace contains relatively few known habitation sites, but it does contain numerous canals and small, probably agriculture-related sites. Although the Lehi Terrace would have been vulnerable to occasional flooding (this could be why the villages were located on higher ground), it would also have offered some of the best agricultural land in the valley. Thus, the Lehi Terrace should also be considered an archaeologically sensitive area, particularly for canals and for sites related to agricultural pursuits. As previously noted, this may also be a sensitive area for buried Archaic sites that have few, if any, surface manifestations.

The archaeological data are less clear for the Blue Point Terrace, an intermediate level between the Mesa and Lehi terraces in the portion of the project area east of Lindsay Road. Much of this terrace has been dissected by erosion or covered with granitic alluvium. Pending further data, the Blue Point Terrace should be considered at least moderately sensitive for the presence of unknown cultural resources.

The final and highest formation, the Sawik Terrace, exists solely as a few erosional remnants high above the river near Granite Reef Dam. Any sites in these areas would most likely be associated with limited, temporary use such as collecting cactus fruit or raw material for making stone tools. Archaeological sensitivity is believed to be moderate to low.

4.4.3.1 Records and Literature Search

An initial records and literature search was conducted of the larger overall study area. This study was conducted by Archaeological Research Services, Inc. (ARS)(Wright, et al 2002). The study area for the records search consisted of a 1-mile area on either side of the Salt River, between SR 101 and Granite Reef Dam. As a result of this study, 234 previously recorded sites were identified. These were inventoried from a review of 329 individual cultural resources surveys, test excavations, and data recovery projects. Although several resources have been previously evaluated, or determined to be eligible for the National Register of Historic Places (NRHP), only two were found to be formally listed on the NRHP. These are the Rohrig School and the Lehi School.

Site types inventoried includes a wide range of resources. Prehistoric sites include sparse lithic scatters, agricultural features, canals, habitation sites, limited activity sites, and village sites. Historic period sites include roads, buildings, homesteads, dams, construction camps, and canals.

4.4.3.2 Field Survey

Subsequent to the records and literature search, an intensive archeological field survey was conducted of an additional 1000 acres along the Salt River that had not been previously surveyed. The survey was also conducted by ARS, Inc. (Wright et al. 2003). The areas chosen for survey were generally in areas that might be used for the ecosystem restoration alternatives.

This survey resulted in the identification of 33 historic and prehistoric sites. In addition, three prehistoric canals were identified as potentially present, although no surface indications were noted. Of the 33 sites, 21 of them were evaluated as eligible for the National Register of Historic Places. The remaining 12 could not be evaluated based on survey information alone. See Table 4.4-3 for a brief description of each site and NRHP eligibility evaluation. Eligibility evaluations were based on areas of research potential developed by ARS.

Table 4.4-3. Archaeological Sites Evaluated for NRHP Eligibility in the Va Shly'ay Akimel Ecosystem Restoration Project Class III Cultural Resources Project Area

SRPMIC Site No.	Site Type*	Comments	NRHP Eligible**
60	P: habitation	Extension of previously recorded Hohokam village	Yes
61	P: artifact scatter	Hohokam artifact scatter in plowed field	Indet.
62	M: artifact scatter	Historic Pima/Maricopa artifact scatter and probable habitation site (late 19th/early 20th century) plus Hohokam artifact scatter	Yes
63	M: artifact scatter	Similar to SRPMIC-62, but probably has a more substantial prehistoric component	Yes
64	P: artifact scatter	Hohokam artifact scatter/possible small habitation site	Indet.
65	M: artifact scatter with features	Historic corral and Pima/Maricopa artifact scatter with an earlier Hohokam component	Indet.
66	M: artifact scatter	Mixed Pima/Maricopa and Hohokam artifacts	Indet.
67	H: artifact scatter	Pima/Maricopa artifact scatter	Indet.
68	M: artifact scatter	Mixed Pima/Maricopa and Hohokam artifacts	Indet.
69	M: artifact scatter with features	Hohokam artifact scatter/possible habitation site plus historic tent pads, trash dumps, artifact scatter and rock features of uncertain age	Yes
70	H: artifact scatter with features	Tent pads and trash scatters associated with canal construction	Indet.
71	H: artifact scatter	Historic construction camp with tent pads, trash dumps (early 20th century)	Yes

SRPMIC Site No.	Site Type*	Comments	NRHP Eligible**
72	P: habitation site	Pioneer–Colonial period Hohokam habitation site; type site for the Red Mountain phase; partially excavated in the 1960s by ASU	Yes
73	P: artifact scatter	Tested by ASU in the 1960s; probable Gila Butte phase habitation	Yes
74	P: artifact scatter	Tested by ASU in the 1960s; probable Colonial/Sedentary habitation	Yes
75	P: artifact scatter with features	Hohokam artifact scatter with one cobble structure, one ashy soil stain, and one check dam	Yes
76	M: artifact scatter with features	Probable Hohokam habitation with dense artifact scatter and several roasting features; also historic tent pads and trash scatters	Yes
77	M: artifact scatter with features	Historic tent pads and trash dumps, prehistoric artifact scatter, check dam of uncertain age	Yes
78	H: camp site	Historic tent pad(s) and trash scatter	Indet.
79	H: power plant	Hydropower plant associated with the South Canal; built 1911–1912	Yes
80	M: artifact scatter	Mixed historic and prehistoric artifacts	Yes
81	M: artifact scatter with features	Extensive historic construction camp with tent pads, trash dumps, and structural remains; plus a probable Hohokam habitation area	Yes
82	M: artifact scatter with features	Historic trash dumps, tent pad, and possible grave, plus a prehistoric artifact scatter	Indet.
83	H: trash dump	Trash dump, ca. 1915–1930	Indet.
84	P: artifact scatter with features	Hohokam artifact scatter with rock features and probable roasting features	Yes
85	H: power plant	Hydroelectric plant associated with the Arizona Canal, ca. 1902	Yes
86	P: artifact scatter with features	Extensive Hohokam artifact scatter with numerous rock features and possible structures	Yes
87	P: artifact scatter with features	Extensive Hohokam site with one or more probable habitation areas plus numerous rock features and roasting pits	Yes
88	H: ditch	Historic (1930s or earlier) ditch; 0exact history and function unknown	Indet.
89	P: artifact scatter	Hohokam artifact scatter	Yes
90	P: artifact scatter	Hohokam artifact scatter with one small rock feature	Indet.
91	H: canal	Highland Canal, constructed 1887–1888	Yes

SRPMIC Site No.	Site Type*	Comments	NRHP Eligible**
92	H: canal	Consolidated Canal, may date as early as 1879 but more likely 1891	Yes

* P = prehistoric, H = Historic, M = multicomponent (both prehistoric and historic)

** Yes = National Register eligible; Indet. = indeterminate eligibility, testing or other investigations

Determination of eligibility of indeterminate sites needs to be accomplished prior to groundbreaking activities. Table 4.4-4 identifies possible research questions that could be included in any testing effort for the indeterminate sites noted in Table 4.4-3.

Table 4.4-4. Areas of Potential Research for the Prehistoric and Protohistoric Sites Located in the SRRP Study Area

Site Category*	Areas of Potential Research
Archaic Sites of All Types	Can be used to clarify the type, intensity, seasonality, and timing of pre-ceramic occupation in what would later become a Hohokam "core" area
Red Mountain Phase Hohokam Sites of All Types	So few Red Mountain phase site components have been excavated that there is much to learn about Red Mountain phase settlement patterns, subsistence practices, material cultural traits, architectural styles, social group composition, etc.
Hohokam Ball Court Villages	Data from these sites can be used to test and refine current models about the function of Hohokam ball court villages; in particular, what types of products may have been exchanged at these sites
Hohokam Platform Mound Sites	Data from these sites can be used to assess and refine current models about the evolution and function of Hohokam platform mounds; also, data from these sites can be used to assess the role of platform mounds sites in the larger local communities
Hohokam Non-Irrigation Agricultural Sites	When were these types of features in use? What types of resources were being grown at these sites, and at what level(s) of productivity? To which habitation sites were these sites probably related?
Polvorón Phase Site Components	Since known Polvorón phase site components are still relatively few in number, they can be used to flesh out material culture trait lists; to fine-tune cultural chronologies; and to better reconstruct Hohokam lifeways at this time
Pioneer Period sites of All Types	There are still relatively few excavated pre-Snaketown phase features in the Phoenix area; as such, all Pioneer period site components have the potential to provide important new information about early Hohokam settlement patterns, subsistence practices, social group composition, etc.

Site Category*	Areas of Potential Research
Colonial & Sedentary Period Hohokam Habitation Sites	These sites can be used to refine existing models of, e.g., Hohokam trade practices, subsistence practices, and site structure
Classic Period Hohokam Sites	These sites can potentially provide important information about whether large migrations occurred into the Salt River Valley within the SRRP project area during this time
Hohokam Irrigation Canal Segments	Can provide information about local canal engineering techniques; the amount of potentially arable land; what crops were being grown; what the micro-environments of local canals were like; the temporal distribution of various irrigation canal segments.
Hohokam Field House Sites	What crops were being grown at these sites? When were these sites being used? How does field house architecture compare to existing models? What was the structure of these sites, e.g., where were the farm fields in relation to the other site facilities?
Protohistoric Native American Site Components	Any Protohistoric site component would be extremely important in understanding when and how the Hohokam left and when and how the Pima entered the lower Salt River Valley
Hohokam Limited Activity Sites; Bedrock Grinding Sites; Quarries; Rock Shelters; Rock Art Sites; and Artifact Scatters of All Time Periods	These small sites are potentially of great importance in determining the range and timing of activities that occurred outside habitation sites
Historic Native American Site Components	Comparisons with analogous, contemporary, Euro-American facilities; material culture studies; subsistence studies; settlement studies.
Historic Euro-American Site Components	Can potentially provide information about building construction techniques; early Mormon settlement patterns, subsistence practices, and patterns of cultural interaction

* Site categories listed in bold type are those with particularly high research potential to address current data gaps in the archaeological record

4.4.3.3 Additional Field Survey and Test Excavations

Beginning in November 2003, Statistical Research, Inc. (SRI) conducted a Class III Cultural Resources Survey and archaeological testing of an additional 300 acres on the Salt River Pima-Maricopa Indian Community. SRI completed the survey in December 2003 and submitted a draft report, *A Class III Cultural Resources Survey and Testing Recommendations for the Proposed Salt River Restoration Project, Maricopa County, Arizona* in January 2004. This report summarized the survey results and contained a testing plan for six archaeological sites, SRPMIC 90, 105, 108, 109, 112, and 113.

Additional Archaeological Testing

Only one feature, a historical-period bell-shaped storage pit, was identified in the trench profiles at SRPMIC-109. Excavation of the pit resulted in the recovery of three mid- to late nineteenth century ollas, a small jar, and two bowls. Each of the ollas was capped with a large metal can. A possible stove pipe, a metal spoon, metal cup, and metal pan were also preserved. A small trash scatter rested on the same surface into which the storage pit was dug. Artifacts in this trash scatter included four cans and an intact wine bottle with a push-up base and hand-applied finish.

Testing at SRPMIC-105 was negative. No buried features or artifacts were encountered during the testing. One 20-meter-long, north-south trench was also excavated through a large hummock, but again no buried artifacts or features were exposed.

At SRPMIC-108 all artifacts within the surface collection units were collected, along with a small chipping station. Between 10 and 30 centimeters of sediment were removed and two small shallow pits were exposed. Both pits were excavated. The fill in Feature 15 was ash-stained and collected *en masse* for flotation analysis. Both backhoe trenches were placed on the lower Lehi terrace along the drainage that bisects the site. No artifacts or features were exposed in the southernmost trench. The northernmost trench, however, contained a cultural deposit that is ash-stained and replete with fire-cracked rock. This stratum is best interpreted as a rake-out accumulation associated with a nearby buried roasting pit or horno. One roasting pit, Feature 1, was visible at the surface during a previous survey. It was bisected during testing and contains large amounts of wood charcoal and fire-cracked rock.

Testing of SRPMIC-90 involved the excavation of two 10-meter-long trenches in an artifact concentration at the east end of the site, along with the mechanical scraping of a 5-by-25-meter area in another artifact concentration at the west end of the site. These excavations were placed in areas containing relatively high densities of surface artifacts. A series of 5-by-5-meter surface collection units were placed over the areas to be mechanically excavated. All artifacts within these units were collected. No buried features or artifacts were encountered in the first artifact concentration. Two small, shallow thermal pits, however, were exposed in the 5-by-25-meter mechanical stripping unit placed in the other artifact concentration. Both of these pits were completely excavated and the fill from each of them was collected *en masse* for flotation analysis.

Testing efforts at SRPMIC-112 and 113 focused on determining the age and function of two ditches that could be followed across the west end of the parcel. Each of these ditches was designated a site number during the survey. Backhoe trenches were excavated across both ditches. Styrofoam was found in the bottom of SRPMIC-112 and no subsurface expression of SRPMIC-113 could be found. The styrofoam in SRPMIC-112 rested on the bottom of the ditch only 15–20 centimeters below the modern surface. A large gravel deposit was found to exist immediately beneath both ditches. As such, neither of them would have conveyed water, nor could they have held water for long. SRPMIC-112 and 113, therefore, are considered modern drainage ditches.

Recommendations

Given the results of this testing program, SRI recommend that the information potential of SRPMIC-90, 105, 112, and 113 has been exhausted. The two thermal pits and surface artifacts at SRPMIC-90 are best interpreted as the remains of a small Colonial period farmstead. The residential locus of this site, however, has been destroyed as part of road construction. No buried features were encountered at SRPMIC-105. SRPMIC-112 and 113 were determined to be modern drainage ditches. As such, these sites cannot contribute significantly towards our understanding of past lifeways within the project area. SRI, therefore, recommended that SRPMIC-90, 105, 112, and 113 are ineligible for inclusion in the NRHP.

SRI evaluated SRPMIC-108 and 109 as eligible for listing on the NRHP. A large subsurface deposit of ash-stained soil and fire-cracked rock was identified at SRPMIC-108. This deposit likely represents rake-out debris from a nearby roasting pit or horno. SRI recommended that this part of the site be mechanically stripped and that the feature(s) be excavated. The excavation of a small roasting pit during testing at this site indicates that organic preservation is excellent in this portion of the site. SRPMIC-108 could, therefore, contribute significantly towards our understanding of prehistoric subsistence in the project area.

SRPMIC-109 represents the remains of a small, mid- to late nineteenth century Piman farmstead in Parcel 3. SRI also recommended that this site be mechanically stripped to determine the subsurface limits, structure, and contents of this site. SRPMIC-109 can contribute significantly towards our understanding of historic period Piman pottery production, agricultural activities, and settlement in the project area.

In addition, archival research indicates that several prehistoric canals have been mapped in the project area. No evidence of these canals or associated field systems is evident on the surface or in subsurface excavations conducted by SRI. Their possible existence, however, should be considered during construction, or an effort should be made to locate these features, if there is a data recovery phase.

Consultation to identify traditional cultural properties has yet to be conducted. The SRPMIC would identify these types of resources. Other tribes may also be consulted to obtain their views.

4.5 AESTHETIC RESOURCES

4.5.1 INTRODUCTION

This section describes the existing visual resources and aesthetic conditions in the Va Shly'ay Akimel study area. Photographs (Figures 4.5-1 through 4.5-6) are included to illustrate the baseline conditions in the area. A description of local governmental organizations with jurisdiction in the area is also provided, along with the regulatory setting guiding aesthetic resources in the area.

Please refer to Sections 4.1, "Topography and Geography," 4.2, "Hydrology and Water Resources," and 4.10, "Land Use," for other details on the physical conditions that influence the visual and aesthetic character of the study area.

4.5.2 GENERAL PROJECT SETTING

The study area is located in the eastern portion of Maricopa County, along the Salt River between the City of Mesa and the Salt River Pima-Maricopa Indian Community. The study area is located within a subdivision of the Sonoran Desert referred to as the Lower Colorado River Valley or the microphyllous desert. This area is the largest and most arid subdivision of the Sonoran Desert. Low annual precipitation and high temperatures support relatively sparse vegetation. Characteristic species include blue paloverde, creosote bush, and triangle bursage.

Terrain ranges from hills and rock outcrops north of the study area to alluvium within the river floodplains to the south. Surrounding land within the study area is relatively flat and rural (agricultural and open space, gravel mining) to the north, and urban (residential, agricultural, light industry, commercial, gravel mining, and vacant land) to the south.

The study area includes the floodway and immediately adjacent land uses. The study area is essentially a wide dry wash dominated by large expanses of sand and gravel. The interior floor of the Salt River Valley is comprised of thick layers of alluvium on nearly level or gently sloping surfaces. These soils are sandy to gravelly, but may include areas of finer particles of silt or clay.

4.5.3 GENERAL DESCRIPTION OF THE PROJECT AREA AT PHOTO LOCATIONS

Views of the study area are limited in quality due to sparse development and access points along the banks, gravel quarry operations, and few roadways crossing the river channel. Views within the wash from various photo locations are characterized by diverse channel widths (narrower at Granite Reef Dam on the east, wider at Pima Freeway on the west), and include open water and natural vegetation in the east and dry sand and gravel in the west. This lack of topographic features limits long-range viewing opportunities along the river channels. Toward the eastern end of the study area, the vegetative communities present appear largely undisturbed. The western end of the study area is dominated by gravel mining operations. Visible degradation of the streambed in the western half of the study area has resulted from dumping of garbage (e.g., household trash, used furniture and appliances, and tires), off-road vehicle use, and gravel mining. Most notably, sand and gravel mining operations within and along the banks of the Salt River in the western half the study area have had a significant effect on visual resources and aesthetic conditions.

Prominent features adjacent to the Salt River include power lines and towers, freeways, urban and rural development, and agricultural fields. Long-distance views include the Usery and Goldfield Mountains to the west and McDowell Mountains to the north.

Figure 4.5-1 shows the locations where photographs were taken throughout the study area. The locations in Figure 4.5-1 are correlated with the photographs shown in Figures 4.5-2 through 4.5-6 and the descriptions below.

4.5.3.1 Pima Freeway

Views of the Salt River from the vicinity of the intersection of the Pima and Red Mountain Freeways are wide open, revealing relatively flat land areas made up of mostly sand, gravel, cobbles, and larger rocks. The Pima and Red Mountain Freeways cross the channel here and are elevated to accommodate crossing during flood flows. To the west of the Pima freeway, views of the channel include shallow, open water with sparse vegetation; to the east of the Pima freeway, views include deeper open water and scattered vegetation, with compacted dirt and gravel areas and little vegetation along the banks. Further east, sand and gravel mining operations dominate the landscape, with operations covering large portions of the north bank and channel bed. Power lines and buildings can be seen on the south side of the channel (Figure 4.5-2).

4.5.3.2 Beeline Highway

Views of the Salt River from the vicinity of Beeline Highway (closest roadway) are relatively broad. The banks of the channel are steeper at this location, with well-defined slopes on both sides. Several areas in this portion of the Salt River are used for illegal dumping of trash and debris. Additional refuse materials have surfaced from the closed landfill located on the northern edge of the channel. Vegetation on the flat dry landscape is sparse in this area, and is dominated by dry grasses. Power lines, buildings, and a new sound wall can be seen on the south side of the channel within City of Mesa boundaries. Sand and gravel mining operations continue within the channel and on both sides of the wash from just east of the Pima Freeway to approximately the center of the study area reach (Figure 4.5-3).

4.5.3.3 Arizona Canal

Views of the portion of the study area located near the center of the reach (the widest section) consist of shallow groundwater recharge ponds. Some vegetation is growing where open water

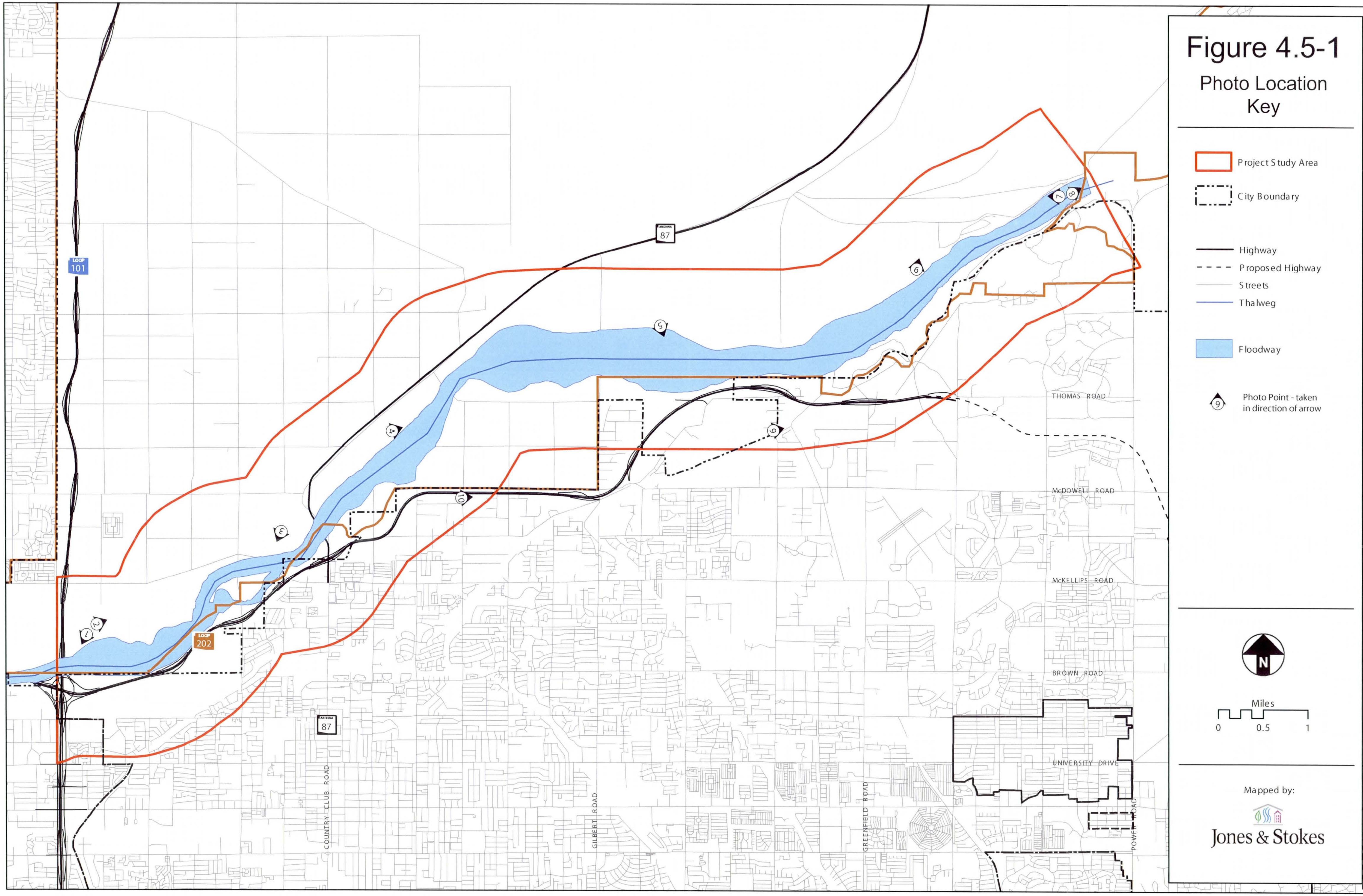


Figure 4.5-1
Photo Location Key
Project Study Area
City Boundary
Highway
Proposed Highway
Streets
Thalweg
Floodway
Photo Point - taken in direction of arrow
N
Miles
0
0.5
1
Mapped by:
Jones & Stokes
THOMAS ROAD
McDOWELL ROAD
McKELLIPS ROAD
BROWN ROAD
UNIVERSITY DRIVE
COUNTRY CLUB ROAD
GILBERT ROAD
GREENFIELD ROAD
POWER ROAD
LOOP 101
LOOP 202
87

Photo 1: View from the north side of the Salt River near the Pima Freeway (101), looking west. Pima Freeway and Red Mountain Freeway (202) interchange shown in the background.

Photo 2: View from the north side of the Salt River east of the Pima Freeway (101), looking northeast. Gravel mining operations shown in background and detention ponds shown in the foreground.

Jones & Stokes

Figure 4.5-2
Views in the Vicinity of the Pima Freeway

Photo 3: View from the north side of the Salt River south of Cypress Golf Course, looking south. Gravel mining operations shown on right in background.

Photo 4: View from the north side of the Salt River near the United Metro Asphalt Company, looking east. Gravel mining operations and Red Mountain Freeway interchange shown in background.

is found. The south side of the channel is barely visible, and channel banks are almost level with the center portion. Views to the northeast include open space, cactus, and creosote bush, with Red Mountain and the McDowell Mountains visible in the distance (Figure 4.5-4).

4.5.3.4 Granite Reef Dam

Views in this section of the study area are dominated by Granite Reef Dam, a large concrete structure that spans the entire width of the channel. A spillway and control house are located on the northern side of the dam structure. The portion of the study area located just west (downstream) of Granite Reef Dam consists of open channel with sparse vegetation within the channel and along the steep, well-defined banks. The alluvial material within the channel consists of larger grained sand, cobbles, and rocks. Standing water can be seen just below the dam, with open water flowing from the dam's spillway and traveling along the northern portion of the channel for approximately ¼ mile. Vegetation supported by this water can be seen growing along the water's edge. Long-distance views include the Usery Mountains to the east and the McDowell Mountains to the north (Figure 4.5-5).

4.5.3.5 South Canal

Views in the vicinity of the South Canal, along the southern boundary of the project area, are generally unobstructed to the north, east, and west. The visible landscape in these directions typically comprises a broad expanse of alluvial flats in the foreground and middle ground, with generally clear views of the Superstition Mountains directly to the east, the Usery and Goldfield Mountains to the northeast, Red Mountain and the McDowell Mountains to the north, and South Mountain and the Estrella Mountains to the distant west. For the most part, vegetation on the flatlands surrounding the Salt River channel is typical Sonoran desert scrub (creosote bush, bursage, various cacti and upland grasses), with isolated patches of mesquite and cottonwood nearer the river channel. Lands to the south, however, are primarily residential and agricultural, and views are thus dominated by homes, small ranches, livestock paddocks, and a proliferation of introduced trees and shrubs. The eastern portion of the project area south of the SouthCanal, in particular, is distinguished by a large number of orange groves (Figure 4.5-6).

4.5.4 REGULATORY SETTING

Although the proposed project is being undertaken by the Corps, the City of Mesa, Maricopa County, and the Salt River Pima-Maricopa Indian Community (SRPMIC) have jurisdiction over various sections of the study area. Unincorporated lands in the study area would fall within the City of Mesa's sphere of influence. These would likely be annexed by the City, which will have jurisdiction over planning new recreational facilities. Maricopa County visual resource elements are therefore not included in the discussion that follows. Other regulations, plans, goals, and policies related to visual resources and aesthetic conditions pertinent to the Va Shly'ay Akimel study area are described below.

4.5.4.1 City of Mesa

The City of Mesa General Plan defines the direction of growth and the type of development that is desired and expected to occur in Mesa between 2002 and 2025 (City of Mesa 2002). The General Plan is a general guide or blueprint for Mesa's future that presents the community's vision through broad goals and objectives. The City's General Plan acknowledges the importance of visual resources and aesthetic conditions by noting in the vision for Mesa 2025 that "The natural environment is used to enhance the beauty of the community."

The plan also acknowledges the opportunities the Salt River offers for recreation and as a refuge for wildlife. Part of Mesa's vision includes enhancements along the Salt River performed in conjunction with the SRPMIC.

4.5.4.1.1 Parks, Recreation, and Open Space

The Parks, Recreation, and Open Space Element provides the guide for developing the open space system in the City for existing and future residents. The element plans for community connectivity to serve residents through trail corridors, canals, utility corridors, and urban pathways.

The element identifies the following goals objectives and policies relevant to visual resources and aesthetic conditions.

Goal PR-1. Create a balanced, accessible and integrated system of open spaces and recreational opportunities to serve the current and future residents and visitors of the City of Mesa.

Objective PR-1.1. Provide a meaningful network of natural and developed open space areas.

Policy PR-1.1a. Identify lands for potential acquisition to preserve open space for recreational, aesthetic and preservation uses.

Policy PR-1.1b. Coordinate with the Arizona State Land Department for the designation, disposition, and acquisition of state trust lands classified as open space under their management within the three designated planning areas.

Objective PR-1.2. Manage and preserve open space to optimize its use and protection.

Policy PR 1.2a. Develop and implement a Mountain Preserve program at Usery Park Recreation Area that addresses the use and management of dedicated, leased or publicly accessed mountainous and hillside areas.

Policy PR1.2c. Develop a land stewardship program that will protect open space land and natural habitats in the City.

Policy PR1.1e. Encourage the preservation of significant natural areas such as the Salt River corridor to enhance their recreation attraction and aesthetic value.

Photo 5: View from the north side of the Salt River at edge of bank, looking south. Groundwater recharge ponds are shown; recharge water is gravity fed from north of Granite Reef Dam via the Southern Canal.

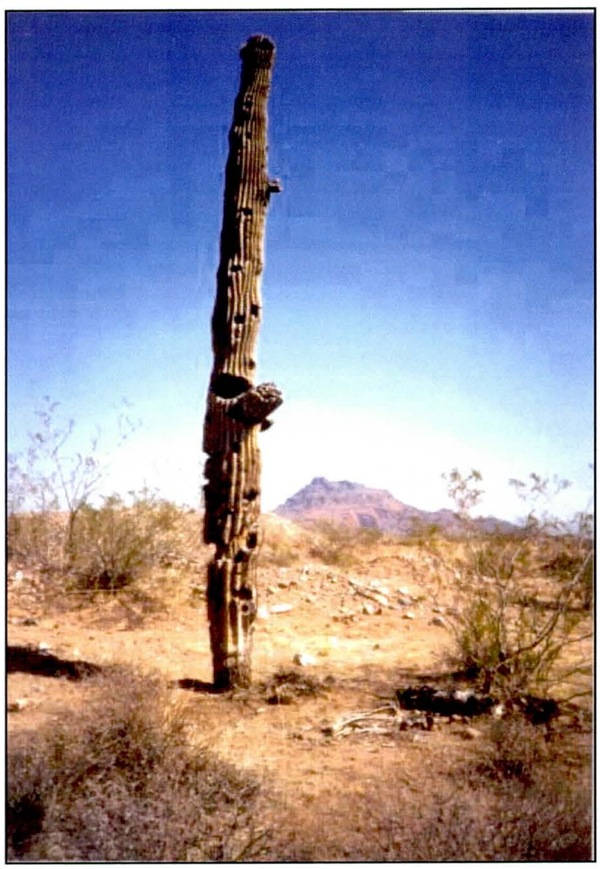


Photo 6: View from the north side of the Salt River, looking northeast. Saguaro cactus and creosote shown in foreground, with Red Mountain in background.

Photo 7: View from the center of the Salt River near Granite Reef Dam, looking west. Dirt access road is shown on the right.

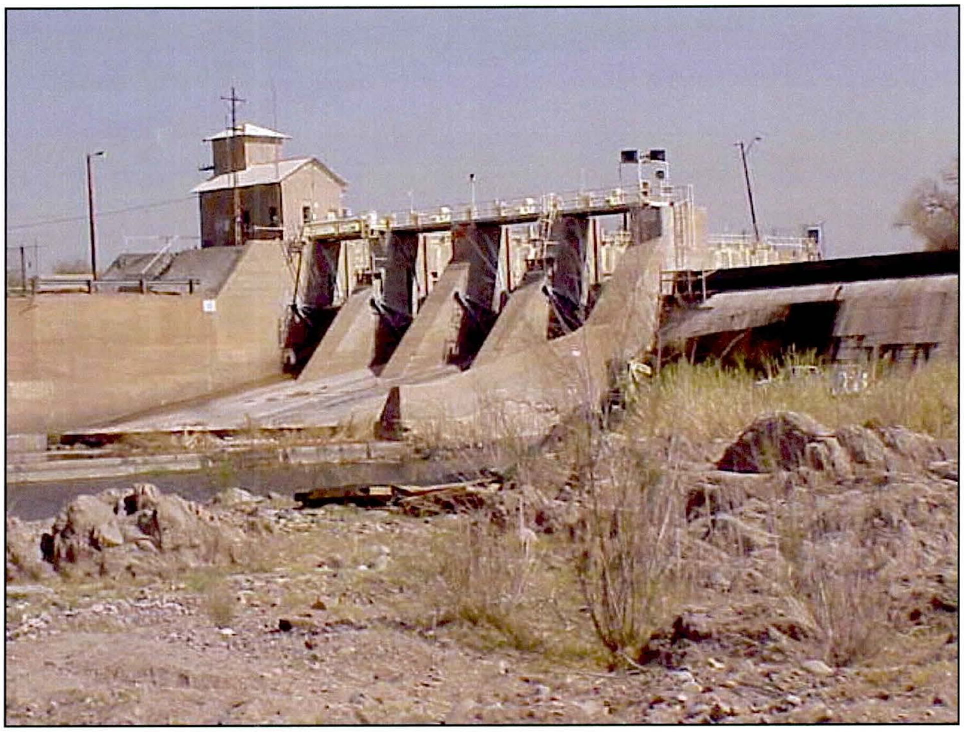


Photo 8: View from the center of the Salt River just below Granite Reef Dam, looking east. Dam control house and spillway are shown.

Figure 4.5-5
Views in the Vicinity of Granite Reef Dam

Photo 9: View from the south side of the Salt River on Val Vista Drive, looking east. Southern Canal is shown.

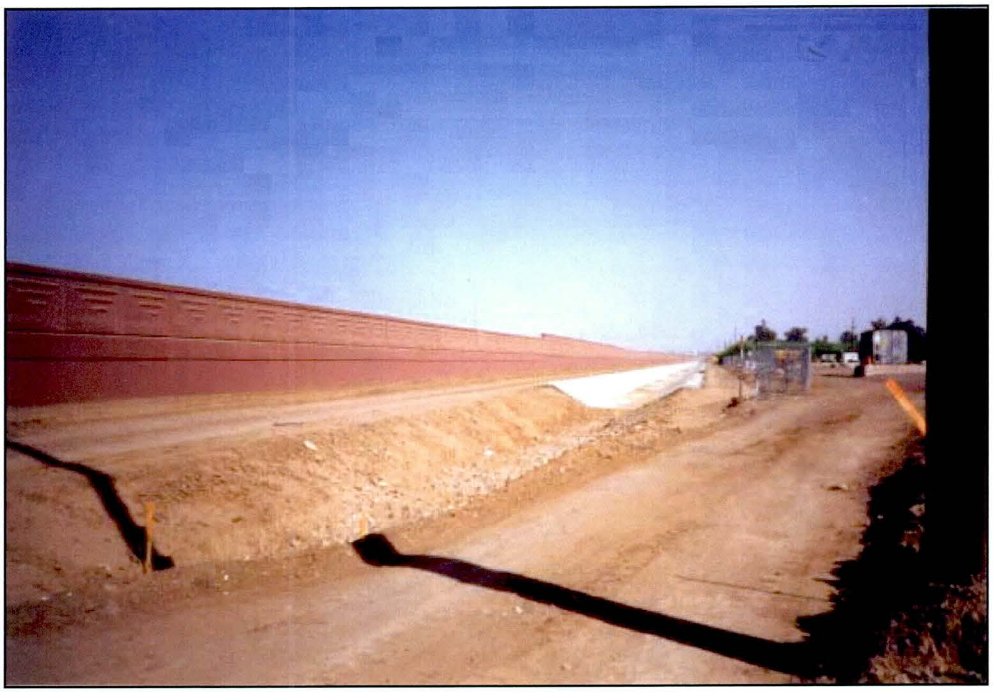


Photo 10: View from the south side of the Salt River at the end of Horne Street, looking east. Sound wall south of the Red Mountain Freeway extension is shown.

Figure 4.5-6
Views in the Vicinity of the City of Mesa

Policy PR 1.2g. Identify natural features in deserts and mountain areas, such as slopes, peaks, ridges, rock outcroppings, stands of vegetation and washes, that could be protected as part of land trusts, as conservation easements, incorporated into developments as design features, or other means of preservation.

Policy PR 1-2h. Encourage preservation in areas with significant environmental features, landforms, and plant communities.

Objective PR 1.3. Maintain where possible the natural aesthetic qualities of the areas that are visually prominent or offer unique settings.

Policy PR 1.3a. Encourage open space areas to align and include prominent natural features to ensure unobstructed view corridors and vistas.

Policy PR 1.3b. Encourage Maricopa County to limit development on Usery Mountain and encourage the City of Mesa to limit development of Spook Hill so the natural attributes remain undisturbed when viewed from adjacent lower elevations.

4.5.4.1.2 Environmental Planning and Conservation

The Environmental Planning and Conservation Element recognizes the importance of a diversity of wildlife and plant communities in maintaining the quality and function of the natural environment. Preservation of corridors is noted as a specific action that can preserve connectivity between wildlife habitats, and the Salt River is one of these primary corridors.

The Environmental Planning and Conservation Element identifies the following goals, objectives, and policies relevant to visual resources and aesthetic conditions:

Goal EPC-3. Provide for the protection and wise use of the resources of the natural environment in the City of Mesa

Objective EPC-3.2. Promote the protection, enhancement, and establishment of native vegetation and plant species.

Policy EPC-3.2c. Promote restoration and revegetation of disturbed areas with native plant species so that disturbed areas, over a reasonable amount of time, match the plant densities of the undisturbed setting.

Policy EPC-3.2d. Recognize and protect areas of significant natural vegetation (such as areas along washes, natural spring areas or on slopes) that are advantageous to the increased densities of the native vegetation.

Objective EPC-3.3. Ensure that new development recognizes limitation associated with the natural features of the land, including slopes, unstable soils, and floodplains.

Policy EPC-3.3d. Require that ridgelines remain as undeveloped natural open space.

Policy EPC-3.3e. Encourage, where feasible, the maintenance of retained washes and new drainage channels in a "natural" desert character. Solutions may include landscaping with native rock and plant materials, contouring, and preservation of existing natural features.

Policy EPC-3.3h. Promote, where applicable, minimum site grading to encourage integration with the natural contours of the land.

4.5.5 SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY

The SRPMIC is considered a sovereign nation and is not under the regulatory or political jurisdiction of any of the local governments in the area or the U.S. federal government. The tribal community does not have any established regulations or plans for visual resources and aesthetic conditions.

4.6 AIR QUALITY

4.6.1 INTRODUCTION

This section describes the existing climate, meteorology, and ambient air quality in the region of the study area, along with the regulatory requirements associated with the management of air pollutants.

4.6.2 CLIMATE AND METEOROLOGY

The climate in central Maricopa County, including the study area, is characteristic of the Sonoran Desert, with hot summers, mild winters, and annual average precipitation totals of approximately 8 inches. Figures 4.6-1 and 4.6-2 present monthly precipitation totals and temperature means, respectively, summarized from data obtained from the National Climatic Data Center On-Line Data Access System for the Phoenix Sky Harbor International Airport long-term monitoring station. Average and median monthly precipitation totals calculated for 1960-1995 are provided in Figure 4.6-1. The long-term annual average and median rainfall for this period are 7.99 inches and 7.62 inches, respectively. (CH2M HILL et al. 1997.) Data gathered for meteorological conditions in the survey area during 2001 and the first quarter of 2002 were downloaded from Arizona Meteorological Network's Internet site and are shown in Table 4.6-1 below (Arizona Meteorological Network 2002).

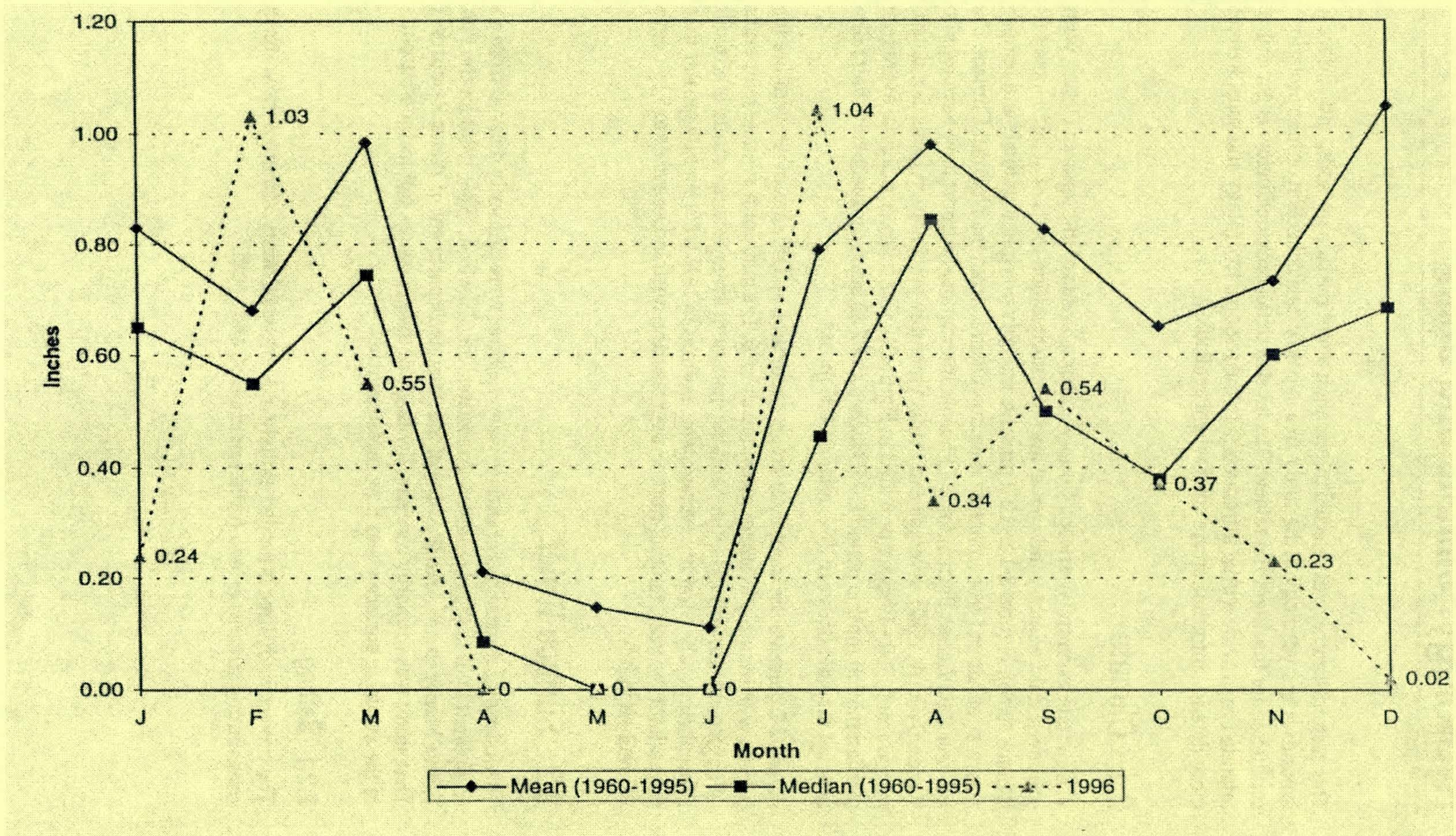
Table 4.6-1. Meteorological Summary for Survey Area, 2001-2002

Month/Year	Average Temperature (° F)	Average Relative Humidity (%)	Average Wind Speed (mph)	Total Rainfall (inches)
2001				
January	50	63	2.6	1.71
February	54	56	2.9	0.62
March	62	49	2.9	0.74
April	68	41	3.6	0.83
May	83	27	3.8	0.06
June	89	26	3.8	0.00
July	91	37	3.7	0.45
August	90	40	3.4	0.62
September	86	35	3.2	0.11
October	74	41	2.7	0.00
November	63	47	2.7	0.14
December	49	58	2.5	0.72
2002				
January	51	45	2.5	0.01
February	56	35	2.7	0.00

Source: Arizona Meteorological Network 2002.

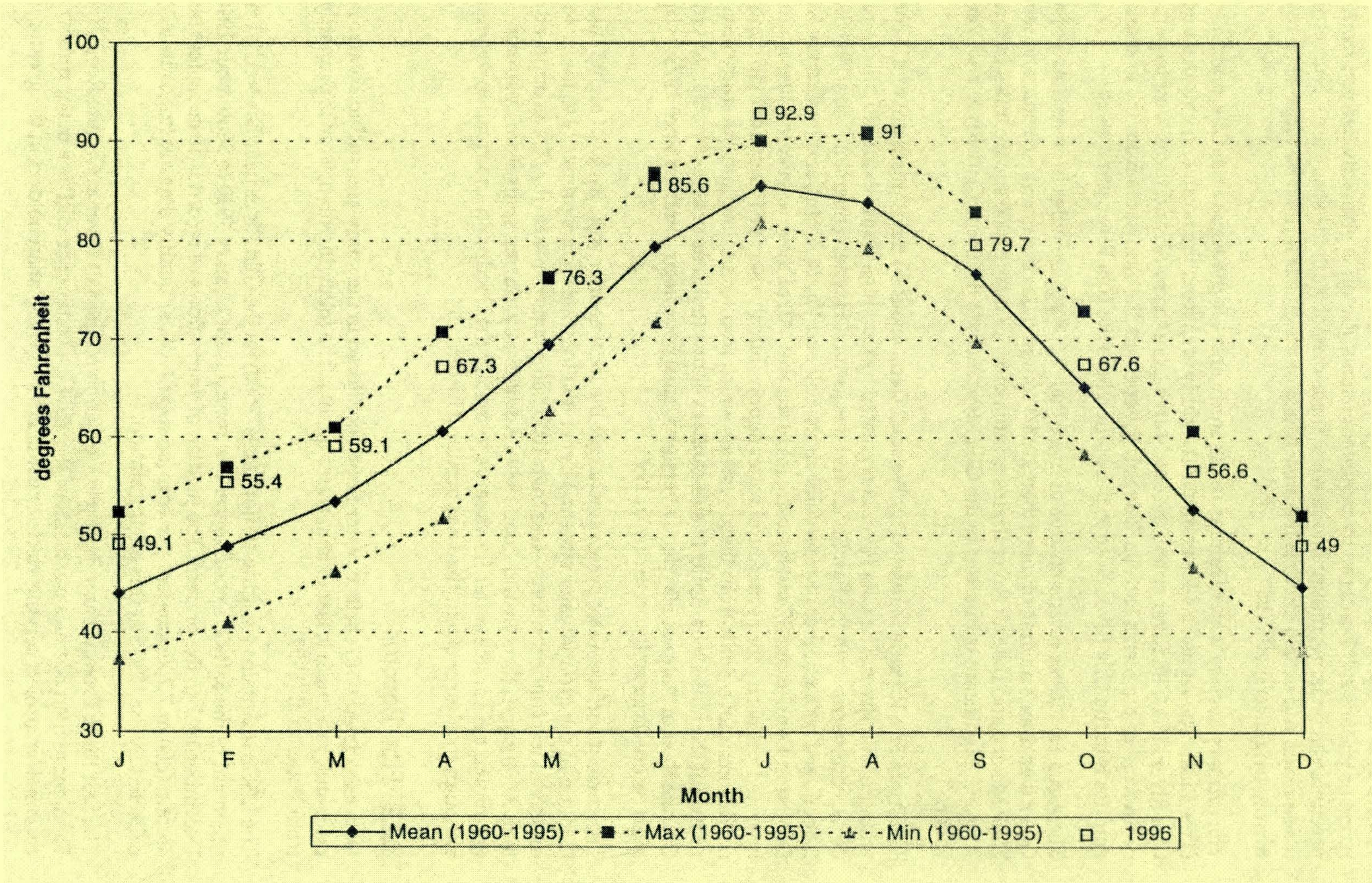
Data from the Phoenix Encanto monitoring station were used because this monitoring station is the closest one to the study area. These data indicate that the rainfall during 2001 was 6.0 inches, which is below average.

Figure 4.6-2 presents the monthly average, maximum, and minimum temperatures for 1960-1995. The minimum average temperature is 44 degrees Fahrenheit (°F) in January and the maximum average temperature is 85.6°F in July (CH2M HILL et al. 1997). Monthly average temperatures for 2001 and the first quarter of 2002 downloaded from Arizona Meteorological Network's Internet site are shown in Table 4.6-1. Data from the Phoenix Encanto monitoring station were used because this monitoring station is the closest to the study area. The minimum average temperature in 2001 and the first quarter of 2002 was 49°F, and occurred during December 2001 (Arizona Meteorological Network 2002). The maximum average temperature for this same period was 91°F, and occurred in July 2001.



Jones & Stokes

Figure 4.6-1
Monthly Total Precipitation, Phoenix, Arizona, 1960-1996



Jones & Stokes

Figure 4.6-2
Monthly Mean Temperature, Phoenix, Arizona, 1960-1996

4.6.3 EXISTING AIR QUALITY

4.6.3.1 Criteria Pollutants

Air quality is evaluated by measurement of ambient concentrations of pollutants that are known to have deleterious effects. The Environmental Protection Agency (EPA) has promulgated primary and secondary National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: carbon monoxide (CO), nitrogen dioxide (NO_2), particulate matter (PM10), ozone (O_3), sulfur dioxide (SO_2), and lead. Primary standards are adopted to protect public health, while secondary standards are adopted to protect public welfare (Arizona Department of Environmental Quality 2000). States are required to adopt ambient air quality standards that are at least as stringent as the federal NAAQS. The ADEQ is responsible for regulating air quality in the state and has adopted the federal NAAQS as state standards. These standards are presented in Table 4.6-2. Table 4.6-3 summarizes some of the health effects associated with each of the six criteria pollutants. Tables 4.6-2 and 4.6-3 appear on the following pages.

Table 4.6-2. State and Federal Ambient Air Quality Standards

Pollutant	Average Time	Primary Standard	Secondary Standard
Carbon monoxide (CO)	1 hour 8 hour	35.00 ppm 9.00 ppm	NS NS
Nitrogen dioxide (NO_2)	Annual	0.053 ppm	0.053 ppm
Particulate matter (PM10)	24 hour Annual	150 $\mu g/m^3$ 50$\mu g/m^3$	150 $\mu g/m^3$ 50$\mu g/m^3$
Ozone (O_3)	1 hour	0.12 ppm	0.12 ppm
Sulfur dioxide (SO_2)	3 hour 24 hour Annual	NS 365 $\mu g/m^3$ (0.14 ppm) 80 $\mu g/m^3$ (0.03 ppm)	1300 $\mu g/m^3$ (0.5ppm) NS NS
Lead	Calendar quarter	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$

Notes:

NS = No standard
ppm = parts per million
$\mu g/m^3$ = micrograms per cubic meter

Source: Arizona Department of Environmental Quality 1998.

Table 4.6-3. Health and Welfare Effects of Criteria Air Pollutants

Pollutant	Health and Welfare Effects
Carbon monoxide (CO)	Impairs the ability of blood to carry oxygen in the body. Cardiovascular system is primarily affected, causing angina pain in persons suffering from cardiac arterial disease. Affects other mammals in a similar manner.
Nitrogen dioxide (NO_2)	Impairs the respiratory system, causing a high incidence of acute respiratory diseases. Preschool children are especially at risk. Damages certain plants and materials. Degrades visibility because of its brownish color and its conversion to nitrate particles. Nitrate particles are also a major component of acid deposition.
Particulate matter (PM10)	Causes irritation and damage to the respiratory system, resulting in difficult breathing, inducement of bronchitis, and aggravation of existing respiratory diseases. Also, certain polycyclic aromatic hydrocarbons in PM10 are carcinogenic. Individuals with respiratory and cardiovascular diseases, children, and elderly persons are at greatest risk. Secondary effects include soiling, damaging materials, and impairment of visibility. PM10 also is associated with acid deposition, which damages materials, plants, and trees and acidifies surface waters, thereby harming aquatic life.
Ozone (O_3)	Damages the respiratory system, reducing breathing capacity and causing chest pain, headache, nasal congestion and sore throat. Individuals with chronic respiratory diseases are especially susceptible to ozone. Injures certain plants, trees, and materials.
Sulfur dioxide (SO_2)	Aggravates, asthma, resulting in wheezing, shortness of breath, and coughing. Healthy persons exhibit the same responses at higher exposures. Asthmatics and atopic individuals are the most sensitive groups, followed by those suffering from bronchitis, persons with emphysema, bronchiectasis, cardiovascular disease, the elderly, and children. Damages certain plants and materials. Impairs visibility and contributes to acid deposition because of its conversion to sulfate particles.
Lead	Damages cardiovascular, renal, and nervous systems, resulting in anemia, brain damage, and kidney disease. Preschool age children are particularly susceptible to brain damage effects. Similar effects are observed in other mammals.

Source: Arizona Department of Environmental Quality 1998.

The ADEQ and Maricopa County Environmental Services Department, Air Quality Division, operate a countywide network of air pollution monitoring stations in the study area (U.S. Army Corps of Engineers 1997). The air quality monitoring station nearest the study area is the Mesa monitoring station (near Broadway Road and Alma School Road); data from this site provide a general profile of the ambient air quality in the area. Table 4.6-4 below presents the concentrations of ambient pollutants recorded in 2000 through 2001, as well as the number of days the ambient concentrations exceeded the federal and state ambient air quality standards.

Table 4.6-4. Ambient Air Quality Monitoring Data from Mesa Monitoring Station

Pollutant Standards	2000	2001
Ozone (O_3)		
Maximum 1-hour concentration (ppm)	0.102	0.093
No. Days Standard Exceeded		
NAAQS (1-hour) > 0.12 ppm	0	0
Carbon Monoxide (CO)		
Maximum 8-hour concentration (ppm)	4.3	2.9
Maximum 1-hour concentration (ppm)	8.0	4.6
No. Days Standard Exceeded		
NAAQS (8-hour) $\geq$ 9.0 ppm	0	0
NAAQS (1-hour) $\geq$ 35 ppm	0	0
Particulate Matter (PM_{10})		
Maximum 24-hour concentration ($\mu g/m^3$)	126	98
Average arithmetic mean concentration ($\mu g/m^3$)	37	30
No. Days Standard Exceeded		
NAAQS (24-hour) > 150 $\mu g/m^3$	0	0

Source: Maricopa County Environmental Services Department, Air Quality Division, 2002.

As of July 1, 1997, EPA had revised two standards, those for O_3 and PM10, to ensure a more effective and efficient protection of public health and the environment. These revised standards are an 8-hour O_3 standard of 0.08 parts per million (ppm), a 24-hour standard for PM2.5 (particulate matter with a diameter of 2.5 microns or smaller) of 65 micrograms per cubic meter ($\mu g/m^3$) and an annual PM2.5 standard of 15 $\mu g/m^3$ (Arizona Department of Environmental Quality 2000).

Areas with air quality that does not meet these standards are designated by EPA as "nonattainment areas." Several areas within Arizona have been designated by EPA as nonattainment areas. Once an area has been designated as a nonattainment area, a state implementation plan (SIP) must be developed to demonstrate the measures that will be undertaken in the area to reduce the pollutant levels to meet the air quality standards. The Phoenix area has been designated by EPA as a nonattainment area for CO, O_3, and PM10 (Arizona Department of Environmental Quality 2000). Maricopa County was reclassified as a "serious" CO and PM10 nonattainment area in June 1996, and was classified as a "serious" nonattainment area for O_3 in February 1998 (Arizona Department of Environmental Quality 2000). The Maricopa Association of Governments is currently preparing or has prepared SIPs to address the control of nonattainment criteria pollutants (Arizona Department of Environmental Quality 2000). No nonattainment areas for lead or oxides of nitrogen are within Arizona (Arizona Department of Environmental Quality 2000).

4.6.3.2 Toxic Air Contaminants

In addition to criteria pollutants, other regulated pollutants include toxic air contaminants (TACs), which are suspected or known to cause cancer, genetic mutations, birth defects, or other serious illnesses in exposed people. TACs are not regulated by the federal or state ambient air quality standards, but are addressed by the National Emission Standards for Hazardous Air Pollutants (NESHAPs) and Title III of the 1990 Clean Air Act Amendments (U.S. Army Corps of Engineers 1997).

The concentrations of toxic pollutants are determined by the level of emissions at the source and the meteorological conditions encountered as these pollutants are transported away from the source. Thus, impacts from toxic pollutant emissions tend to be site specific and their intensity is subject to constantly changing meteorological conditions. The worst meteorological conditions that affect short-term impacts (low wind speed, highly stable air mass, and constant wind direction) occur relatively infrequently in the Phoenix metropolitan area (U.S. Army Corps of Engineers 1997).

4.6.4 REGULATORY SETTING

Federal, state, and regional agencies have established standards and regulations addressing air pollutant emissions that may affect proposed projects.

4.6.4.1 Federal and State Regulations

The following federal and state regulatory considerations may apply to the project and the alternatives.

- The federal Clean Air Act of 1970, which directs the attainment and maintenance of NAAQS for six "criteria" pollutants, including CO, O_3, particulate matter, sulfur oxides, oxides of nitrogen, and lead.

- The 1977 Clean Air Act, which enacted legislation to control seven air toxic pollutants. EPA adopted the NESHAPs contained in the Act, which were designated to control emissions of hazardous air pollutants to prevent adverse health effects in humans.
- The 1990 amendments to the Clean Air Act, which determine standards for attainment and maintenance of the NAAQS (Title I), motor vehicles and reformulation (Title II), hazardous air pollutants (Title III), acid deposition (Title IV), operating permits (Title V), stratospheric ozone protection (Title VI), and enforcement (Title VII).
- EPA's New Source Review (NSR) and Prevention of Significant Deterioration (PSD) regulations.

4.6.4.2 Federal Conformity Requirements

Federal projects are subject to either the Transportation Conformity Rule (40 Code of Regulations [CFR], Part 51, Subpart T), which applies to federal highway or transit projects, or the General Conformity Rule (40 CFR Part 51, Subpart W), which applies to all other federal projects. Because the proposed action is not a federal highway or transit project, it is subject to the General Conformity Rule.

The purpose of the General Conformity Rule is to ensure that federal projects conform to applicable SIPs so that they do not interfere with strategies employed to attain the NAAQSs. The rule applies to federal projects in areas designated as nonattainment areas for any of the six criteria pollutants for which the EPA has established NAAQSs and in some areas designated as maintenance areas. The rule applies to all federal projects except:

- programs specifically included in a transportation plan or program that is found to conform under the federal transportation conformity rule,
- projects with associated emissions below specified *de minimis* threshold levels, and
- certain other projects that are exempt or presumed to conform.

The project study area is in a nonattainment area for federal ozone, CO, and PM10 standards. The applicable *de minimis* thresholds are 50 tons per year (tpy) of reactive organic gases and nitrogen oxides, 100 tpy of CO, and 70 tpy of PM10. If the Va Shly'ay Akimel project would result in total direct and indirect emissions in excess of the *de minimis* emission rates, it must be demonstrated that the emissions conform with the applicable SIP for each affected pollutant. If emissions would not exceed the *de minimis* levels, and are not regionally significant, the project is presumed to conform and no further analysis or determination is required.

4.6.4.3 Regional and Local Regulations

Maricopa County has jurisdiction for air quality within Maricopa County. The Va Shly'ay Akimel project study area is located within Maricopa County, and emissions that would result from the construction and maintenance of the Va Shly'ay Akimel project are therefore subject to

Maricopa County rules and regulations. The rules and regulations of this agency are designed to achieve defined air quality standards that are protective of public health (U.S. Army Corps of Engineers 1997). To that purpose, they limit the emissions and permissible impacts of emissions from projects, and specify emission controls and control technologies for each type of emitting source to ultimately achieve the air quality standards (U.S. Army Corps of Engineers 1997). The construction contractor will be required to obtain appropriate air permits for this project.

The most important air quality regulation applicable to this project is Maricopa County Rule 310, which requires all construction activities to use stringent control measures to minimize fugitive dust emissions. The mitigation measures described in Section 5.6 include the anticipated requirements under Rule 310.

4.7 NOISE

4.7.1 INTRODUCTION

This section describes the existing noise setting in the vicinity of the Va Shly'ay Akimel study area, including noise sources and the regulatory setting for noise. General information about noise is also provided.

4.7.2 GENERAL NOISE SETTING

A noise environment consists of a base of steady background noise that is derived from many distant and indistinguishable noise sources, combined with sound from individual local sources. In the study area, these local sources include frequent aircraft overflights, traffic noise from streets and freeways in the area, industrial use, and sand and gravel mining operations along the study area.

4.7.2.1 Description of Noise Characteristics

Noise is measured on the decibel (dB) scale, which quantifies sound intensity. Because the human ear is not equally sensitive to all frequencies within the entire spectrum, noise measurements are weighted more heavily within those frequencies of maximum human sensitivity in a process called "A-weighting." The human ear can detect changes in sound levels of approximately 3 A-weighted decibels (dBA) under normal conditions. Changes of 1 to 3 dBA are typically noticeable under controlled conditions, whereas changes of less than 1 dBA are only discernable under controlled, extremely quiet conditions. A change of 5 dBA is typically noticeable by the general public in an outdoor environment. Background information on noise characteristics is included in Appendix F.

Noise may be generated from a point source, such as a piece of construction equipment, or from a line source, such as a road containing moving vehicles. Noise attenuates (decreases) with distance at a rate of 6 dB per doubling of distance for a point source and 3 dB per doubling of distance from a line source. The rate at which noise attenuates can also be affected by the type of terrain over which the noise passes. For an acoustically soft site, such as undeveloped areas, open space, and vegetated areas, noise from a line source attenuates at a rate of 4.5 dBA per doubling of the distance. These rates represent the extremes, and most areas contain a combination of hard and soft elements, with the noise attenuation falling somewhere between these two attenuation factors. Objects that block the line of sight attenuate the noise source if the receptor is located within the "shadow" of the blockage, such as behind a sound wall. If a receptor is located behind the wall but has a view of the source, the wall will do little to attenuate the noise. Additionally, a receptor located on the same side of the wall as the noise source may experience an increase in the perceived noise level because the wall will reflect noise back to the receptor, possibly compounding the noise.

Time variation in noise exposure is typically expressed in terms of the average energy over time (called L_{eq}), or alternatively, as a statistical description of the sound level that is exceeded over some fraction of a given observation period.

4.7.2.2 Effects of Noise

High noise levels can interfere with a broad range of human activities in a way that degrades public health and welfare. Such activities may include:

- speech communication in conversation and teaching,
- telephone communication,
- listening to television and radio,
- listening to music,
- concentration during mental and physical activities,
- relaxation, and
- sleep.

Interference with listening situations can be determined in terms of the level of the environmental noise and its characteristics. The amount of interference in nonlistening situations often depends on factors other than the physical characteristics of the noise. These may include attitude toward the source of an identifiable noise, familiarity with the noise, characteristics of the exposed individual, and the intrusiveness of the noise.

4.7.2.3 Noise Sources

The Va Shly'ay Akimel study area is located in a mixed setting containing both urbanized areas and semi-rural areas. The study area has a moderate activity levels and several sources of adverse noise. The principle sources of noise in the study area are sand and gravel mining operations. This is the largest contributor of ambient noise in the area. Automobiles traversing on SR 202 and SR 101 are another contributor of ambient noise in the area. Traffic noise in the area may be characterized as moderately loud. Aircraft departing from and entering Phoenix Sky Harbor Airport contribute to the ambient noise in the study area. The airport is not within the immediate vicinity of the study area, though the study area runs generally parallel to the airport's takeoff and approach zone. However, because aircraft produce intense noise and pass over the area at relatively low altitudes, these aircraft are considered to be moderate noise sources.

Talley Industries, located south of the project site, is another source of noise in the study area. Talley Industries occasionally detonates explosives left over from the manufacture of ejection seats. This noise is not continuous and therefore is not considered to be significant.

4.7.2.4 Sensitive Receptors

The study area contains residential and agricultural land uses. Sensitive receptors for noise in the study area consist of residential uses located to the south of the river channel and a few scattered houses on the north side of the river channel.

4.7.3 REGULATORY SETTING

4.7.3.1 Federal and State Standards and Regulations

EPA has identified the relationship between noise levels and human response. EPA has determined that over a 24-hour period, a L_{eq} of 70 dBA will result in some hearing loss. Interference with activity and annoyance will not occur if exterior levels are maintained at an L_{eq} of 55 dBA and interior levels at or below 45 dBA. Although these levels are relevant for planning and design and are useful for informational purposes, they are not land use planning criteria because they do not consider economic cost, technical feasibility, or the needs of the community.

In addition to the L_{eq} limitations discussed above, in accordance with 24 CFR 51, Subpart B, "Noise Abatement and Control," EPA set 55-dBA day-night average sound level (L_{dn}) as the basic goal for residential noise intrusion. However, other federal agencies, in consideration of their own program requirements and goals, as well as the difficulty of actually achieving a goal of 55-dBA L_{dn}, have settled on the 65-dBA L_{dn} level as their standard. At 65-dBA L_{dn}, activity interference is kept to a minimum, and annoyance levels are still low. It is also a level that can realistically be achieved.

The federal government regulates occupational noise exposure common in the workplace through the Occupational Health and Safety Administration (OSHA) under EPA. Noise exposure of this type is dependent on work conditions and is addressed through a facility's or construction contractor's health and safety plan. With the exception of construction workers involved in facility construction, occupational noise is irrelevant to this study and is not further addressed in this document.

4.7.3.2 Regional and Local Standards and Regulations

Local governmental jurisdictions are responsible for regulating noise within their respective political boundaries. Specific noise regulations are discussed in the respective zoning ordinances for each of the local jurisdictions, where applicable.

Maricopa County

Maricopa County does not have a noise ordinance. Noise-producing aspects of new projects and existing development fall under the jurisdiction of individual cites in which a given development is located. On October 20, 1997, the County adopted the Maricopa County Comprehensive Plan, which contains a noise element. The Comprehensive Plan states that due to increased highway traffic, air traffic, construction, and industrial and commercial activities brought about by growth and development, noise has become an increasing concern to both the public and governmental agencies. The Comprehensive Plan sets forth Objectives and Policies to reduce or eliminate sources of noise, including unnecessary traffic (Maricopa County Planning and Development Department 1997).

City of Mesa

The City of Mesa Noise Ordinance sets forth the City policy regarding noise-producing activities and associated constraints on such activities. The ordinance limits the amount of noise that may be produced by various land use activities, vehicles, and construction, and limits the amount of noise that may be produced in areas adjacent to hospitals, schools, and churches. For construction noise, limitations are placed on the time of day that noise-generating construction activities can occur and further limits the days on which these activities can occur (City of Mesa 2000).

Salt River Pima-Maricopa Indian Community

The Community does not have a noise ordinance regulating noise within the Va Shly'ay Akimel study area. However, the creation of excessive noise considered detrimental to the life or health of any individual or in disturbance of the public peace and welfare is not permitted. Noise issues are handled on a case-by-case basis, and all projects on Community lands require a permit for construction (Thompson pers. comm.).

4.8 SOCIAL AND ECONOMIC RESOURCES (INCLUDING ENVIRONMENTAL JUSTICE)

4.8.1 INTRODUCTION

This section presents information regarding the social and economic resources that exist in the vicinity of the study area. A description of the population characteristics, including population, ethnicity, housing trends, local industries, and employment rates is provided below. In addition, environmental justice issues are presented. The data and associated tables and figures presented in this section are based on information obtained from the 2000 U.S. Census Bureau surveys for Maricopa County (County) and for the tracts adjacent to the Salt River in the vicinity of the study area. Additional information regarding population- and housing-growth forecasts and other demographic projections for the County and local municipalities was obtained through the Maricopa Association of Governments (1997) and Arizona Department of Economic Security (1997 and 2000) web sites.

Information regarding employment, personal income, and educational attainment was obtained from the 2000 Census database. In this socioeconomic section of this report, the term *study area* refers to the group of census tracts that exist within or extend into the study area. Whenever possible, the 2000 census information has been supplemented by the most current information available from the online database of the City of Mesa (2002).

4.8.2 GENERAL SOCIOECONOMIC SETTING

4.8.2.1 Population

The southern portion of the study area lies in the City of Mesa, Arizona, which has a total population of 421,614 (City of Mesa 2002), and the northern portion lies in the Salt River Indian reservation, which has a total population of 6,403. Table 4.8-1, "Population and Household Characteristics in the Vicinity of the Study Area," shows the 2000 population and household and family structure for the County and the study area. In 2000, the population in the County totaled 3,072,149 people (U.S. Census Bureau 2000). The Maricopa Association of Governments (MAG) projects that the County's population will grow to approximately 3,709,566 by 2010, and to approximately 4,516,090 by 2020, increases of 637,417 and 1,443,941 people, respectively (Maricopa Association of Governments 2002). The population living in the census tracts in the study area makes up approximately 1.7% of the total County population. The average population of the tracts within the study area is 4,741 persons (U.S. Census Bureau 2000).

Table 4.8-1. Population and Household Characteristics in the Vicinity of the Study Area

Jurisdiction	Population	Number of Households	Persons per Household	Number of Families	Persons per Family
Maricopa County	3,072,149	1,133,048	2.71	763,110	3.21
Study Area	52,153	13,973	3.73	9,362	4.20

Source: U.S. Census Bureau 2000

4.8.2.2 Ethnicity

Table 4.8-2, "Ethnic Population Characteristics in the Vicinity of the Study Area," shows the ethnic makeup of the County and the study area in 2000. The approximate population breakdown of the County by ethnicity is: 66.2% white, 24.8% Hispanic, 3.5% African American, 1.5% American Indian and Alaskan Native, 2.1% Asian, 0.1 % Native Hawaiian or other Pacific Islander, 0.1% other races, and 1.6% two or more races (U.S. Census Bureau 2000).

Table 4.8-2. Ethnic Population Characteristics in the Vicinity of the Study Area

Jurisdiction	White	Black or African American	American Indian or Alaskan Native	Asian	Native Hawaiian or other Pacific Islander	Other	Hispanic or Latino	Two or more Races
Maricopa County	2,034,530	108,521	45,703	64,562	3,725	4,086	763,341	47,681
Percent of County Total	66.2%	3.5%	1.5%	2.1%	0.1%	0.1%	24.8%	1.6%
Va Shly'ay Akimel Study Area	44,812	1,823	4,447	1,179	102	767	16,791	1,685
Percent of Study Area Total	62.6%	2.5%	6.2%	1.6%	0.1%	1.1%	23.4%	2.4%

Source: U.S. Census Bureau 2000

The ethnic composition of the study area resembles but does not mirror that of the County as a whole. Most notably, the population of American Indian and Alaskan Natives is approximately 4.7% greater in the study area than in the County as a whole. The approximate population breakdown in the study area is: 62.6% white, 23.4% Hispanic, 2.5% African American, 6.2% American Indian and Alaskan Native, 1.6% Asian, 0.1% Hawaiian and Pacific Islander, 1.1% other races, and 2.4% two or more races (U.S. Census Bureau 2000).

4.8.2.3 Housing

The housing within the study area is characterized by urban, rural residential, and rural farming. Table 4.8-3, "Housing Occupancy Rates in the Vicinity of the Study Area," shows the housing data for the County and study area for 2000. The County had a total of 1,250,231 housing units, of which 1,132,886 (90.6%) were occupied. MAG projects that the County will have approximately 1,490,212 housing units by the year 2010, and approximately 1,824,979 by 2020. On the local level, MAG predicts that the City of Mesa, in which approximately 2% of the study area is located, will have approximately 194,762 housing units by 2010, and approximately 241,532 by 2020 (Maricopa Association of Governments 1997).

Table 4.8-3. Occupancy Rates in the Vicinity of the Study Area

Jurisdiction	Households	Housing Units	Occupied Housing Units	Occupancy (in percentage)
Maricopa County	1,133,048	1,250,231	1,132,886	90.6%
Study Area	13,973	15,486	13,969	90.2% (avg.)
Percentage of County Total	1.2%	1.2%	1.2%	

Source: U.S. Census Bureau 2000

The study area had a total of 15,486 housing units and 13,973 households, with an average occupancy rate of 90.2 %. The study area includes approximately 1.2% of the housing within the County and generally has a slightly lower occupancy rate than the County as a whole (U.S. Census Bureau 2000).

Table 4.8-4, "Housing-Unit Type and Housing-Unit Median Value in the Vicinity of the Study Area," shows that in 2000, 13,516 housing units (87.3% of the total housing units within the study area) were located in urban areas within the study area, while 1,970 housing units (12.7%) were located in rural areas (66 on farms and 1,904 on non-farmland). In the County, approximately 1,212,724 housing units (97.0% of the total housing units of the County) were located in urban areas, and approximately 37,507 housing units (3.0%) were located in rural areas. The housing units within the study area had a median value of $72,945, while those in the County had a median value of $122,000 (U.S. Census Bureau 2000).

Table 4.8-4. Housing-Unit Type and Housing-Unit Median Value in the Vicinity of the Study Area

	Rural		Urban		Median Unit Value
Urban	Farm	Non-Farm	Inside	Outside	Median Value
Maricopa County	493	37,014	1,193,574	19,150	$122,000
Study Area	66	1,904	13,516	0	$72,945

Source: U.S. Census Bureau 2000

4.8.2.4 Employment

According to the Arizona Department of Economic Security (ADES), approximately 1,553,900 people were employed in Maricopa County in 2000, with employment expected to continue to grow in the region. Employment opportunities in the Phoenix-Mesa metropolitan area are expected to expand to 2,086,543 jobs by 2008; this would represent an 8-year increase of 532,643 jobs (2000–2008). In January 2002, the total civilian labor force in the County was 1,586,600, of which 1,501,000 were employed. Table 4.8-5, "Industry Employment in Maricopa County, January 2002," shows that there are 1,501,000 people currently employed in the County (Arizona Department of Economic Security 2002), a slight decrease from 2 years ago.

Table 4.8-5. Industry Employment in Maricopa County, January 2002

Jurisdiction	
Maricopa County	
Total Civilian Labor Force	1,586,600
Total Unemployment	85,600
Total Employment	1,501,000
Non-Farm Employment	1,528,500
Goods Producing	258,900
Mining and Quarrying	1,000
Construction	112,500
Manufacturing	145,400
Service Producing	1,269,600
Transportation, Communication, and Public Utilities	82,200
Trade	374,400
Financial, Insurance, and Real Estate	125,300
Government	

Jurisdiction	
Federal	19,700
State and Local	171,300

Source: Arizona Department of Economic Security (2002)

* Adjusted to the Current Population Survey (CPS 2002) to reflect place of residence. BENCHMARK YEAR 2001 QUARTER 1

Table 4.8-6, "Occupational Employment in the Vicinity of the Study Area," shows the major employment sectors within the County and study area for 2000 and the number of people employed in each sector. Approximately 1,427,292 people were employed in the County, and 18,490 people were employed in the study area. The two largest employment sectors in the County were Management/Professional and Sales/Office Occupations, which employed 33.9% and 29.7% of the work force, respectively. The largest employment sector in the study area was Sales/Office Occupations, which employed 25.9% of the work force, but the second largest was Production, Transportation, and Material Moving Occupations, which employed 19.6% of the work force. The third and fourth largest employment industries in the County as a whole were Service Occupations and Production, Transportation, and Material Moving Occupations employing 14.6% and 11.0 % of the work force, respectively. In the study area, the third and fourth largest employment sectors were Management/Professional Occupations and Service Occupations, employing 19.1% and 19.0% of the work force, respectively. The study area accounts for approximately 1.3% of the countywide employment for workers above 16 years of age (U.S. Census Bureau 2000).

Table 4.8-6. Occupational Employment in the Vicinity of the Study Area

Occupational Category	Number of Employees	Percent of Total
Maricopa County		
Management, professional, and related occupations:	483,582	33.9%
Management, business, and financial operations occupations:	209,597	14.7%
Management occupations, except farmers and farm managers	137,342	9.6%
Farmers and farm managers	1,553	0.1%
Business and financial operations occupations:	70,702	5.0%
Business operations specialists	34,441	2.4%
Financial specialists	36,261	2.5%
Professional and related occupations:	273,985	19.2%
Computer and mathematical occupations	43,317	3.0%
Architecture and engineering occupations:	38,728	2.7%
Architects, surveyors, cartographers, and engineers	28,634	2.0%

Occupational Category	Number of Employees	Percent of Total
Drafters, engineering, and mapping technicians	10,094	0.7%
Life, physical, and social science occupations	8,609	0.6%
Community and social services occupations	17,201	1.2%
Legal occupations	15,058	1.1%
Education, training, and library occupations	66,776	4.7%
Arts, design, entertainment, sports, and media occupations	27,471	1.9%
Healthcare practitioners and technical occupations:	56,825	4.0%
Health diagnosing and treating practitioners and technical occupations	39,718	2.8%
Health technologists and technicians	17,107	1.2%
Service occupations:	208,498	14.6%
Healthcare support occupations	20,623	1.4%
Protective service occupations:	28,056	2.0%
Fire fighting, prevention, and law enforcement workers, including supervisors	14,238	1.0%
Other protective service workers, including supervisors	13,818	1.0%
Food preparation and serving related occupations	68,582	4.8%
Building and grounds cleaning and maintenance occupations	50,917	3.6%
Personal care and service occupations	40,320	2.8%
Sales and office occupations:	423,504	29.7%
Sales and related occupations	179,982	12.6%
Office and administrative support occupations	243,522	17.1%
Farming, fishing, and forestry occupations	5,327	0.4%
Construction, extraction, and maintenance occupations:	149,539	10.5%
Construction and extraction occupations:	91,502	6.4%
Supervisors, construction and extraction workers	12,137	0.9%
Construction trades workers	78,914	5.5%
Extraction workers	451	0.0%
Installation, maintenance, and repair occupations	58,037	4.1%
Production, transportation, and material moving occupations:	156,842	11.0%
Production occupations	85,055	6.0%
Transportation and material moving occupations:	71,787	5.0%
Supervisors, transportation and material moving workers	2,364	0.2%
Aircraft and traffic control occupations	3,485	0.2%

Occupational Category	Number of Employees	Percent of Total
Motor vehicle operators	36,116	2.5%
Rail, water and other transportation occupations	2,831	0.2%
Material moving workers	26,991	1.9%
Total (for the 6 Major Categories):	1,427,292	-
Study Area		
Management, professional, and related occupations:	3,523	19.1%
Management, business, and financial operations occupations:	1,548	8.4%
Management occupations, except farmers and farm managers	963	5.2%
Farmers and farm managers	100	0.5%
Business and financial operations occupations:	485	2.6%
Business operations specialists	226	1.2%
Financial specialists	259	1.4%
Professional and related occupations:	1,975	10.7%
Computer and mathematical occupations	334	1.8%
Architecture and engineering occupations:	217	1.2%
Architects, surveyors, cartographers, and engineers	99	0.5%
Drafters, engineering, and mapping technicians	118	0.6%
Life, physical, and social science occupations	56	0.3%
Community and social services occupations	141	0.8%
Legal occupations	100	0.5%
Education, training, and library occupations	647	3.5%
Arts, design, entertainment, sports, and media occupations	155	0.8%
Healthcare practitioners and technical occupations:	325	1.8%
Health diagnosing and treating practitioners and technical occupations	144	0.8%
Health technologists and technicians	181	1.0%
Service occupations:	3,522	19.0%
Healthcare support occupations	338	1.8%
Protective service occupations:	402	2.2%
Fire fighting, prevention, and law enforcement workers, including supervisors	174	0.9%
Other protective service workers, including supervisors	228	1.2%
Food preparation and serving related occupations	1,136	6.1%
Building and grounds cleaning and maintenance occupations	1,064	5.8%

Occupational Category	Number of Employees	Percent of Total
Personal care and service occupations	582	3.1%
Sales and office occupations:	4,786	25.9%
Sales and related occupations	1,492	8.1%
Office and administrative support occupations	3,294	17.8%
Farming, fishing, and forestry occupations	225	1.2%
Construction, extraction, and maintenance occupations:	2,809	15.2%
Construction and extraction occupations:	1,697	9.2%
Supervisors, construction and extraction workers	167	0.9%
Construction trades workers	1,510	8.2%
Extraction workers	20	0.1%
Installation, maintenance, and repair occupations	1,112	6.0%
Production, transportation, and material moving occupations:	3,625	19.6%
Production occupations	1,975	10.7%
Transportation and material moving occupations:	1,650	8.9%
Supervisors, transportation and material moving workers	50	0.3%
Aircraft and traffic control occupations	18	0.1%
Motor vehicle operators	774	4.2%
Rail, water and other transportation occupations	58	0.3%
Material moving workers	750	4.1%
Total (for the 6 Major Categories):	18,490	-

In Maricopa County, 1,877,045 people are expected to be employed by the year 2010, and 2,212,889 people are expected to be employed by 2020. Although employment predictions are not available specifically for the study area, the City of Mesa is expected to have 214,936 persons employed by 2010, and 264,158 persons employed by 2020 (Maricopa Association of Governments 1997).

4.8.2.5 Income

Table 4.8-7, "Median Income in Maricopa County and the Vicinity of the Study Area," shows median household income for residents within Maricopa County and the study area for the year 2000. The median household income for the County was $45,358, whereas the median household income for the study area was $33,417 (U.S. Census Bureau 2000).

Table 4.8-7. Median Income in Maricopa County and in the Vicinity of the Study Area

Jurisdiction	Median Household Income
Maricopa County	$45,358
Study Area	$33,417 (avg.)

Source: U.S. Census Bureau 2000

4.8.3 ENVIRONMENTAL JUSTICE

In 1994, The President of the United States issued Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations. The objectives of the executive order include developing federal agency implementation strategies, identifying minority and low-income populations where proposed federal actions could have disproportionately high and adverse human health and environmental effects, and encouraging the participation of minority and low-income populations in the NEPA process.

There are two types of data that must be reviewed to evaluate environmental justice effects: minority populations and income levels. Minority data for census tracts located within the study area were obtained from the recent 2000 census. Countywide statistics were reviewed to determine the percentage of the population not classified as Caucasian and the percentage classified as Hispanic. Using the county average for comparison, each of the census tracts in the study area was evaluated to determine whether the minority and/or Hispanic population percentages were greater than the county average. If a census tract percentage exceeded the county average, the tract was evaluated for environmental justice effects based on its minority population. Figure 4.8-1 shows the locations of the census tracts that meet this criterion and are evaluated for environmental justice impacts in this EIS.

The second criterion for an environmental justice analysis is income. Income data were obtained from the 2000 census and used in this analysis. To determine the locations of low-income populations, county income data were reviewed to determine the countywide percentage of households that have incomes below poverty levels. Then, the individual census tracts were evaluated to determine the percentage of households within the tract that have incomes below poverty levels. If a census tract percentage exceeded the county average, the tract was included in the analysis based on income levels. Figure 4.8-2 shows the locations of the census tracts that meet this criterion and are evaluated for environmental justice impacts in this EIS

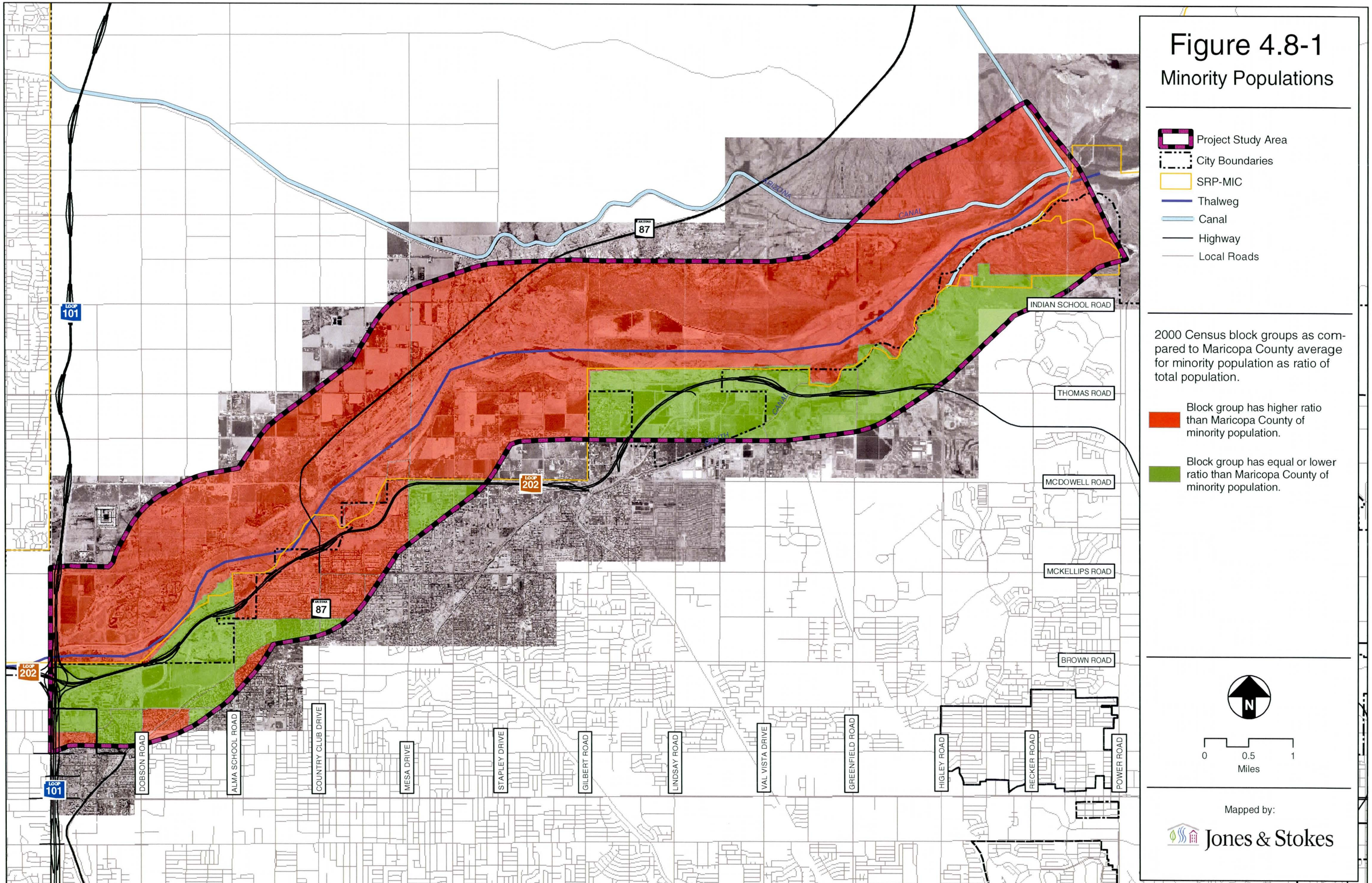


Figure 4.8-1
Minority Populations
Project Study Area
City Boundaries
SRP-MIC
Thalweg
Canal
Highway
Local Roads
2000 Census block groups as compared to Maricopa County average for minority population as ratio of total population.
Block group has higher ratio than Maricopa County of minority population.
Block group has equal or lower ratio than Maricopa County of minority population.
N
0
0.5
1
Miles
Mapped by:
Jones & Stokes
INDIAN SCHOOL ROAD
THOMAS ROAD
MCDOWELL ROAD
MCKELLIPS ROAD
BROWN ROAD
DOBSON ROAD
ALMA SCHOOL ROAD
COUNTRY CLUB DRIVE
MESA DRIVE
STAPLEY DRIVE
GILBERT ROAD
LINDSAY ROAD
VAL VISTA DRIVE
GREENFIELD ROAD
HIGLEY ROAD
RECKER ROAD
POWER ROAD
101
202
87
CANAL

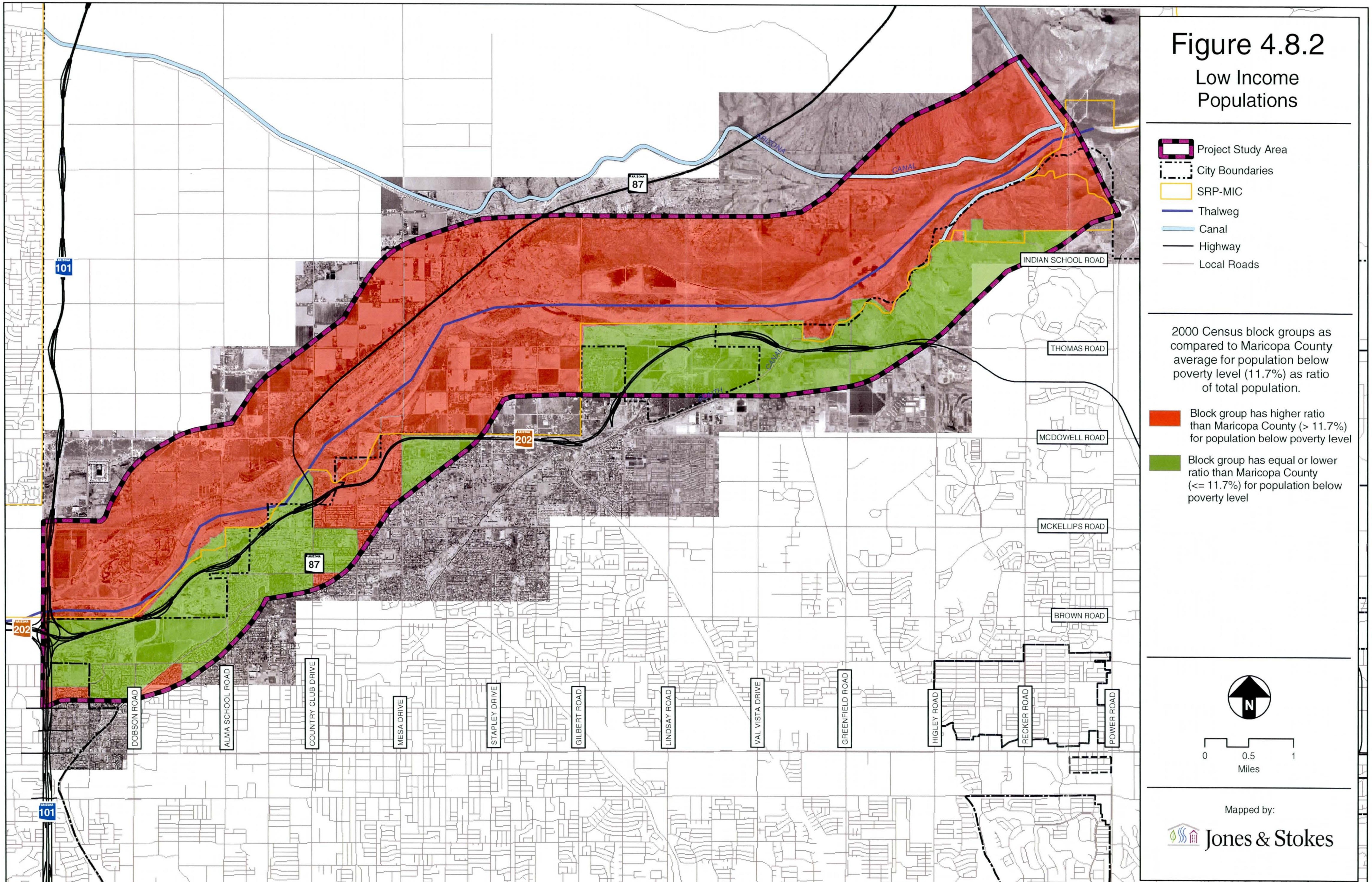


Figure 4.8.2
Low Income Populations
Project Study Area
City Boundaries
SRP-MIC
Thalweg
Canal
Highway
Local Roads
2000 Census block groups as compared to Maricopa County average for population below poverty level (11.7%) as ratio of total population.
Block group has higher ratio than Maricopa County (> 11.7%) for population below poverty level
Block group has equal or lower ratio than Maricopa County (<= 11.7%) for population below poverty level
N
0
0.5
1
Miles
Mapped by:
Jones & Stokes
INDIAN SCHOOL ROAD
THOMAS ROAD
MCDOWELL ROAD
MCKELLIPS ROAD
BROWN ROAD
DOBSON ROAD
ALMA SCHOOL ROAD
COUNTRY CLUB DRIVE
MESA DRIVE
STAPLEY DRIVE
GILBERT ROAD
LINDSAY ROAD
VAL VISTA DRIVE
GREENFIELD ROAD
HIGLEY ROAD
RECKER ROAD
POWER ROAD
101
202
87
CANAL

4.9 TRANSPORTATION

4.9.1 INTRODUCTION

This section discusses the transportation system that exists within the vicinity of the Va Shly'ay Akimel study area. A general description of the physical system is provided, along with current roadway conditions and the regulatory setting.

4.9.2 TRANSPORTATION SETTING

The Va Shly'ay Akimel project proposes restoration of a 14-mile reach of the Salt River extending from Granite Reef Dam to the SR 101/202 interchange. The dominant mode of transportation for this area is the automobile. Along this reach of the Salt River, there are four bridged crossings (including the interchange) and one at-grade crossing. Nearly all local streets and arterials near the Salt River form a north-south, east-west grid roadway network. Exceptions to this grid include the Beeline Highway (SR 87) and SR 202.

4.9.2.1 Interstate Highways

There are no interstate highways within 5 miles of the project study area. The nearest interstate highway is I-10, which is approximately 5 miles west of the SR 101/202 interchange.

4.9.2.2 State Highways

There are three state highways near the study area: SR 87, SR 101, and SR 202. SR 87 is also known as the Beeline Highway north of the Salt River and as Country Club Drive south of the Salt River. According to Arizona Department of Transportation (ADOT) staff, SR 87 is no longer an ADOT right-of-way through Mesa and Chandler (Catchpole pers. comm.). From the north, SR 87 parallels the Salt River in a southwesterly direction until it reaches the Country Club Drive alignment, at which point the roadway bears due south, crosses the Salt River, and becomes Country Club Drive. The crossing at the Salt River is a bridged, four-lane crossing. ADOT lists the Average Daily Traffic (ADT) volumes for the segment of SR 87 between McKellips Road and McDowell Road at 17,700 vehicles per day (ADOT 2002). The Level of Service (LOS) was listed as LOS B in 1996; however, no recent LOS data are available.

SR 101 is also known as the Pima Freeway and is a north-south freeway. SR 101 has a bridged crossing of the Salt River on the west end of the study area. The Pima Freeway is a six- to eight-lane freeway, with the majority of it being six lanes. Near the Va Shly'ay Akimel study area, SR 101 has on/off ramps at 8th Street in Mesa and at McKellips Road, McDowell Road, Indian School Road, and Chaparral Road along the west boundary of the Salt River Pima-Maricopa Indian Community (SRPMIC). ADOT lists the ADT volume for the segment of SR 101 between McKellips Road and McDowell Road at 134,000 vehicles per day (ADOT 2002). SR 202 is also known as the Red Mountain Freeway and is an east-west freeway that generally parallels the south side of the Salt River in the study area. SR 202 is presently under construction. As of July 2000 it was open from SR 101 to Gilbert Road. In January 2003, the 4.5-mile stretch opened from Gilbert Road to Higley Road. As it continues eastward, the SR 202 alignment diverges from the Salt River, and is thereby outside the Va Shly'ay Akimel project area. East of Power Road, SR 202 turns south to intersect US 60 and continue as the Santan Freeway. The Red Mountain Freeway is a six-lane freeway, with on/off ramps at Dobson Road, Alma School Road, McKellips Road, Country Club Drive, Gilbert Road, McDowell Road, Thomas Road, Val Vista Drive, Greenfield Road, and Higley Road. ADOT lists the ADT volume for the segment of SR 202 between Dobson Road and McKellips Road at 94,000 vehicles per day (ADOT 2002).

Level of Service (LOS) Concept

The roadway system's ability to accommodate traffic demand is typically controlled and limited by the capacity of the intersections. Intersection capacity analysis is, therefore, a principal tool used in traffic engineering to determine the adequacy of a system to meet traffic demands.

Beginning in 1965, LOS concept has been used in traffic engineering to describe the quality of traffic flow and the degree of congestion a driver can expect. The concept defines the near-capacity condition as LOS "E," while a free-flow condition under which a driver would experience very little or no delay is defined as LOS "A." Capacity analysis is the procedure used to compare the forecast traffic volume with the theoretical carrying capacity of an intersection. The results of the capacity analysis provide an estimator of the quality of flow for that intersection.

Based on peak-hour turning movement counts, the LOS at each signalized intersection is calculated using methodologies as presented in Chapter 16 of the *Highway Capacity Manual 2000*, published by the Transportation Research Board. The capacity analysis methodologies for unsignalized intersections are outlined in Chapter 17 of the same document. For signalized intersections, LOS is based on control delay per vehicle, measured in seconds. Table 4.9-1 outlines the LOS concept for signalized intersections:

Table 4.9-1. Roadway Segment Level of Service

Level of Service	Control Delay per Vehicle (sec/vehicle)
A	≤ 10.0
B	> 10.0 and ≤ 20.0
C	> 20.0 and ≤ 35.0
D	> 35.0 and ≤ 55.0
E	> 55.0 and ≤ 80.0
F	> 80.0

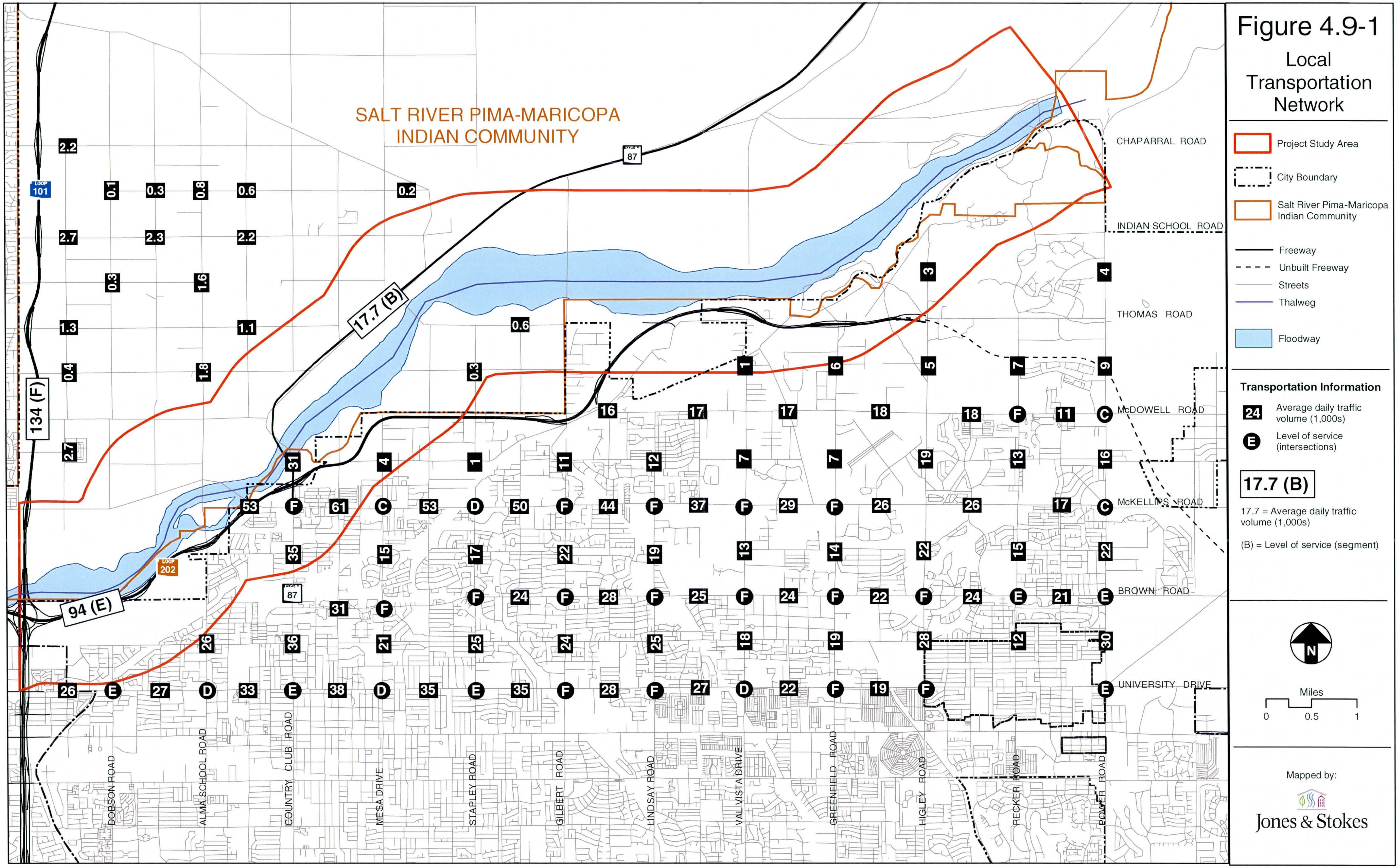


Figure 4.9-1
Local Transportation Network
Project Study Area
City Boundary
Salt River Pima-Maricopa Indian Community
Freeway
Unbuilt Freeway
Streets
Thalweg
Floodway
Transportation Information
Average daily traffic volume (1,000s)
Level of service (intersections)
17.7 (B)
17.7 = Average daily traffic volume (1,000s)
(B) = Level of service (segment)
Miles
0
0.5
1
N
Mapped by:
Jones & Stokes
SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY
CHAPARRAL ROAD
INDIAN SCHOOL ROAD
THOMAS ROAD
McDOWELL ROAD
McKELLIPS ROAD
BROWN ROAD
UNIVERSITY DRIVE
DOBSON ROAD
ALMA SCHOOL ROAD
COUNTRY CLUB ROAD
MESA DRIVE
STAPLEY ROAD
GILBERT ROAD
LINDSAY ROAD
VAL VISTA DRIVE
GREENFIELD ROAD
HIGLEY ROAD
RECKER ROAD
POWER ROAD
134 (F)
94 (E)
17.7 (B)
101
202
87

Three key segments of highway had LOS statistics for 1996, but no more recent LOS data were available. The segment of SR 87 between McKellips Road and McDowell Road was listed as LOS B in 1996. The segment of SR 101 between McKellips Road and McDowell Road was listed as LOS C in 1996. The segment of SR 202 between Dobson Road and McKellips Road was listed as LOS A in 1996; SR 202 currently extends to Higley Road.

4.9.2.3 Local Roadway Network

The study area is elongated east-west and generally follows the Salt River floodplain (Figure 4.9-1). Several local roadways parallel the river, while others cross the river in a north-south direction. Nearly all local streets and arterials near the Salt River form a north-south, east-west grid roadway network. Typically, arterial roadways in Maricopa County have an ultimate section of six lanes with a left-turn lane or a raised median. Where it is required and possible, the City of Mesa will widen arterial sections to include three through lanes in each direction with dual left-turn lanes and one right-turn lane at intersections (Foy pers. comm.).

Tables 4.9-2 and 4.9-3 list major arterial roadways in the project area and their available present ADT volumes for the City of Mesa and the SRPMIC, and future estimated volumes for City of Mesa roadways.

Table 4.9-2. City of Mesa ADT Volumes

Location	2001 ADT (1,000s)	2025 ADT (1,000s)
University Drive, west of Dobson Road	26	29
University Drive, west of Alma School Road	27	31
University Drive, west of Country Club Drive	33	34
University Drive, west of Mesa Drive	38	39
University Drive, west of Stapley Drive	35	35
University Drive, west of Gilbert Road	35	35
University Drive, west of Lindsay Road	28	29
University Drive, west of Val Vista Drive	27	27
University Drive, west of Greenfield Road	22	23
University Drive, west of Higley Road	19	21
University Drive, west of Recker Road	NA	20
University Drive, west of Power Road	NA	19
Brown Road, west of Mesa Drive	31	33
Brown Road, west of Gilbert Road	24	30

Location	2001 ADT (1,000s)	2025 ADT (1,000s)
Brown Road, west of Lindsay Road	28	29
Brown Road, west of Val Vista Drive	25	26
Brown Road, west of Greenfield Road	24	26
Brown Road, west of Higley Road	22	26
Brown Road, west of Recker Road	24	26
Brown Road, west of Power Road	21	28
McKellips Road, west of Country Club Drive	53	NA
McKellips Road, west of Mesa Drive	61	52
McKellips Road, west of Stapely Drive	53	51
McKellips Road, west of Gilbert Road	50	51
McKellips Road, west of Lindsay Road	44	46
McKellips Road, west of Val Vista Drive	37	40
McKellips Road, west of Greenfield Road	29	34
McKellips Road, west of Higley Road	26	31
McKellips Road, west of Recker Road	26	29
McKellips Road, west of Power Road	17	29
McDowell Road, west of Lindsay Road	16	22
McDowell Road, west of Val Vista Drive	17	22
McDowell Road, west of Greenfield Road	17	22
McDowell Road, west of Higley Road	18	22
McDowell Road, west of Recker Road	18	20
McDowell Road, west of Power Road	11	18
Dobson Road, north of University Drive	13	18
Alma School Road, north of University Drive	26	33
Country Club Drive, north of University Drive	36	40
Country Club Drive, north of Brown Road	35	39
Country Club Drive, north of McKellips Road	31	NA
Mesa Drive, north of University Drive	21	25
Mesa Drive, north of Brown Road	15	20
Mesa Drive, north of McKellips Road	4	15
Stapely Drive, north of University Drive	25	25
Stapely Drive, north of Brown Road	17	18

Location	2001 ADT (1,000s)	2025 ADT (1,000s)
Stapely Drive, north of McKellips Road	1	NA
Stapely Drive, north of McDowell Road	0.3	NA
Gilbert Road, north of University Drive	24	26
Gilbert Road, north of Brown Road	22	22
Gilbert Road, north of McKellips Road	11	18
Lindsay Road, north of University Drive	25	26
Lindsay Road, north of Brown Road	19	19
Lindsay Road, north of McKellips Road	12	13
Val Vista Drive, north of University Drive	18	22
Val Vista Drive, north of Brown Road	13	20
Val Vista Drive, north of McKellips Road	7	18
Val Vista Drive, north of McDowell Road	1	12
Greenfield Road, north of University Drive	19	22
Greenfield Road, north of Brown Road	14	16
Greenfield Road, north of McKellips Road	7	12
Greenfield Road, north of McDowell Road	6	10
Higley Road, north of University Drive	28	38
Higley Road, north of Brown Road	22	34
Higley Road, north of McKellips Road	19	30
Higley Road, north of McDowell Road	5	22
Recker Road, north of University Drive	12	16
Recker Road, north of Brown Road	15	18
Recker Road, north of McKellips Road	13	19
Recker Road, north of McDowell Road	7	19
Recker Road, north of Thomas Road	3	NA
Power Road, north of University Drive	30	40
Power Road, north of Brown Road	22	32
Power Road, north of McKellips Road	16	25
Power Road, north of McDowell Road	9	18
Power Road, north of Thomas Road	4	NA

Source: City of Mesa 2002

Table 4.9-3. Salt River Pima-Maricopa Indian Community ADT Volumes

Location	2001 ADT (1,000s)
Chaparral Road, east of 92nd Street	2.2
Camelback Road, east of Dobson Road	0.3
Camelback Road, east of Alma School Road	0.6
Camelback Road, east of Mesa Drive	0.2
Indian School Road, east of 92nd Street	2.7
Indian School Road, east of Alma School Road	2.3
Indian School Road, east of Extension Road	2.2
Thomas Road, east of 92nd Street	1.3
Thomas Road, east of Extension Road	1.1
Thomas Road, east of Stapely Drive	0.6
92nd Street, north of McKellips Road	2.7
92nd Street, north of McDowell Road	0.4
92nd Street, north of Thomas Road	0.3
92nd Street, north of Camelback Road	0.1
Alma School Road, north of McDowell Road	1.8
Alma School Road, north of Thomas Road	1.6
Alma School Road, north of Camelback Road	0.8

Source: Salt River Pima-Maricopa Indian Community 2001

The following table (Table 4.9-4) lists available intersection LOS for arterial roadways in Mesa.

Table 4.9-4. Mesa Arterial Intersection LOS

Location	2001 Intersection Peak Hour LOS	
	AM	PM
University Drive/Dobson Road	E	E
University Drive/Alma School Road	C	D
University Drive/Country Club Drive	E	E
University Drive/Mesa Drive	D	D

Location	2001 Intersection Peak Hour LOS	
	AM	PM
University Drive/Stapley Drive	E	E
University Drive/Gilbert Road	F	F
University Drive/Lindsay Road	F	F
University Drive/Val Vista Drive	B	D
University Drive/Greenfield Road	D	F
University Drive/ Higley Road	F	F
University Drive/ Power Road	E	E
Brown Road/ Mesa Drive	F	F
Brown Road/Stapley Drive	F	F
Brown Road/ Gilbert Road	F	F
Brown Road/ Lindsay Road	F	F
Brown Road/ Val Vista Drive	F	F
Brown Road/ Greenfield Road	F	F
Brown Road/ Higley Road	F	F
Brown Road/ Recker Road	D	E
Brown Road/ Power Road	E	E
McKellips Road/ Country Club Drive	C	F
McKellips Road/ Mesa Drive	C	C
McKellips Road/ Stapely Drive	D	D
McKellips Road/ Gilbert Road	F	F
McKellips Road/ Lindsay Road	F	F
McKellips Road/ Val Vista Drive	F	F
McKellips Road/ Greenfield Road	E	F
McKellips Road/ Power Road	F	C
McDowell Road/ Recker Road	C	F
McDowell Road/ Power Road	B	C

Source: City of Mesa 2002

The SRPMIC 2001 Transportation Plan does not list current roadway or intersection LOS. The report lists roadway segments that are anticipated to be failing by the year 2020. The LOS analysis for roadway segments is based on a traffic volume-to-capacity ratio, with the LOS E ratio being 0.91 to 1.00 and the LOS F ratio being greater than 1.01. The year 2020 failing arterial roadway segments identified in the SRPMIC Transportation Study include:

- Alma School Road from McKellips Road to Indian School Road,
- Mesa Drive from SR 87 to Indian School,
- Gilbert Road from SR 87 to Shea Boulevard,
- McKellips Road from SR 101 to SR 87,
- McDowell Road from SR 101 to SR 87,
- Thomas Road from Dobson Road to SR 87,
- Indian School Road from Dobson to Mesa Drive, and
- SR 87 from Center Street to Gilbert Road.

Four local roadways cross the Salt River in the study area; one crosses the river at grade, while the others have bridges spanning the floodplain. These roadways are:

- Alma School Road (bridge),
- Country Club Drive/SR 87 (bridge),
- Gilbert Road (bridge), and
- McKellips Road (at grade).

4.9.2.4 Railroads

No railroad lines cross the Salt River within the study area.

4.9.2.5 Airports

Two airports operate near the study area. These include Phoenix Sky Harbor International Airport and Mesa Falcon Field Municipal Airport. Phoenix Sky Harbor International Airport is 6 miles to the west of the study area. This airport handles both commercial and Air National Guard aircraft. Mesa Falcon Field Municipal Airport is located on the southeast corner of McDowell Road and Greenfield Road in Mesa, approximately ½ mile south of the southern boundary of the project study area.

4.9.3 REGULATORY SETTING

The Va Shly'ay Akimel project could potentially affect local roadway conditions, access, and through traffic flow. It may be necessary to obtain encroachment permits or similar legal agreements from the respective public agencies responsible for the numerous roadways through the study area. Such permits would be needed for any location where an activity would occur physically within the right-of-way of a public road. The regulatory setting of the transportation network in the area is guided by numerous governmental and political jurisdictions, which would be responsible for issuing such permits. Throughout the study area, these agencies include the

City of Mesa, SRPMIC, Maricopa County Department of Transportation, ADOT, and the Federal Aviation Administration.

4.10 LAND USE

4.10.1 INTRODUCTION

This section describes the existing land uses and recreational opportunities in the vicinity of the Va Shly'ay Akimel study area. A discussion of the various planning organizations with jurisdiction in the area is provided, along with information on the regulatory setting for future development projects in the area.

4.10.2 LAND USES IN THE PROJECT STUDY AREA

The proposed Va Shly'ay Akimel project activities will occur primarily within the Salt River floodplain. The general area is characterized by relatively flat topography, and there are a variety of land uses throughout the study area.

The land use pattern is made up of a patchwork of jurisdictional and political boundaries between the City of Mesa (the City), unincorporated areas of Maricopa County (the County), and the Salt River Pima-Maricopa Indian Community (SRPMIC). Remnant County islands are located in two locations within the study area and are completely surrounded by the City and the SRPMIC. These lands are within the City's sphere of influence and would likely be annexed by the City as growth and development reaches the area.

Several gravel mining operations are located along the Salt River, with processing operations occurring along its banks. The river contains a large groundwater recharge basin in the central portion of the study area, just east of North Gilbert Road.

The land area north of the Salt River is generally within the SRPMIC reservation. Upland areas south of the river are generally within the City's jurisdiction, but islands of unincorporated areas of the County are also present. A clear contrast is evident between the rural and open character of the upland areas north of the river, within the SRPMIC reservation, and the more urbanized area south of the river, within the City's sphere of influence.

Created by Executive Order in 1879, the SRPMIC consists of 52,600 acres, located 15 miles northeast of the City of Phoenix. The SRPMIC is home to nearly 6,000 enrolled members representing two pre-American Sovereign Indian tribes, the Pima and Maricopa. The SRPMIC maintains 19,000 of its acres as natural preserve. The secondary land use is agriculture, which supports a variety of crops, including cotton, melons, potatoes, brown onions, and carrots (Salt River Pima-Maricopa Indian Community 2002). The majority of the central and eastern portions of the study area that are located directly north of the Salt River is a combination of natural preserve areas and agricultural lands. Gravel mining and processing, two closed landfills, and other industrial operations have a significant influence on land use patterns in the western portion of the study area that is located along the north banks of the river. Other land uses are scattered intermittently throughout the area along the north banks of the river, including a shooting range, a recreational vehicle park, private farms, and a commercial golf course.

The west and central portions of the study area south of the river and within the City's sphere of influence are largely made up of very low-density rural residential uses to higher-density suburban residential uses. Industrial and commercial development, with some agricultural uses, has a strong influence on land use patterns in the eastern portion of the study area. The south banks of the river are also scattered with gravel mining and processing operations.

4.10.3 REGULATORY SETTING

Although the proposed project is being undertaken by the U.S. Army Corps of Engineers (Corps), the State, County, City, and SRPMIC have jurisdiction over planning and development decisions within their respective political boundaries in the study area. Regulatory requirements and future growth policies for these organizations are identified within several different planning documents. The regulatory setting for each of these organizations is presented below.

4.10.3.1 State of Arizona

In recent years, the State of Arizona adopted growth management legislation, known as "Growing Smarter" and "Growing Smarter Plus," in response to concerns about the rates of population growth in communities throughout the state. This legislation requires all cities in Arizona to update their General Plans. These laws were enacted to improve the way cities plan for future growth, expansion, and redevelopment by

- reforming local planning and zoning procedures,
- increasing citizen participation in growth and planning issues, and
- adjusting State Land Trust policies to preserve open space and enhance conservation.

City and county plans are required to include new elements and/or modify existing elements. Additionally, each municipality must coordinate their plan with other plans in the region. The Growing Smarter Act mandates five new elements to be added to municipal plans:

16. Open Space
17. Growth Areas
18. Environmental Planning
19. Cost of Development
20. Water Resources

The Act provides for increasing public participation, as well as modifying existing procedures regarding adoption, re-adoption, and amendments to the General Plan. Written procedures must be in place to provide for:

- Public participation,
- Public hearings, and
- Consultation with school districts, public utilities, associations of governments, and public land management agencies.

The State Land Department is also required to prepare a conceptual land use plan, with an annual 5-year disposition or development plan for all trust lands located in urban areas, and it must identify lands projected for sale, lease, reclassification, or rezoning over each period.

The 2000 legislation requires that voters ratify new community plans at least once every 10 years. If a proposed new plan fails to receive a sufficient number of votes, the existing plan remains in effect. Minor amendments to an existing plan must be approved by the City Council.

During the 2002 legislative session, HB 2601 was introduced to address issues with the Growing Smarter legislation that were identified by stakeholders statewide through the efforts of the Growing Smarter Oversight Council. The bill was signed by Governor Jane Hull on May 6, 2002. The amendments included:

- An extension of the deadline for the adoption of updated General or Comprehensive Plans. Given their population size categories, Mesa, as a municipality over 75,000 persons and Maricopa, as a county over 125,000 persons were allowed one additional year to 12/31/02.
- Clarification of language regarding the water resources element. A new requirement was added that included an analysis of how the demand from future projected growth will be served by the legally and physically available supplies or a plan to obtain additional necessary supplies. Also, ADWR is now included in the review and comment process on all water resources elements.
- Revises the requirements for the 60-day review period. The time frame for the review and comment period by affected entities is now at least 60 days prior to the notice of hearing by the planning commission.

4.10.3.2 Maricopa County

Portions of the study area are within unincorporated areas of the County and are governed by County planning and development activities.

4.10.3.2.1 Maricopa County Comprehensive Plan

As required by state law, Maricopa County prepared a comprehensive plan "to conserve the natural resources of the County, to ensure efficient expenditure of public funds, and to promote the health, safety, convenience, and general welfare of the public" (Maricopa County 1997). The plan provides a guide for decisions made by the planning and zoning commission and the board of supervisors concerning growth and development. In response to Growing Smarter/Growing Smarter Plus, Maricopa County achieved certification of portions of its 1997 plan as compliant with the legislation. Complete compliance with Growing Smarter/Growing Smarter Plus required the addition of some elements, accomplished in 2002. One of the new elements, "Environmental Effects," contains some goals, objectives, and policies pertinent to the project

The County lands within the study area are designated as a "General Plan Development Area" on the County's land use map. These areas are defined as unincorporated areas that are likely to be annexed by a city or town in the future and are included in an adopted municipal general plan. As is the case within the study area, these areas often include many of the unincorporated lands that are either surrounded by a jurisdiction or surrounded by a strip annexation. The County will take into consideration the general plans of municipalities within these areas to guide decision making under the following circumstances: 1) the municipal plan has been updated in the previous five years; and 2) the municipality can demonstrate that residents, property owners, and improvement districts from the unincorporated areas in the specific planning area have been involved in the planning process (Maricopa County 1997). The City of Mesa General Plan meets these criteria and is discussed later in this chapter.

The Salt River itself is identified as "Proposed Open Space" on the land use map. This designation recognizes that natural resources and open spaces are important to the quality of life in the county and, if acquired, are intended to be planned and managed to protect, maintain, and enhance their intrinsic value for recreational, aesthetic, and biological purposes. Additionally, the General Plan provides that public access should be protected and preservation shall be encouraged. When combined with Dedicated Open Space lands, the Proposed Open Spaces are intended to establish an interconnected system of protected natural open spaces, corresponding to regionally significant mountains, rivers, washes, upland desert, and cultural resources in unincorporated areas of the County (Maricopa County 1997).

The County's size and environmental diversity is greater than many states, and it provides a complex natural ecosystem. As part of the overriding vision for the County, protection of the unique desert environments is identified among the top priorities. The Maricopa County Comprehensive Plan focuses on maintaining and improving the physical environment, natural resource conservation, and other environmental considerations. Additionally, the plan recognizes the importance of creating, improving, and conserving natural habitat and open space to increase biological diversity. River and wash policies include discouraging development within 100-year floodplains, maximizing wildlife habitat and native vegetation along waterways, and developing management principles to protect the natural riparian habitat of the region (Maricopa County 1997).

The Maricopa County Comprehensive Plan is arranged in a series of elements, each containing a series of goals, objectives, and policies used to define development standards and to guide public investment and public and private decision-making (Maricopa County 1997). Listed below are several goals and policies in the Maricopa County Comprehensive Plan (both 1997 and 2002 additions) that are relevant to the proposed project.

Land Use Element (Maricopa County 1997)

Goal: Promote efficient land development that is compatible with adjacent land uses, is well integrated with the transportation system, and is sensitive to the natural environment.

Objective L10: Promote the balance of conservation and development.

Policy L10.1: Encourage the preservation of environmentally sensitive areas through the transfer of development rights, density transfers, or other suitable techniques.

Objective L11: Promote an interconnected open space system.

Policy L11.1: Determine, encourage, and support techniques for acquisition and maintenance for open space.

Policy L11.3: Encourage the protection of ridgelines, foothills, significant mountainous areas, wildlife habitat, native vegetation, and riparian areas.

Transportation Element (Maricopa County 1997)

Goal: Promote an efficient, cost-effective, integrated, accessible, environmentally sensitive, and safe countywide multi-modal system that addresses existing and future roadway networks and promotes transit, bikeways, and pedestrian travel.

Environmental Element (Maricopa County 1997)

Goal 1: Promote development that considers adverse environmental impacts on the natural and cultural environment, preserves highly valued open space, and remediates areas contaminated with hazardous materials.

Objective E4: Encourage the protection of habitat.

Policy E4.4: Explore incentives to preserve habitat.

Policy E4.5: Explore methods to acquire lands classified as priority habitat areas as part of an open space plan.

Objective E5: Promote the protection and preservation of riparian areas.

Policy E5.1: Encourage site evaluation and classification of riparian areas as required by the Corps 404 permit program or by other state or federal laws, regulations, and/or guidelines.

Policy E5.2: Consider incentives and options for preservation.

Environmental Effects Element (Maricopa County 2002)

Goal 1: Encourage development that considers environmental impacts on air quality, water quality, and sensitive plant and wildlife species, as well as the impacts that noise exposure has on health and quality of life.

Goal 3: Encourage development that minimizes environmental hazards.

Objective E2: To help improve water quality, encourage development that minimizes land disturbance to reduce soil erosion and sedimentation in rivers, streams, and washes.

Policy E2.1: Encourage development that minimizes blading, cutting, and filling.

Policy E2.2: Encourage development that minimizes disturbance of the natural desert environment and utilizes native soils, plants, and existing topography.

Objective E4: Encourage protection and preservation of sensitive plant and wildlife habitat and riparian areas within the framework of state and federal laws, regulations, and guidelines.

Policy E4.1: Encourage protection of plants identified by the Arizona Native Plant Law.

Policy E4.2: Encourage protection of all endangered and threatened plants and wildlife designated on the Endangered Species List for Maricopa County.

Policy E4.3: Encourage the development of corridors linking established and proposed open space areas to allow migration of wildlife and encourage biodiversity of species.

Objective E7: Encourage development that protects air quality, water quality, and water resources; that minimizes soil and waterway disturbance; that mitigates noise problems; and that preserves historic resources.

Policy E7.1: Promote development that minimizes grading and blading of the landscape.

Policy E7.2: Promote development that emphasizes protection of waterways.

4.10.3.3 City of Mesa

The City of Mesa General Plan was adopted by City Council on June 24, 2002 and passed by the voters in the City election of November 5, 2002. It provides a vision and guide to the community's citizens, businesses, and officials as the community grows and develops in the future (City of Mesa 2002). The General Plan defines seven subareas that have particular features or land use issues for consideration in the land use plan. Some portions of the city, including some of the areas within the study area, are not within a defined subarea. Those subareas that overlap the study area include, from west to east, Mesa Grande, Lehi, and Falcon Field.

The vision of the Mesa 2025 General Plan is to provide for a prosperous and economically balanced community, to address the need for future housing and employment opportunities, and to support Mesa as a sustainable community in the 21st century. While 2025 is a reference year used for some purposes in the General Plan, the General Plan's Land Use Plan map presents "buildout" land use rather than the prospective land use in a particular future year.

Each element includes Goals, Objectives, and Policies. Several goals and policies in the Mesa General Plan that may be relevant to the proposed project are listed below under the title for the General Plan Element in which they appear. The pertinent elements are Parks, Recreation, and Open Space and Environmental Planning and Conservation.

Environmental Planning and Conservation Element

This element addresses the quality of the environment and the conservation of natural resources. It also addresses the protection of Mesa's historic sites and structures. It combines the provisions of the Environmental Planning Element and the Conservation Element as required by the Arizona Growing Smarter Statute.

The following goals, objectives, and policies of the Environmental Conservation Element are relevant to the proposed project:

Goal EPC-3: Provide for the protection and wise use of the resources of the natural environment in Mesa.

Objective EPC-3.1: Maintain connections between wildlife habitats by identifying and protecting corridors for unimpeded movement.

Policy EPC-3.1a: Establish sufficient trails, wildlife corridors, and other linear linkages between large open space areas.

Policy EPC-3.1b: Require an effective means for the safe and uninterrupted movement of wildlife through open space corridors at all infrastructure and roadway crossings.

Policy EPC-3.1c: Encourage the design of walls and fences to not disrupt natural wildlife movement patterns and design all infrastructure and roadways to minimize the impact on wildlife corridors.

Policy EPC-3.1e: Design public recreational spaces to be wildlife-friendly whenever possible.

Policy EPC-3.1f: Promote enhanced landscaping along washes and wildlife corridors to promote the use of such areas by native wildlife.

Policy EPC-3.1g: Encourage the establishment of open space lands that restrict and/or limit human use to protect significant plant and animal habitats.

Policy EPC-3.1h: Encourage the preservation of a system of linkages, connections, and gateways between significant open spaces and significant animal and plant habitats.

Objective EPC-3.2: Promote the protection, enhancement, and establishment of native vegetation and plant species.

Policy EPC-3.2c: Promote the restoration and re-vegetation of disturbed areas with native plant species so that the disturbed area, over a reasonable amount of time, matches the plant densities of the undisturbed setting.

Policy EPC-3.2d: Recognize and protect areas of significant natural vegetation (such as areas along washes, natural spring areas, or on slopes) that are advantageous to the increased densities of the native vegetation.

Objective EPC-3.3: Ensure that new development recognizes limitations associated with the natural features of the land, including slope, unstable soils, and floodplains.

Policy EPC-3.3k: Restrict development in floodplains and floodways according to FEMA designations.

Parks, Recreation, and Open Space Element

The City of Mesa is committed to providing meaningful parks and open spaces through a variety of recreational venues, both passive and active, for all residents to enjoy. This element describes the goals, objectives, and policies that will meet these needs. Specific details are contained in the Parks and Recreation Master Plan.

The following goals, objectives, and policies of the Recreation Element are relevant to the project:

Goal PR-1: Create a balanced, accessible, and integrated system of open spaces and recreational opportunities to serve the current and future residents and visitors of the City of Mesa.

Objective PR-1.1: Provide a meaningful network of natural and developed open space areas.

Policy PR-1.1a: Identify lands for potential acquisition to preserve Open Space for recreational, aesthetic and preservation uses.

Policy PR-1.1c: Strive to acquire open space acreage as defined in Table 9.1 and further described in the Parks and Recreation Master Plan.

Objective PR-1.2: Manage and preserve open space to optimize its use and protection.

Policy PR-1.2b: Continue to create a plan for securing use licensing and maintaining a dedicated trail system with SRP assistance.

Policy PR-1.2e: Encourage the preservation of significant natural areas such as the Salt River corridor to enhance their recreation attraction and aesthetic value.

Policy PR-1.2f: Limit development in the areas that may pose natural or manmade environmental hazards such as steep slopes and flood plains.

Policy PR-1.4a: Encourage the development of innovative specialty parks to provide new recreation opportunities. An example of this includes linear pedestrian/bicycle/open space systems in the floodways and utility corridors throughout the City.

Objective PR-1.5: Promote an interconnected open space network that responds to local and regional needs.

Objective PR-1.6: Coordinate open space plans, related improvements and implementation strategies with neighboring jurisdictions, stakeholders and user groups.

Policy PR-1.6a: Coordinate the provision of river trail linkages with Maricopa County, the Flood Control District of Maricopa County, the Town of Gilbert, and the Cities of Chandler, Tempe and Scottsdale.

Policy PR-1.6b: Work with Maricopa County and other appropriate agencies and stakeholders to identify and preserve or protect environmentally sensitive areas and open space sites within new annexation areas of the City.

Objective PR-2.4: Strive to establish pedestrian connections between open space and parks.

Policy PR-2.4a: Through the Parks and Recreation Master Plan, integrate drainage and utility easements into the circulation plan.

Objective PR-2.6: Require that useable open space and recreational facilities be an integral part of all residential planned area developments.

Policy PR-2.6a: Encourage park designs that promote integration with surrounding demographics and land uses, provide pedestrian connections to adjacent neighborhoods, and contribute to the neighborhood's character and identity.

4.10.3.4 Salt River Pima-Maricopa Indian Community

The SRPMIC is considered a sovereign nation and is not under the regulatory or political jurisdiction of any of the local governments in the area or the U.S. federal government. All land use activities are guided by the SRPMIC's established procedures and activities. The SRPMIC adopted a general development plan in December 1988. The land uses in the project area include agriculture, commercial, industrial, natural resources, open space, public use, and residential. The SRPMIC does not have specific land use regulatory mechanisms, but has generally zoned portions of the SRPMIC along the Salt River as natural resources, agriculture, open space, and industrial use areas.

4.11 RECREATION

4.11.1 INTRODUCTION

This section presents the existing recreational opportunities in the vicinity of the Va Shly'ay Akimel study area. A discussion of the planning organizations with jurisdiction in the area is provided along with information on the regulatory environment guiding recreational facilities in the area.

The project study area (Figure 4.11-1) is located within the boundaries of the following local government jurisdictions: Maricopa County, the City of Mesa, and the Salt River Pima-Maricopa Indian Community (SRPMIC). Remnant County islands, which are completely surrounded by the City of Mesa and the SRPMIC, are located in two locations within the study area. These lands are within the City of Mesa's sphere of influence and would likely be annexed by the City as growth and development reaches the area.

There are few regional recreational facilities in the vicinity of the project study area. Papago Park is located just north of the Salt River in eastern Phoenix and western Tempe. It includes about 1,400 acres bounded on the north by Oak Street, on the south by State Highway 202, on the west by 52nd Street and on the east by 68th Street. The park includes: rock formations dating back 15 million years, ramadas, picnic facilities, three fish ponds stocked with rainbow trout and channel catfish, a baseball stadium, a softball complex, volleyball courts, a zoo, botanical gardens, a state historical museum, two golf courses, an archery shooting range, nature trails, and restrooms.

Maricopa County provides a countywide system of trails; the primary component of which is the Sun Circle Trail. The Sun Circle Trail, when completed, will encircle the Phoenix metropolitan area (Maricopa County 1982). The Sun Circle Trail will provide opportunities for hiking, horseback riding, and bicycling.

North and east of the study area are the McDowell, Goldfield, and Usery Mountains. Some of the recreational uses in these areas include fishing, camping, hiking, biking, and horseback riding.

4.11.2 EXISTING RECREATION ENVIRONMENT

4.11.2.1 Maricopa County

The area within and surrounding SRPMIC lands and the City of Mesa, does not currently have any significant dedicated riparian habitat areas with supporting recreation facilities. Dedicated open space exists in the form of regional parks, wilderness areas, wildlife areas, and passive open space that provide recreation and visual resources for the residents of the area (Maricopa County 1997). Primary recreation areas in Maricopa County include the following:

National Trails Systems

- North Mountain Trail: consisting of 9 miles of trails located in northwest Phoenix.
- South Mountain Trail: consists of 14 miles of desert trails in the center of South Mountain Park, providing for hiking and horseback riding.
- Sun Circle Trail: 110 miles of urban to open desert trails forming a loop around the Phoenix metropolitan area for hiking and bicycling.
- Squaw Peak Trail: includes 1.2 miles of urban wilderness area.

State Parks

- Painted Rocks State Park: 140-acre historical park located 15 miles west of Gila Bend.
- Lost Dutchman State Park: 300 acres of desert park on the Apache Trail located near the Maricopa/Pinal County border that includes picnic facilities, restrooms, and 35 campsites.

BLM Lands

- Greenbelt Resource Conservation Area located south of Buckeye: includes hunting and hiking.

State Game and Fish Department

- Black Canyon Shooting Range: includes 1,290 acres located 20 miles north of Phoenix.
- Base and Meridian: 173 acres of wildlife habitat located 3 miles south of Cashion.
- Gila River Wildlife Area: 6,896 acres of wildlife habitat extending from Avondale to the Gillespie Dam.

Major Water Bodies

- Apache Lake Marina: located 35 miles east of Phoenix in Maricopa and Gila County.
- Bartlett Lake: Maricopa County (35 miles northeast of Phoenix).
- Canyon Lake: Maricopa County (30 miles east of Phoenix).
- Lake Pleasant: Maricopa and Yavapai County (25 miles north of Phoenix).
- Saguaro Lake: Maricopa County (25 miles east of Phoenix).

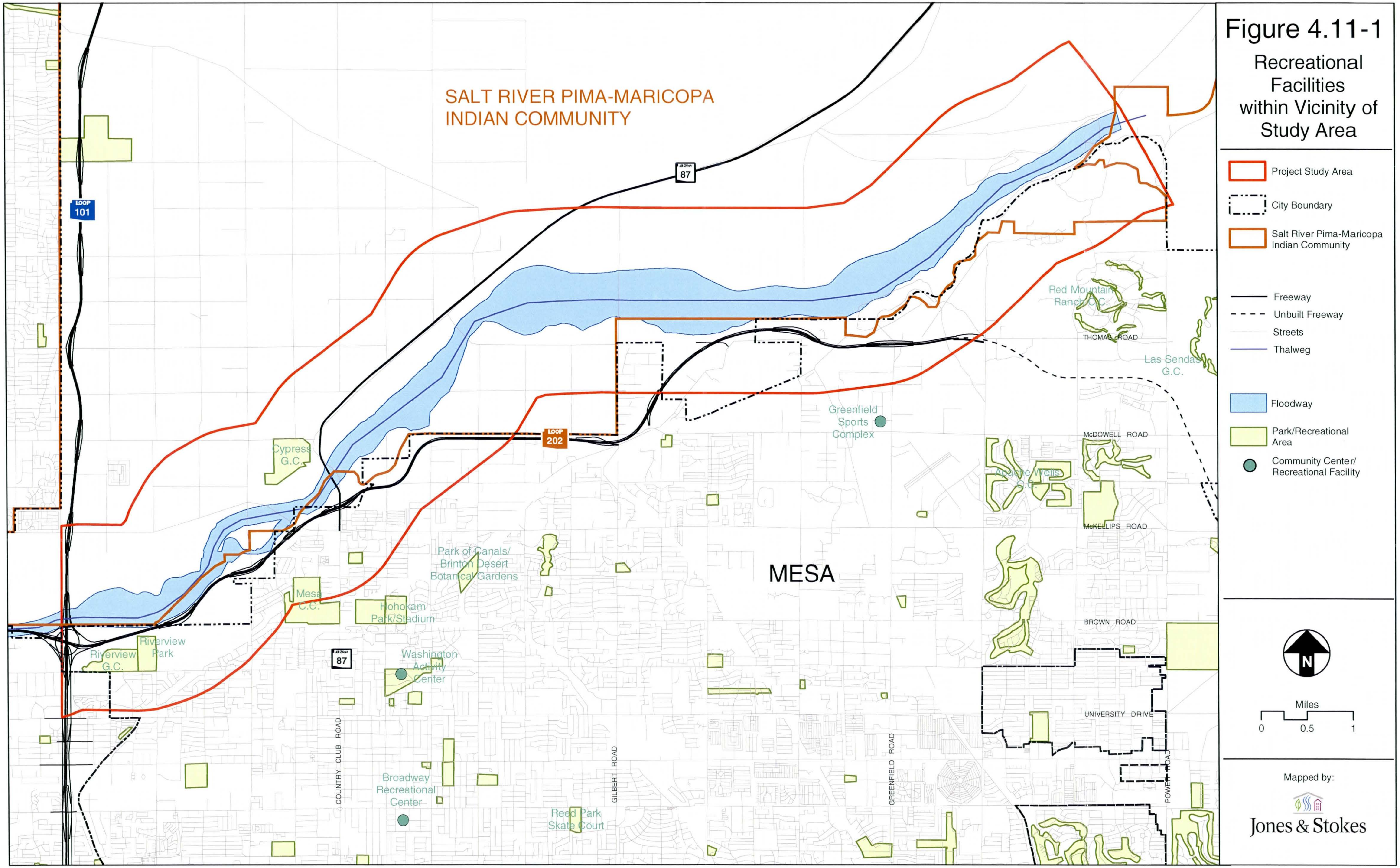


Figure 4.11-1
Recreational Facilities within Vicinity of Study Area
Project Study Area
City Boundary
Salt River Pima-Maricopa Indian Community
Freeway
Unbuilt Freeway
Streets
Thalweg
Floodway
Park/Recreational Area
Community Center/ Recreational Facility
Miles
0
0.5
1
N
Mapped by:
Jones & Stokes
SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY
MESA
LOOP 101
LOOP 202
87
Red Mountain Ranch G.C.
THOMAS ROAD
Las Sendas G.C.
Greenfield Sports Complex
McDOWELL ROAD
Apache Wells G.C.
McKELLIPS ROAD
BROWN ROAD
UNIVERSITY DRIVE
POWER ROAD
Cypress G.C.
Park of Canals/ Brinton Desert Botanical Gardens
Mesa C.C.
Hohokam Park/Stadium
Riverview Park
Riverview G.C.
Washington Activity Center
Broadway Recreational Center
Reed Park Skate Court
COUNTRY CLUB ROAD
GILBERT ROAD
GREENFIELD ROAD

Maricopa County

- Estrella Regional Park: 18,000 acres located 3 miles south of Goodyear.
- Thunderbird Park/Adobe Dam
- Cave Buttes Recreation Area

4.11.2.2 City of Mesa

Within the City of Mesa there are approximately 55 traditional park sites. Mesa Parks are classified into four groups based on size, service area, typical recreation facilities provided, and public emphasis. The four groups are neighborhood parks, community parks, district parks, and specialized facilities/areas. In addition to parks, the City also has seven recreation centers and sports complexes (Broadway Recreation Center, Gene Autry Sports Complex, Hohokam Stadium, Jefferson Gym/Recreation Center, Red Mountain Multigenerational Center, Reed Park Skate Court, Washington Activity Center. Recreational facilities within the City also include 13 public swimming pools, as well as special facilities (such as museums and stadiums). The closest recreational facilities to the Va Shly'ay Akimel study area is the Riverview Golf Course and Riverview Park; both located near the west end of the study area in the City of Mesa. Riverview Golf Course is located at 2202 W. 8th Street and is a regulation nine-hole course. Riverview Park is located at 2100 W. 8th Street and comprises soccer fields, four lighted softball fields, playground, restrooms, two lighted basketball courts, hard-surface volleyball court, and a lake within a 51-acre area (City of Mesa 2001).

In the project study area, the existing streambed consists primarily of a dry wash with no recreational facilities or public access for recreation.

Tempe Town Lake

Another recreational feature downstream from the project study area in the City of Tempe is the Tempe Town Lake. The 220-acre Tempe Town Lake is contained within the Salt River flood channel using inflatable dams, a water pump system, and slurry walls. Resorts, restaurants, retail shops, and a marina are planned for the neighboring areas.

Rio Salado Project

The Rio Salado Project is a planned recreational and habitat restoration project that will restore the Salt River to a more natural state. The recreational elements associated with this project would include trails, scenic overlooks, interpretive centers, gathering areas, parking, restrooms, and shade structures. Activities along the project area would include bird watching, hiking, biking, and equestrian uses, wildlife observation, and fishing. The Rio Salado project is located downstream from the project study area.

4.11.2.3 Salt River Pima-Maricopa Indian Community

No parks that fall within the jurisdiction of the SRPMIC were observed within the Va Shly'ay Akimel study area. However, the Cypress Golf Course and a recreational vehicle park and shooting range are located within 1/4 mile of the study area.

4.11.3 REGULATORY ENVIRONMENT

Maricopa County, the City of Mesa, and SRPMIC have jurisdiction over respective planning and development decisions in the study area. Unincorporated land in the study area falls within the City of Mesa's sphere of influence and would likely be annexed by the City, which would have jurisdiction over planning new recreational facilities.

4.11.3.1 Maricopa County

Portions of the study area are within unincorporated Maricopa County. The Maricopa County Comprehensive Plan contains goals and policies related to recreation facilities (Maricopa County 1997.

The Comprehensive Plan seeks to establish a network of protected open spaces that correspond to regionally significant mountains, rivers, washes, and upland deserts. Parks and recreation facilities are a form of secured open space that provide the foundation of a coordinated outdoor recreation system and contribute to the County's quality of life. Existing publicly owned recreation areas include neighborhood and community parks, Maricopa County regional parks (largest county park system in the country), State Game and Fish lands, and a municipal mountain preserve. These lands provide recreational opportunities within or near urbanized areas. The Comprehensive Plan recommends acquisition of open space to meet the passive and active recreation needs of the region's population.

Dedicated open space areas are those areas that are under public ownership (except state trust land) that have unique environmental and physical qualities. These areas include mountains and foothills, rivers and washes, canals, significant desert vegetation, wildlife habitat, and cultural resources. Within Maricopa County, dedicated open space exists in the form of regional parks, wilderness areas, wildlife areas and the Tonto National Forest. Dedicated open space currently comprises approximately 2,000 square miles, with another 650 square miles of proposed open space in the unincorporated areas of the county. Open space provides recreation and visual resources for the residents of Maricopa County. The Maricopa County Comprehensive Plan transportation element contains the following goal related to recreational facilities:

Goal: Promote an efficient, cost-effective, integrated, accessible, environmentally sensitive, and safe countywide multimodal system that addresses existing and future roadway networks, as well as promotes transit, bikeways, and pedestrian travel.

4.11.3.2 City of Mesa

The City of Mesa General Plan defines the direction of growth and the type of development that is desired and expected to occur in Mesa between 2002 and 2025 (City of Mesa 2002). The General Plan is a guide for Mesa's future development that presents the community's vision through broad goals and objectives.

The City of Mesa's Parks and Recreation Division developed a Parks and Recreation Plan to provide more detailed analysis of the City's recreation and open space needs for the future. The plan was completed in August 2002 and the goals, objectives and policies contained therein were incorporated into the City's General Plan.

The general park standards the City developed and identified are listed below in Table 4.11-1.

Table 4.11-1. City of Mesa Park Standards

Type of Facility	Description	Park Size	Service Radius/Siting Criteria
Neighborhood Park	Serves the recreational and social focus of the neighborhood	3-15 acres (3 acres min.)	½ mile
Neighborhood Park/School	Can fulfill the space requirements for other park classes	3-15 acres	½ mile (Elem./Jr. High School) 3 miles (High School) Determined by location of school enrollment boundary
Community Parks		15-40 acres	3 miles Serves two or more neighborhoods
Urban Paths and Trails	Open space linkages for parks within the community	Varies, based on resource availability and opportunity	Varies
Metro Parks	Serves as a special use park, typically for sports and/or signature facilities	40-200 acres	2-3 miles
Regional Park	Serves the entire community with a significant level of park space dedicated to active and passive users	200+ acres	Entire city

Source: City of Mesa 1996

Several goals and policies in the Mesa General Plan that may be relevant to the proposed project are provided below under the respective General Plan Elements.

Transportation Element

Goal T-1. Provide a balanced, multi modal transportation system for the City of Mesa that supports the safe and efficient movement of people and goods.

Objective T-1.4. Create a comprehensive system of bicycle facilities, programs, and services.

Policy T-1.4b. Develop an interconnected network of shared use paths along canal banks, utility easements, and roadway rights-of-way to link open spaces, parks, recreational facilities, and schools throughout the City and into adjacent jurisdictions.

Recreation Element

Goal PR-1. Create a balanced, accessible and integrated system of open spaces and recreational opportunities to serve the current and future residents and visitors of the City of Mesa.

Objective PR-1.1. Provide a meaningful network of natural and developed open space areas.

Policy PR-1.1c. Strive to acquire open space acreage as defined in Table 9.1 [Table 4.11-1 above] and further described in the Parks and Recreation Master Plan.

Objective PR-1.2. Manage and preserve open space to optimize its use and protection.

Policy PR-1.2b. Continue to create a plan for securing use licensing and maintaining a dedicated trail system with SRP assistance.

Objective PR-1.4. Enhance recreational opportunities through the multi-purpose use of open space resources.

Policy PR-1.4a. Encourage the development of innovative specialty parks to provide new recreation opportunities. An example of this includes linear pedestrian/bicycle/open space systems in the floodways and utility corridors throughout the City.

Environmental Planning and Conservation Element

Goal EPC-3. Provide for the protection and wise use of the resources of the natural environment in the City of Mesa

Objective EPC-3.1. Maintain connections between wildlife habitats by identifying and protecting corridors for unimpeded movement.

Policy EPC-3.1a. Establish sufficient wildlife trails, corridors, and other linear linkages between large open space areas.

Policy EPC-3.1e. Design public recreational spaces to be wildlife-friendly whenever possible.

Policy EPC-3.1g. Encourage the establishment of open space lands that restrict and/or limit human use to protect significant plant and animal habitats.

Policy EPC-3.1h. Encourage the preservation of a system of linkages, connections, and gateways between significant open spaces and significant animal and plant habitats.

Economic Development Element

Goal ED-3. Utilize the competitive advantages of the City and region to promote Mesa as a community where people may live, learn work, shop, and play.

Objective ED-3.4. Maintain a well-rounded community in terms of recreational, cultural, educational, and health care opportunities.

Policy ED-3.4a. Support the expansion of the City's parks and recreation system and facilities.

4.11.3.3 Salt River Pima-Maricopa Indian Community

The Salt River Pima-Maricopa Indian Community is considered a sovereign nation and is not under the regulatory or political jurisdiction of any of the local governments in the area or the U.S. federal government. All land use activities are guided by the tribal community's established procedures and regulations. The tribal community does not have any established regulations or plans for recreational facilities.

4.12 PUBLIC HEALTH AND SAFETY

4.12.1 INTRODUCTION

This section describes the existing environmental conditions in the Va Shly'ay Akimel study area relating to public health and safety, including hazardous and toxic materials. In addition, the various regulations relating to the handling and use of hazardous materials are described.

4.12.2 GENERAL PROJECT SETTING

The Salt River is a terraced, low-gradient river. Historically, its flow has been directed by development, dating back to Native American use of the river for irrigation. Presently, the Salt River is mostly a dry riverbed whose flow is dependent on large storm events, treatment plant releases, or upstream dam releases.

Depth to groundwater ranges from 120 feet below land surface near the SR 101/202 interchange to 350 feet below land surface near Power Road. The direction of flow is highly variable; however, groundwater flow is generally to the west-southwest (Arizona Department of Water Resources 1992). Soil types in the Salt River are porous sands, gravel, and rounded cobbles. The primary modern use of the Salt River is for extreme flood event flood control.

The land uses in the vicinity of the Salt River between the SR 101/202 interchange and Power Road are sand and gravel quarries, commercial developments, and residential developments on the south side of the river and residential developments, sand and gravel quarries, and landfills on the north side of the river.

The soils and water in the riverbeds are potentially subject to contamination from several sources, including discharge from stormwater systems that may carry metals, grease, and oils of minimal toxicity; overland flows that may transmit sediment and fertilizers; leachate from landfills within the riverbed; and point-source dumping by the general public.

The City of Mesa collects and discharges untreated stormwater from its streets and gutters into the Salt River. City ordinances do not allow gutters and storm sewers to be used for any purpose other than stormwater. The Environmental Protection Agency (EPA) issued the City a permit for this activity. Under this permit, the City of Mesa is obligated to sample and test the stormwater (City of Mesa 2002). According to City of Mesa staff, the stormwater is tested throughout the system for 26 pollutants (Mendelzon pers. comm.).

A City of Mesa wastewater treatment plant (Northwest Water Reclamation Plant) is located on the south side of the river, just east of the SR 101/202 interchange. The City of Mesa treats and releases municipal wastewater from this plant into the Salt River under a National Pollutant Discharge Elimination System (NPDES) permit issued by EPA. Under this permit, Mesa must submit an annual report with analytical results of sampling (City of Mesa 2002). The 1999 annual report indicates that the plant had no discharges that violated applicable EPA or local standards (City of Mesa 1999). Additionally, City staff indicated that there had not been any violations in 2000 or 2001 (Draper pers. comm.).

Portions of the Salt River are used as illegal dumping sites for commercial and residential refuse and other materials. Domestic refuse, as well as construction debris, is common within the area. Dumping could result in potential sources of contamination.

Mosquitoes are also a health concern in the study area. The ecological characteristics in the study area provide an ideal environment for mosquito infestation. Mosquitoes are a public health concern because of their potential to spread disease. Maricopa County Vector Control monitors mosquitoes along the Salt River primarily during the summer months. Monitoring methods include carbon dioxide traps set twice each month (Ramirez pers. comm.).

4.12.3 REGULATORY SETTING

The principal federal regulatory agency for hazardous waste is the EPA. In Arizona, the Arizona Department of Environmental Quality (ADEQ) is responsible for implementing federal regulations throughout the state. Federal law requires state regulations to be at least as stringent as federal regulations.

4.12.3.1 Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as Superfund, was passed by Congress in 1980 to facilitate the cleanup of the nation's toxic waste sites. In 1986, Congress amended CERCLA by issuing the Superfund Amendment and Reauthorization Act (SARA), Title III (community right-to-know laws). Title III states that past and present owners of land contaminated with hazardous substances can be held liable for the entire cost of cleanup, even if the material was dumped illegally when the property was under different ownership.

There are three primary databases for CERCLA: the EPA National Priorities List of Superfund Sites (NPL), the Arizona Water Quality Assurance Revolving Fund (WQARF), and the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS). The results of database searches for NPL, WQARF, and CERCLIS are shown below. Except where noted, the searches were conducted for the entire study area as defined at the beginning of this chapter.

4.12.3.2 National Priorities List

The EPA publishes the NPL, which lists federal Superfund sites in Arizona that are under investigation or remediation by EPA for known soil or groundwater contamination. There are no NPL sites within the specified search area (Environmental FirstSearch 2002).

4.12.3.3 Water Quality Assurance Revolving Fund

The ADEQ Office of Waste Programs maintains information for WQARF study areas. The WQARF program is the state equivalent to the federal Superfund, which funds cleanup projects resulting from the release of hazardous materials into the environment. There are no identified WQARF sites within the search area (Environmental FirstSearch 2002).

4.12.3.4 Comprehensive Environmental Response, Compensation, and Liability Information System

CERCLIS is the EPA's database of current and potential Superfund sites currently or previously under investigation under CERCLA. There are two CERCLIS sites within the project study area, which are described in Table 4.12-1 (Environmental FirstSearch 2002).

Table 4.12-1. CERCLIS Sites

Facility	Location	Status
North Center Street Landfill	End of N. Center Street at the Salt River	NFRAP
Busby Metals	522 W. McKellips Road	NFRAP

NFRAP – No Further Remedial Action Planned by ADEQ or EPA

Source: Environmental FirstSearch 2002

4.12.3.5 Solid Waste Landfills

A review of the ADEQ databases for active and inactive municipal solid waste landfills, rubbish landfills, private solid waste landfills, closed solid waste landfills, and private disposal facilities required to report to ADEQ (under Section 37, Chapter 315, Laws 1991, House Bill 2121) identified three such facilities (Table 4.12-2) that are within ½ mile of the Salt River flow centerline (Environmental FirstSearch 2002).

Table 4.12-2. Landfills

Facility	Location	Status
City of Mesa Landfill (North Center Street Landfill)	NEC, Center Street and Lehi Road	Closed
Salt River/Pima Tribe (Tri-City) Landfill	1 mile north of McDowell Road on the SR 87	Closed
Allied Concrete Landfill	SEC, Center Street and Lehi Road	Closed

Source: Environmental FirstSearch 2002

Other sources omit specific reference to the "Allied Concrete Landfill" that ADEQ lists and identify the solid waste landfills within the project study area as:

1. Tri-City (sometimes "Tri-Cities") Landfill
2. North Center Street Landfill (owned by SRPMIC),
3. North Center Street Landfill (owned by City of Mesa), and
4. Cypress (sometimes "Old Tri-City," "Old Tri-Cities," or "Country Club") Landfill.

Mr. Dick Jeffries, Manager of the Planning and Permitting Unit of ADEQ's Solid Waste Section, noted there is little standardization in how landfills are named. Furthermore, because landfills were not formally regulated prior to the 1991 passage of Subtitle D of RCRA (40 CFR 257-258), many gaps and/or inaccuracies are known to exist in the historical record (Jeffries pers. comm.). It is likely that the "Allied Concrete Landfill" and the "North Center Street Landfill" owned by the City of Mesa are one and the same.

For the purposes of this report, the four landfills listed above will be uniformly referred to as the Tri-City Landfill, North Center Street Landfill (SRPMIC), North Center Street Landfill (City of Mesa), and Cypress Landfill. The locations and conditions of these landfills are discussed in greater detail in the sections below. It should be noted, however, that waste from illegal "wildcat" dumps and/or dumps that preceded the historical record may be encountered throughout the project area.

Tri-City Landfill

The Tri-City Landfill, located in Township 2 North, Range 5 East, Section 34 of the Gila and Salt River Baseline and Meridian, comprises approximately 217 acres. The landfill is bounded to the north by the Beeline Highway (SR 87) and an SRP methane gas power generation station, to the south by the Salt River channel, by the Union Rock and Materials Corporation aggregate processing facility to the southwest, and by undeveloped land to the east.

The site, which is owned by the SRPMIC, operated from 1972 until October 1993. According to the *Final Closure Report and Postclosure Maintenance Plan: Tri-Cites Landfill and North Center Street Landfill* (CH2M HILL 1994), the landfill site was originally excavated for gravel deposits to a maximum depth of approximately 50 feet below the river channel surface and is now estimated to contain approximately 40 million cubic yards of waste and daily cover soil. The waste received consisted of residential household waste, commercial construction and demolition materials, landscaping and yard cleanup waste, and some inert soil, asphalt, and concrete. Methane gas that develops in the landfill is currently directed via a collection system to the gas power generation station that adjoins the property to the north.

The Tri-City Landfill site is underlain by several feet of gravelly silt followed by nearly continuous zones of cobbly sandy gravel, occasionally separated by lenses of clean sand or silty sand. Although the water table may rise nominally during late winter or spring flows, depth to groundwater is generally between 150 and 200 feet. While the landfill site does not contain a bottom barrier or liner, no obvious indicators of landfill leachate have been identified from groundwater quality analyses (CH2M HILL 1994). This is considered consistent with the significant depth to groundwater in the immediate vicinity and the fact that low annual rainfall tends to minimize production of leachate.

The Tri-City Landfill was closed and capped in 1994. CH2M HILL developed the closure plan; the actual boundaries of the landfill were determined by test pit excavations conducted by SHB-Agra; and Simons, Li & Associates served as design engineer for bank protection measures placed along the river channel. The landfill site was "hard-banked" with cement-stabilized alluvium (CSA), commonly referred to as "soil cement," to alleviate chances for a flood event to expose or wash out landfill materials. The selected bank protection slope was extended 10–15 feet below the river channel and upward at a slope of 1:1 to the elevation of a 100-year flood event, plus 3 feet of freeboard. The thickness of the CSA layer is approximately 5.6 feet.

Existing daily cover soil at the Tri-City Landfill varied in depth from 2–15 feet. In compliance with Subtitle D of RCRA, Part 258, Subpart F, at closure the landfill was covered with an 18-inch barrier layer of compacted silty/clayey soil that meets strict ASTM D698 permeability requirements. The barrier soils were then graded to promote runoff and topped by a 1-foot vegetative layer (Subtitle D specifies a minimum of 6 inches) of sandy loam that was later hydroseeded with grasses. As the waste materials contained in the Tri-City Landfill decompose, the site is expected to continue to settle over an approximately 30-year period following closure, or until approximately the year 2024. Settling is expected to be uneven across the site, which will necessitate periodic additions of cover soil to discourage ponding of water and consequent percolation. (CH2M HILL 1994.)

North Center Street Landfill (SRPMIC)

The North Center Street Landfill, located in Township 1 North, Range 5 East, Section 3, covers approximately 35 acres. It is bounded by the Salt River channel on the north, undeveloped SRPMIC land to the west, the City of Mesa Police Department firearms training range to the southwest, Vulcan/CalMat to the south, and undeveloped SRP-owned land to the east. The North Center Street Landfill operated from 1979 until it was closed in 1980, and is estimated to contain approximately 3 million cubic yards of waste and cover soil. The waste received consisted of residential household waste, commercial construction and demolition materials, landscaping and yard cleanup waste, and some inert soil, asphalt, and concrete. (CH2M HILL 1994.)

Like the Tri-City Landfill, the North Center Street Landfill site was originally excavated for gravel deposits for use in construction and concrete aggregates. Its maximum depth is estimated at 40 to 50 feet below the river channel surface, and it too is unlined. The North Center Street Landfill received final closure at the same time (1994) and in a manner similar to that of the Tri-City Landfill. Unlike the Tri-City site, however, methane gas collected at North Center Street Landfill is burned off in a process known as flaring.

North Center Street Landfill (City of Mesa)

According to the Phase I Environmental Site Assessment completed by Liesch Southwest (2002), the site of the City of Mesa Police Department firearms training range adjacent to the North Center Street Landfill owned by the SRPMIC was originally used for disposal of waste by the City of Mesa, dating back at least to the 1960s. The site has since been developed with two classroom buildings, an office, and armory, a storage yard for miscellaneous vehicles and equipment, and a car impoundment lot. The embankments of the five currently operating target ranges appear to have been constructed of fill soil material that includes a large percentage of waste debris. The landfill beneath is thought to predate the Tri-City and Cypress Landfills. No information is currently available regarding its total acreage, depth, volume, or contents.

Cypress Landfill

The Cypress Landfill is located north of the Salt River channel and south of the Cypress Golf Course between Alma School Road and Country Club Drive. No information is currently available regarding its total acreage, depth, volume, or contents. The Cypress Landfill operated from at least the early 1960s to approximately 1980. The facility was never permitted and, to date, no closure plans have been initiated. The site is known to contain contaminants, although precise information regarding the nature of the contamination is unavailable. According to Liesch Southwest (2002), the site was investigated in 1990 by Ecology and Environment, Inc. at the request of USEPA. The investigation was conducted in response to the visible presence on the surface of 60–65 drums in various stages of decay. Fourteen of these drums were removed under emergency procedures through the ADEQ WQARF program. The contents of the other drums may have leached into the ground or groundwater. The SRPMIC have indicated they would like to clean up the site for future development and are in the process of requesting funding for a USEPA Brownfield Pilot Project study for this site. (Liesch Southwest 2002).

4.12.3.6 Arizona Leaking Underground Storage Tank List

The ADEQ Office of Water Quality maintains a list of reported leaking underground storage tanks (LUSTs). Based on a search of this database, there are 22 reported leaking underground storage tanks at 11 sites within the search area. A LUST designated as "Closed" has been remediated to the ADEQ's satisfaction. Of the 22 reported LUSTs within ½ mile of the river centerline, three remain open and one of the open LUSTs has likely impacted groundwater (Environmental FirstSearch 2002). These sites are listed in Table 4.12.3 below.

Table 4.12-3. LUST Sites

Facility	Location	Status
Travizo Hay Company	1747 N. Alma School Road	1 Open
ADOT Mesa Maintenance	2409 N. Country Club Drive	2 Open – likely groundwater contamination
AZ Department of Public Safety	2409 N. Country Club Drive	1 Closed
Bingo Hall/Ray Station	2345 N. Country Club Drive	1 Closed
Circle K	1150 W. McClellan	1 Closed
Sunward Materials/BCW	1564 N. Alma School Road	1 Closed
Karl Watkins	2116 N. Country Club Drive	1 Closed
Conteras Contractors	2110 N. Country Club Drive	7 Closed
Chandler Ready Mix Materials	3250 E. Lehi Drive	5 Closed
Cashway Concrete & Materials	650 W. McKellips Road	1 Closed
Valley Wide Contracting Co. Inc.	620 W. McKellips Road	1 Closed

Source: Environmental FirstSearch 2002

4.12.3.7 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) directs EPA to administer a regulatory program that extends from the manufacturing of hazardous waste to its disposal; the law regulates the generation, transportation, treatment, storage, and disposal of hazardous waste at all facilities and sites in the nation. RCRA was amended in 1984 by the Hazardous and Solid Waste Act, which affirmed and extended the "cradle-to-grave" system of regulating hazardous wastes.

Under RCRA, EPA maintains a list of facilities involved in the generation, transport, treatment, storage or disposal of hazardous waste. There are three separate databases: RCRA Corrections Log; RCRA Treatment, Storage, and Disposal Facilities (TSD); and RCRA Generators. For RCRA Correction Log and RCRA TSD facilities, the search was conducted for the project study area. For RCRA generators the search distance was ¼ mile from the river flow centerline. Table 4.12-4 shows the listed sites (Environmental FirstSearch 2002).

Table 4.12-4. RCRA Sites

Facility	Location	Status
RCRA Correction Sites		
Talley Defense Systems, Inc.	4111 and 4301 N. Higley Road	Listed violations & regulatory enforcement actions
RCRA TSD Sites		
Talley Defense Systems, Inc.	4111 and 4301 N. Higley Road	TSD
RCRA Generator Sites		
Statewide Environmental Services	1747 N. Alma School Road	No Longer Regulated
Blue Circle West Leasing	1564 N. Alma School Road	Generates < 100 kg/month
New West Materials	1540 N. Alma School Road	Generates < 100 kg/month

Source: Environmental FirstSearch 2002

4.12.3.8 Occupational Safety and Health Administration

Occupational Safety and Health Administration (OSHA) is the primary federal agency responsible for worker safety in the handling and use of chemicals in the workplace. The employer is required to monitor worker exposure to listed hazardous substances and notify workers of exposure. OSHA regulations specify requirements for employee training, availability of safety equipment, accident-prevention programs, and hazardous substance exposure warnings.

4.12.3.9 Vector Control

Maricopa County Department of Environmental Services, Vector Control Division and the Arizona State Department of Health Services, Office of Infectious Disease Services, Vector-Borne and Zoonotic Disease Section are the agencies primarily responsible for control of mosquitoes and other animal vectors in the project area.

4.12.4 POTENTIAL FOR RECYCLING AND/OR RE-USE OF NON-TOXIC FILL MATERIALS

Certain non-toxic materials used or excavated during project construction may have the potential to be recycled and/or re-used. An analysis of potentially recyclable materials present within the project study area has been conducted based on information contained in the Va Shly'ay Akimel Phase I Environmental Site Assessment (Liesch Southwest 2002). Jones & Stokes contacted representatives of Maricopa County, the City of Mesa, and the SRPMIC to identify requirements for recycle and re-use of fill and/or construction materials. An inventory of recycle facilities in the vicinity of the project area is presented in Table 4.12-5.

Table 4.12-5. Recycle Facilities

Facility	Contact Name & Title	Address	Material Accepted	Recyclable	Costs
Johnson Steward Johnson	Laron Dewitt, General Manager	1132 W. McLellan Rd. Mesa, AZ 85201	Concrete and asphalt	No, Disposal only.	Unknown
Maricopa County Solid Waste Department	Lisa Mwale, Waste Tire Coordinator	2801 W. Durango St., Phoenix, AZ 85009	Tires	No, Transfer station only.	Non-residents are free. $140/ ton for off-road tires.
Mesa Materials	Patti Southway, Sales Rep	3410 N. Higley Rd. Mesa, AZ 85215	Broken asphalt only	Yes	$15/load (10-wheeler truck) or $25/load (larger than 10-wheeler truck)
Salt River Landfill	Randy Watkins, Compliance & Recycling Coordinator	13602 N. Beeline Highway Scottsdale, AZ 85256	Greenwaste and large appliances	Yes	$34/ton (discount for some cities)
Salt River Sand and Rock	Donna Casillos, Sales Rep	Dobson and McKellips Rd. Scottsdale, AZ 85256	Concrete and asphalt	No, Disposal only.	$20/load (10-wheeler truck) and $30/load (larger than 10-wheeler truck)

CHAPTER 5. ENVIRONMENTAL CONSEQUENCES OF PROPOSED ACTION AND ALTERNATIVES

This section describes the environmental effects associated with the no-action alternative and each of the action alternatives. A brief discussion of the approach and methodology for performing the analysis is provided. The results of the analysis, both direct and indirect, are also included in this section. The environmental effects are described separately for each resource area and project alternative. For impacts that are substantial and adverse, mitigation measures have been provided. Although some short-term impacts will occur as a result of project construction and temporary site disturbance, the long-term impacts are expected to be beneficial because the major focus of the action alternatives is to increase vegetation and wildlife habitat in the project study area.

5.1 GEOLOGY AND TOPOGRAPHY

5.1.1 APPROACH AND METHODOLOGY

Geology and topography impact assessments in or near the project area focus on soil and erosion potential. The Natural Resources Conservation Service classifies soil with erosion hazards of slight, moderate, high, very high, and severe, establishing the significance criteria. These classifications are based on slope, climate, vegetation, and the physical/chemical characteristics of the soil. In addition to direct and indirect impacts, both short-term and long-term construction-related effects and longer term and permanent effects were also considered. The significance determination was based on past field experience with similar restoration projects.

Other evaluated impacts include geomorphologic impacts, impacts due to seismic activity, and impacts to prime and unique farmlands. Geomorphologic impacts assessed potential changes to existing landforms and possible effects on the hydrologic functionality and associated shifts of the river channel.

As discussed in Section 4.1, "Geology and Topography," seismic activity is not considered a concern in the project area. No active faults are known to occur on or near the project site, so no direct impacts related to surface rupture are anticipated. Seismic activity is very low in the region of the proposed project. Seismic impacts related to ground motion are also not anticipated.

Although prime farmland is in the vicinity of the project location, no farmland will be adversely affected by any of the proposed action alternatives. Section 1540(b) of the Farmland Protection Act, 7 U.S.C. 4201(b), states that the purpose of the Act is to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses. All project impacts will be confined to the banks of the Salt River, therefore not converting any farmland to nonagricultural uses.

Operation and Maintenance (O&M) activities for the proposed action will include repair work after major flooding events; dredging and reconstruction may be required in the restoration areas.

5.1.2 ENVIRONMENTAL IMPACTS

5.1.2.1 No Action

Under the No-Action Alternative, the existing topography would remain relatively unaffected. Landforms would remain approximately the same, although large-scale flood events will continue to change the floodplain. Areas within the channel that are currently subject to erosion will continue to erode at current rates. Additionally, ongoing human encroachment and gravel mining will continue to adversely affect river channel profile and planform. In the short-term ongoing gravel mining within the project area will cause upstream headcutting, sediment trapping within the gravel pits and reduction in downstream sediment transport, and associated downstream channel bed and bank erosion. No short-term impacts on geology or topography are associated with the restoration and enhancement of the river corridor. Long-term impacts of the No-Action Alternative could include an increase in the potential for wind-related soil erosion from continued decreased water availability. This could result in a substantial decrease in vegetative cover over time.

5.1.2.2 Alternative F

Activities under this alternative include the creation of irrigation and drainage ditches throughout the project area, spillways, bank armors, constructed wetlands, a low-flow channel, a grade control structure west of Gilbert Road at the center point of the old Gilbert Quarry, and a water distribution channel. Many of the procedures involve several forms of reshaping, including excavation and grading. These restoration measures will occur at multiple sites designated throughout the project area.

Impact: Minor Geomorphologic Changes in the River Channel

Under Alternative F, the geomorphologic character of the existing landscape will be permanently altered due to the many reshaping procedures planned for the project. River bottom areas will undergo surface reshaping, which includes moving soil to fill depressions or remove unwanted mounds. In addition, soils will be imported to various areas to provide the necessary environment for new vegetation. Clay, mixed gravel, and cobble layers will be placed in areas of proposed wetland habitats. The current wind erosion potential will likely be reduced, except for the initial construction-related effects.

The addition of a Surface Braided Irrigation Network (SBIN), 2–3 feet wide and 6 inches deep, will change the existing water runoff pattern. It will affect the erosion and deposition within the channel; however, it is unlikely to cause functional changes in the river channel's current erosion and deposition patterns. The river channelization will create a low-flow channel that is free to migrate. Erosion potential may change due to the channel's ability to migrate. Continued quarrying at the Higley Plant has the potential to increase the rate of downstream sediment deposition in Reach 7, thereby decreasing the bedload material downstream in Reach 6. The lack of bedload material may affect the stability of the river channel in Reach 6. However, these potential geomorphologic changes are considered less than significant.

Mitigation Measure: No mitigation required.

Impact: Beneficial Changes to the River Channel

Armoring the south bank, east of Gilbert Road, will reduce erosion as well as provide bank stabilization and soil protection for new vegetation. Further east along the south bank, the berm of coarse rock will help prevent further erosion. Between Alma School Road and Country Club Road, the south bank will be reinforced with soil cement to prevent further erosion as well as possible damage to SR 202. The grade control structure will help stabilize the river system and help protect the river channel from headcutting. This is considered a beneficial effect.

Mitigation Measure: No mitigation required.

5.1.2.3 Alternative N

Under Alternative N, the channel alterations will be substantially similar to those of Alternative F. Habitat configurations and reshaping measures will remain relatively the same, with the exception that no bank stabilization, spillways, or river channelization will occur. The different reshaping measures will result in minor variations in the geomorphologic changes to the river channel. These changes and their impacts are consistent with those of Alternative F.

5.1.2.4 Alternative O (Preferred Alternative)

Modifications for Alternative O will be similar to descriptions set forth in Alternative F. However, as described in Alternative N, no bank stabilization, spillways, or river channelizations will occur. The different reshaping measures will result in minor variations in the geomorphologic changes to the river channel, which are consistent to the changes and impacts outlined in Alternative F.

5.1.2.5 Alternative E

Changes to the river channel will be very similar in scope to the modifications described for Alternative F. The primary difference is the location, quantity, and configuration of habitat areas that would be constructed in the channel and on the adjacent bank areas. Under this alternative, the configuration of habitats is restricted to Sonoran Desert vegetation. The different reshaping measures will result in minor variations in the geomorphologic changes that would occur. However, for the purposes of this assessment, these changes and their impacts are consistent with those of Alternative F.

5.1.2.6 Alternative A

Alternative A is considerably similar to Alternative E with regard to the geomorphologic changes that would occur. This alternative is restricted to Sonoran Desert vegetation, limiting the reshaping methods for an irrigation system to SBIN. As a result, the only reshaping procedures for Alternative A are the SBIN and the old Gilbert Quarry. In addition, bank stabilization by means of bank armoring is not included as a restoration measure. The impacts associated with this alternative are less than significant.

5.2 HYDROLOGY AND WATER RESOURCES

5.2.1 APPROACH AND METHODOLOGY

This section describes the impacts of the various alternatives to hydrology and water quality within the study area. These impacts were determined through inspection of the plans for each alternative and a review of the construction and restoration aspects of each alternative. Impacts on surface hydrology were evaluated to determine whether the implementation of the alternative would result in substantial alteration of watercourses or in stream channels. Additionally, impacts were analyzed to determine if the alternative would exacerbate flooding in currently flood-prone areas or create new potential for flooding or flood damage. Groundwater hydrological impacts were analyzed to determine whether an alternative would result in a substantial loss or change in groundwater resources within the area.

Water quality impacts were evaluated to determine whether construction or operation of an alternative would result in degradation of existing or future water quality, resulting in the potential for violations of existing water quality standards. The analysis focuses on turbidity and sedimentation associated with construction and restoration activities and the potential for water quality impacts caused by accidental spills of fuels or solvents during construction.

The project alternatives, including the recommended plan (preferred alternative), Alternative O, were also evaluated to ensure compliance with the Guidelines established under the Federal Pollution Control Act (Clean Water Act) Amendments of 1972 (Public Law 92-500), as amended by the Clean Water Act of 1977 (Public Law 95-217), legislation collectively referred to as the Clean Water Act. These guidelines, referred to as the Section 404(b)(1) Guidelines or "Guidelines," are the substantive criteria used in evaluating discharges of dredged or fill material under Section 404 of the Clean Water Act. Fundamental to the Guidelines is the precept that "dredged or fill material should not be discharged into the aquatic ecosystem, unless it can be demonstrated such a discharge will not have an unacceptable adverse impact either individually or in combination with known and/or probable impacts of other activities affecting the ecosystems of concern."

The Guidelines require that, except as provided under §404(b)(2), "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have significant adverse environmental considerations." A "practicable alternative" is defined as "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes," and include both on- and off-site alternatives.

The results of the evaluation identified short-term construction-related impacts on water quality (e.g., turbidity, stormwater pollutants, accidental fuel spills), hydrology (e.g., increases in water surface elevations), and wildlife (e.g., disturbance). No long-term impacts were identified. The evaluation also identifies best management practices (BMPs) and mitigation measures that will be implemented during construction to avoid and/or minimize any short-term impacts. Based on the evaluation and the inclusion of mitigation measures to address short-term impacts, the project has been determined to be in compliance with the Guidelines. A more detailed description of the Clean Water Act, Section 404(b)(1) compliance evaluation is provided in Appendix A.

5.2.2 ENVIRONMENTAL IMPACTS

5.2.2.1 No Action

Under the No-Action Alternative, existing flooding and flood damage will continue at approximately the same level of magnitude and frequency. Water quality is expected to decline slightly as the watershed continues to urbanize. Erosion and sedimentation processes would continue at current rates and degrees of magnitude.

5.2.2.2 Alternative F

Impact: Temporary Adverse Effects on Water Quality during Project Construction

Project construction and restoration activities proposed under this alternative include grading, site preparation for vegetation planting, channel excavation and reshaping, and the installation of bank stabilization, and grade control features. These activities as well as O&M activities such as sediment removal will result in soil disturbance and have the potential to cause temporary discharges of soil and sediment into the river channel. Soil discharged into the river channel may increase turbidity, stimulate algal growth, increase sediment deposition, and adversely affect aquatic organisms. This would be a potentially significant impact but can be mitigated through the implementation of Mitigation Measure HWR-1.

Mitigation Measure HWR-1: Implement Erosion Control Measures

The Corps and their contractors shall implement erosion control measures throughout the construction period and during implementation of O&M activities to minimize erosion and sediment input into the river. The Corps will oversee implementation of erosion control measures. The contractor selected for the project shall:

- conduct construction and O&M activities during the dry season;
- conduct all construction work in accordance with site-specific construction plans that minimize the potential for increased sediment inputs to the river;
- divert concentrated runoff away from channel banks;
- minimize vegetation removal;
- identify with construction fencing all areas that require clearing, grading, revegetation, or reshaping and minimize areas to be cleared, graded, reshaped or otherwise disturbed;

- grade and stabilize spoils and stockpile sites to minimize erosion and sediment input to the river;
- implement erosion control measures as appropriate to prevent sediment from entering the river channel or other watercourses to the extent feasible, including the use of silt fencing or fiber rolls to trap sediments and erosion control blankets to protect channel banks;
- mulch disturbed areas as appropriate and plant with appropriate species as soon as practicable after disturbance; and
- avoid operating equipment in flowing water by using temporary cofferdams or other suitable structures to divert flow around the channel and bank construction areas.

Impact: Potential Adverse Effects on Water Quality Associated with Accidental Spills of Fuels or Other Toxic Materials During Project Construction

Project construction and restoration activities could result in accidental spills of fuel or other toxic materials associated with the operation of construction equipment (e.g., gasoline, oils, lubricants, solvents). Hazardous substances that enter the river channel could have temporary adverse effects on water quality and aquatic organisms. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-2.

Mitigation Measure HWR-2: Implement Spill Prevention Measures

The Corps and their contractors shall prepare a spill prevention and response plan that regulates the use of hazardous and toxic materials, such as petroleum-based fuels and lubricants for construction equipment. The Corps will oversee development and implementation of a stormwater pollution prevention plan. Elements of the plan will ensure that:

- workers are trained to avoid and manage spills;
- construction and maintenance materials are prevented from entering the river channel;
- all spills are cleaned up immediately and appropriate agencies are notified of any spills and of the cleanup procedures employed;
- staging and storage areas for equipment, materials, fuels, lubricants, solvents, and other possible contaminants are located at least 100 feet away from the river's normal high-water area;
- vehicles are removed from the river's normal high-water area before refueling or lubricating;
- vehicles are immediately removed from the work area if they are leaking; and
- equipment is not operated in flowing water (if necessary, suitable temporary structures can be installed to divert water around in-channel work areas).

Impact: Changes in 100-year Water Surface Elevations

Channel reshaping and vegetation planting activities proposed under Alternative F have the potential to increase 100-year water surface elevations and increase the potential for flooding in the project area. As part of the project planning process, the Corps conducted modeling (HEC-RAS) to analyze changes in hydraulic conditions associated with implementation of the project alternatives. Hydraulic modeling conducted for Alternative F demonstrated increases in water surface elevations in the lower and middle project reaches (Reaches 3, 4, 5, and 6) associated with the establishment of cottonwood/willow and wetland vegetation in the main channel. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-3.

Mitigation Measure HWR-3: Identify Changes in 100-year Floodplain

The Corps will conduct additional hydraulic analyses to identify changes in the 100-year floodplain associated with increased surface water elevations and assess the potential for flooding and flood damage in the lower and middle reaches of the project area. If it is determined that implementation of this alternative will increase the potential for flood-related damages, the Corps will modify the low-flow channel design and/or implement any additional design changes necessary to reduce water surface elevations in the affected reaches of the project area.

Impact: Beneficial Changes in Flooding Frequency and Severity

The construction of bank stabilization features and the excavation of a low-flow channel proposed under Alternative F have the potential to change 100-year water surface elevations and reduce the potential for flooding in the project area. Hydraulic modeling conducted by the Corps as part of the planning process demonstrated decreases in water surface elevations in the lower and middle reaches of the project area (Reach 2 and the upper segment of Reach 5) associated with the new low-flow channel and projected future gravel mining activities. This is considered a beneficial impact.

Mitigation Measure: No mitigation required.

Impact: Changes in Groundwater Hydrology

Irrigation water sources proposed under Alternative F consist primarily of surface water SRPMIC agricultural return flows, and surplus agricultural water and stormwater runoff from the Hennessey, Evergreen, and Tempe Drains. However, the Alternative includes the construction of one new groundwater well. Irrigation water will be pumped from this new well and diverted to planting areas through distribution channels or pipelines during times when surface water sources are not available. Because groundwater will only be used intermittently, and because groundwater in sufficient quantity is available to supply water wells within the project area, it is unlikely that the installation of a new well and the intermittent pumping of groundwater for irrigation purposes will impact nearby wells. However, because groundwater resources are carefully controlled in Arizona, the installation of a new well and the pumping of groundwater will require permits for the withdrawal of irrigation water. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-4. This alternative is not anticipated to alter the groundwater hydrology and water delivery system above Granite Reef Dam.

Mitigation Measure HWR-4: Obtain Permits for Groundwater Withdrawal

The Corps will work with the appropriate agencies to obtain the permits necessary for the construction of a new groundwater well and the withdrawal of appropriate amounts of groundwater that is needed for irrigation purposes.

Impact: Potential Adverse Effects on Water Quality Associated with Irrigation Water

Under Alternative F, SRPMIC agricultural return flows, surplus agricultural water and stormwater runoff from the Hennessey, Evergreen, and Tempe Drains, treated effluent from the City of Mesa wastewater treatment plant, and discharge from local storm drains will be diverted into newly constructed distribution channels and pipelines for irrigation purposes. These water sources may contain contaminants (e.g., VOCs, metals, ions, nutrients, herbicides) that could have adverse effects on water quality and aquatic organisms. In general because of their sources, irrigation return flows and surplus agricultural water are of relatively high quality and are suitable for use as irrigation for restoration plantings. Additionally, as these are existing discharges to the river, the water quality of these sources is currently regulated under permits held by the local sponsors (SWPPP and AZ Pollutant Discharge Elimination System). The effluent discharged from the City of Mesa wastewater treatment plant currently meets aquifer recharge standards, surface water quality standards and NPDES requirements so it is also suitable for irrigation use. However, because stormwater discharges represent runoff from urban, rural, and agricultural areas, water quality varies greatly based on land use and the magnitude, duration, and timing of storm events. Sediment and pollutants tend to accumulate between storm events and the highest concentrations of pollutants are often washed into rivers, creeks, and streams during "first flush" events. However it is difficult to assess potential adverse effects on water quality associated with the use of stormwater for irrigation as only limited water quality data is available for the project area. A review of existing water quality data showed that storm water runoff exceeded applicable standards for five trace metals including total recoverable lead, and dissolved copper, cadmium, silver, and zinc (Knight Piésold 2003). Because of the lack of existing data related to stormwater quality, this impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-5.

Mitigation Measure HWR-5: Conduct Additional Stormwater Quality Sampling and Analysis

The local sponsors will develop a stormwater quality sampling plan and conduct sampling and analyses to identify potential contaminants and adverse effects on water quality associated with using stormwater as an irrigation source for restoration plantings. If the analyses show that constituents exceed applicable water quality standards, the local sponsors will develop a stormwater monitoring plan and identify measures and implement water quality improvement measures (e.g., scheduling of irrigation withdrawals to avoid "first flush" events; installing detention basins, treatment swales, or other facilities to pre-treat stormwater; and/or identify other irrigation sources).

5.2.2.3 Alternative N

Impact: Temporary Adverse Effects on Water Quality during Project Construction

Under Alternative N, potential adverse effects on water quality associated with construction and O&M activities (e.g., soil disturbance and temporary discharges of soil and sediment) would be similar to those described under Alternative F. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-1.

Mitigation Measure HWR-1: Implement Erosion Control Measures

Same as described above.

Impact: Potential Adverse Effects on Water Quality Associated with Accidental Spills of Fuels or Other Toxic Materials during Project Construction

Under Alternative N, potential adverse effects on water quality associated with accidental spills of fuel or other toxic materials associated with the operation of construction equipment (e.g., gasoline, oils, lubricants, solvents) would be similar to those described under Alternative F. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-2.

Mitigation Measure HWR-2: Implement Spill Prevention Measures

Same as described above.

Impact: Changes in 100-year Water Surface Elevations

Channel reshaping and vegetation planting activities proposed under Alternative N have the potential to increase 100-year water surface elevations and increase the potential for flooding in the project area. Hydraulic modeling conducted by the Corps for Alternative N demonstrated increases in water surface elevations in the lower and middle project reaches (Reaches 2, 3, 4, 5, and 6) associated with the establishment of cottonwood/willow and wetland vegetation in the main channel. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-3.

Mitigation Measure HWR-3: Identify Changes in 100-year Floodplain

Same as described above.

Impact: Beneficial Changes in Flooding Frequency and Severity

Hydraulic modeling conducted by the Corps for Alternative N demonstrated decreases in water surface elevations in the middle reach of the project area (upper segment of Reach 5) associated with projected future gravel mining activities. These activities have the potential to change 100-year water surface elevations in the reach and reduce the potential for flooding in the project area. This is considered a beneficial impact.

Mitigation Measure: No mitigation required.

Impact: Changes in Groundwater Hydrology

Under Alternative N potential changes in groundwater hydrology associated with well construction and the pumping of groundwater for irrigation purposes would be similar to those described under Alternative F. Under Alternative N, groundwater will be pumped from a new well and diverted to planting areas through distribution channels or pipelines during periods when surface water sources are not available. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-4. This alternative is not anticipated to alter the groundwater hydrology and water delivery system above Granite Reef Dam.

Mitigation Measure HWR-4: Obtain Permits for Groundwater Withdrawal

Same as described above.

Impact: Potential Adverse Effects on Water Quality Associated with Irrigation Water

Under Alternative N, potential adverse effects on water quality associated with the use of stormwater discharge for irrigation would be similar to those described under Alternative F. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-5.

Mitigation Measure HWR-5: Conduct Additional Stormwater Quality Sampling and Analysis

Same as described above.

5.2.2.4 Alternative O (Preferred Alternative)

Impact: Temporary Adverse Effects on Water Quality during Project Construction

Under Alternative O, potential adverse effects on water quality associated with construction and O&M activities (e.g., soil disturbance and temporary discharges of soil and sediment) would be similar to those described under Alternative F. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-1.

Mitigation Measure HWR-1: Implement Erosion Control Measures

Same as described above.

Impact: Potential Adverse Effects on Water Quality Associated with Accidental Spills of Fuels or Other Toxic Materials during Project Construction

Under Alternative O, potential adverse effects on water quality associated with accidental spills of fuel or other toxic materials associated with the operation of construction equipment (e.g., gasoline, oils, lubricants, solvents) would be similar to those described under Alternative F. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-2.

Mitigation Measure HWR-2: Implement Spill Prevention Measures

Same as described above.

Impact: Beneficial Changes in Flooding Frequency and Severity

Hydraulic modeling conducted by the Corps for Alternative O demonstrated decreases in water surface elevations in the lower and middle reaches (Reach 3 and the lower segment of Reach 5) of the project area associated with the construction of a low-flow channel, and projected future gravel mining activities. These activities have the potential to change 100-year water surface elevations in the reach and reduce the potential for flooding in the project area. This is considered a beneficial impact.

Mitigation Measure: No mitigation required.

Impact: Changes in Groundwater Hydrology

Under Alternative O potential changes in groundwater hydrology associated with well construction and the pumping of groundwater for irrigation purposes would be similar to those described under Alternative F. Under Alternative N, groundwater will be pumped from a new well and diverted to planting areas through distribution channels or pipelines during periods when surface water sources are not available. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-4. This alternative is not anticipated to alter the groundwater hydrology and water delivery system above Granite Reef Dam.

Mitigation Measure HWR-4: Obtain Permits for Groundwater Withdrawal

Same as described above.

Impact: Potential Adverse Effects on Water Quality Associated with Irrigation Water

Under Alternative O, potential adverse effects on water quality associated with the use of stormwater discharge for irrigation would be similar to those described under Alternative F. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-5.

Mitigation Measure HWR-5: Conduct Additional Stormwater Quality Sampling and Analysis

Same as described above.

5.2.2.5 Alternative E

Impact: Temporary Adverse Effects on Water Quality during Project Construction

Under Alternative E, potential adverse effects on water quality associated with construction and O&M activities (e.g., soil disturbance and temporary discharges of soil and sediment) would be similar to those described under Alternative F. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-1.

Mitigation Measure HWR-1: Implement Erosion Control Measures

Same as described above.

Impact: Potential Adverse Effects on Water Quality Associated with Accidental Spills of Fuels or Other Toxic Materials during Project Construction

Under Alternative E, potential adverse effects on water quality associated with accidental spills of fuel or other toxic materials associated with the operation of construction equipment (e.g., gasoline, oils, lubricants, solvents) would be similar to those described under Alternative F. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-2.

Mitigation Measure HWR-2: Implement Spill Prevention Measures

Same as described above.

Impact: Changes in 100-year Water Surface Elevations

Channel reshaping and vegetation planting activities proposed under Alternative E have the potential to increase 100-year water surface elevations and increase the potential for flooding in the project area. Hydraulic modeling conducted by the Corps for Alternative E demonstrated increases in water surface elevations in the lower and upper project reaches (Reaches 2 and 7) associated with the establishment of Upper Sonoran Desert vegetation in the main channel. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-3.

Mitigation Measure HWR-3: Identify Changes in 100-year Floodplain

Same as described above.

Impact: Beneficial Changes in Flooding Frequency and Severity

Hydraulic modeling conducted by the Corps for Alternative E demonstrated decreases in water surface elevations in the middle reach of the project area (Reach 5) associated with projected future gravel mining activities. These activities have the potential to change 100-year water surface elevations in the reach and reduce the potential for flooding in the project area. This is considered a beneficial impact.

Mitigation Measure: No mitigation is required.

Impact: Changes in Groundwater Hydrology

Under Alternative E potential changes in groundwater hydrology associated with well construction and the pumping of groundwater for irrigation purposes would be similar to those described under Alternative F. Under Alternative E, groundwater will be pumped from a new well and diverted to planting areas through distribution channels or pipelines when surface water sources are not available. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-4. This alternative is not anticipated to alter the groundwater hydrology and water delivery system above Granite Reef Dam.

Mitigation Measure HWR-4: Obtain Permits for Groundwater Withdrawal

Same as described above.

Impact: Potential Adverse Effects on Water Quality Associated with Irrigation Water

Under Alternative E, potential adverse effects on water quality associated with the use of stormwater discharge for irrigation would be similar to those described under Alternative F. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-5.

Mitigation Measure HWR-5: Conduct Additional Stormwater Quality Sampling and Analysis

Same as described above.

5.2.2.6 Alternative A

Impact: Temporary Adverse Effects on Water Quality during Project Construction

Under Alternative A, potential adverse effects on water quality associated with construction and O&M activities (e.g., soil disturbance and temporary discharges of soil and sediment) would be slightly less than those described under Alternative F because of the smaller construction area. . This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-1.

Mitigation Measure HWR-1: Implement Erosion Control Measures

Same as described above.

Impact: Potential Adverse Effects on Water Quality Associated with Accidental Spills of Fuels or Other Toxic Materials during Project Construction

Under Alternative A potential adverse effects on water quality associated with accidental spills of fuel or other toxic materials associated with the operation of construction equipment (e.g., gasoline, oils, lubricants, solvents) would be similar to those described under Alternative F. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-2.

Mitigation Measure HWR-2: Implement Spill Prevention Measures

Same as described above.

Impact: Changes in 100-year Water Surface Elevations

Channel reshaping and vegetation planting activities proposed under Alternative A have the potential to increase 100-year water surface elevations and increase the potential for flooding in the project area. Hydraulic modeling conducted by the Corps for Alternative A demonstrated no increases in water surface elevations in the project area. No impact was identified.

Mitigation Measure: No mitigation required.

Impact: Changes in Groundwater Hydrology

The construction of new groundwater wells and the pumping of groundwater for irrigation purposes is not proposed under Alternative A. No impact was identified.

Impact: Potential Adverse Effects on Water Quality Associated with Irrigation Water

Under Alternative A, potential adverse effects on water quality associated with the use of stormwater discharge for irrigation would be similar to those described under Alternative F. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-5.

Mitigation Measure HWR-5: Conduct Additional Stormwater Quality Sampling and Analysis

Same as described above.

5.3 BIOLOGICAL RESOURCES

This section analyzes the impact of each alternative on the biological resources of the project study area. The analysis is centered on the short- to intermediate-term impacts associated with disruption of habitat during restoration and construction activities. The long-term biological impacts are expected to be beneficial because the major focus of the alternatives is to increase wildlife habitat in the project study area.

5.3.1 APPROACH AND METHODOLOGY

Biological baseline studies were used as the basis to evaluate project impacts for each alternative. Plans for each alternative were reviewed and the potential changes in habitat communities were determined. Short-term impacts were determined through the analysis of existing habitats in the area and the projected areas of disturbance that would occur during construction and restoration activities. Impacts related to wetlands were primarily based on the increase in vegetative coverage in acres as well as the increase in habitat value as indicated by the changes in AAFCUs anticipated in the modified HGM modeling process.

Tables 5.3-1, 5.3-2, 5.3-3, 5.3-4 and 5.3-5 provide an analysis of the increase in habitat acreage for each of the project alternatives. Figure 5.3-1 provides a comparison of the increases in AAFCUs over time for each of the project alternatives. These tables appear on the pages that follow.

The following criteria were considered in determining impacts on biological resources:

- federal legal protection (e.g., Endangered Species Act of 1973),
- federal agency regulations and policies,
- documented resource scarcity and sensitivity (e.g., species tracked in the AGFD Heritage Data Management System),
- adverse effects on special aquatic habitats (e.g., wetlands),
- reduction in native vegetation communities over at least a 20-year period,
- disruption or loss of high-quality wildlife habitat, and
- take or harassment of any listed threatened or endangered species.

Impacts on substantial portions of local populations of federal candidate species were also considered in assessing impacts on biological resources.

Figure 5.3-1. Trend in Average Annual Functional Capacity Units (AAFCUs) for the Va Shly'ay Akimel Alternatives

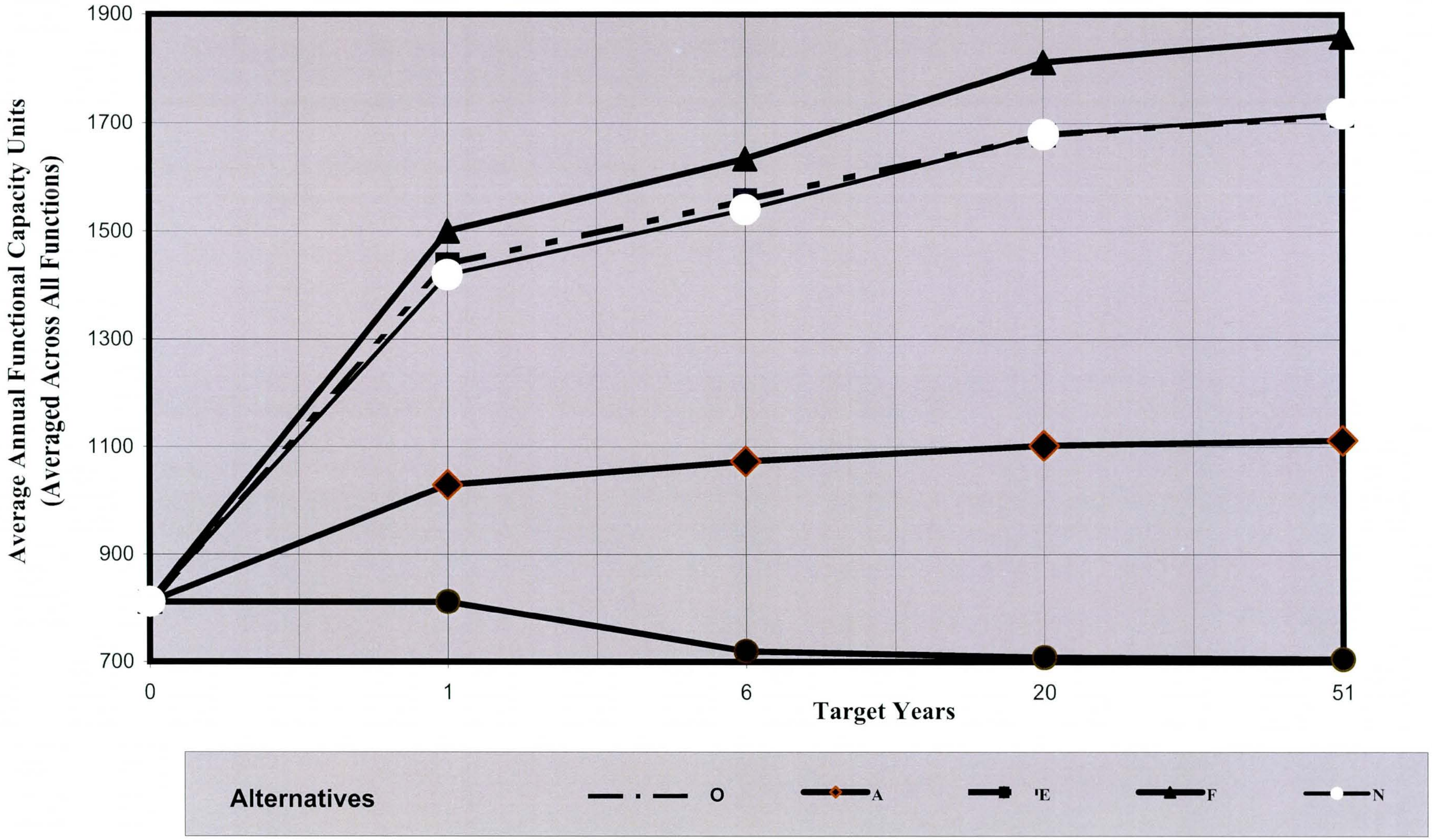


Table 5.3-1. Comparison of Habitat Types (Acres): No-Action Alternative and Alternative F

Code	Description	Target Year - No Action Alternative					Target Year - Alternative F				
		2002	2008	2013	2033	2058	2002	2008	2013	2033	2058
		0	1	6	26	51	0	1	6	26	51
AGCROP	Farms and Croplands - Dairy, Cotton, and Alfalfa	249.70	249.70	247.40	247.40	247.40	249.70	210.90	210.90	210.90	210.90
BUFFER	Existing Buffer Zones - Mesquite, Ironwood, Rabbitbush, Quailbush, Cat-claw Acacia, Palo Verde, and Creosote	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CTWWFOR	Existing Cottonwood-Willow Forests in the Active Channel	69.50	69.50	30.60	30.60	0.00	69.50	67.90	67.90	67.90	67.90
DESERT	Desert Areas - Bare Earth, Cacti, Rabbitbush, Acacia	961.90	961.90	931.90	931.90	931.90	961.90	457.00	457.00	457.00	457.00
DITCHES	Ditches	56.50	56.50	47.20	47.20	47.20	56.50	44.30	44.30	44.30	44.30
MESQUITE	Existing Mesquite Woodlands - on the Terraces and in the Active Channel	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10

Code	Description	Target Year - No Action Alternative					Target Year - Alternative F				
		2002	2008	2013	2033	2058	2002	2008	2013	2033	2058
		0	1	6	26	51	0	1	6	26	51
NEWBUFFER	Newly Developed Upland Buffer Zones - Mesquite, Ironwood, Rabbitbush, Quailbush, Cat-claw Acacia, Palo Verde, and Creosote	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NEWCWWFOR	Newly Developed Cottonwood-Willow Forests in the Active Channel	0.00	0.00	0.00	0.00	0.00	0.00	701.10	701.10	701.10	701.10
NEWMESQUIT	Newly Developed Mesquite Woodlands - on the Terraces and in the Active Channel	0.00	0.00	0.00	0.00	0.00	0.00	558.00	558.00	558.00	558.00
NEWOPENWAT	Newly Developed Open Water Areas in the Active Channel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NEWRVRBOTM	Newly Developed River Bottom Areas in the Active Channel - Largely Unvegetated (Includes Emergents)	0.00	0.00	0.00	0.00	30.60	0.00	602.90	602.90	602.90	602.90
NEWSCRUB	Newly Developed Scrub-Shrublands in the Active Channel	0.00	0.00	0.00	0.00	0.00	0.00	266.40	266.40	266.40	266.40

Code	Description	Target Year - No Action Alternative					Target Year - Alternative F				
		2002	2008	2013	2033	2058	2002	2008	2013	2033	2058
		0	1	6	26	51	0	1	6	26	51
OPENWATER	Existing Open Water Areas in the Active Channel - Inactive Sand and Gravel Operations	100.50	100.50	79.90	79.90	79.90	100.50	100.30	100.30	100.30	100.30
PARKS	Parks and Recreation Areas	9.60	9.60	9.60	9.60	9.60	9.60	9.60	9.60	9.60	9.60
RIVERBOTTM	Existing River Bottom Areas in the Active Channel - Largely Unvegetated (Includes Emergents)	334.60	334.60	216.30	216.30	216.30	334.60	271.40	271.40	271.40	271.40
SANDGRAVEL	Existing Sand and Gravel Operations/Extractions in the Active Channel	1651.60	1651.60	1621.60	1621.60	1621.60	1651.60	1099.20	1099.20	1099.20	1099.20
SCRUBSHRUB	Existing Scrub-Shrublands in the Active Channel - Rabbitbush, Quailbush, Ironwood, and Saltbush	2057.10	2057.10	2035.90	2035.90	2035.90	2057.10	1041.30	1041.30	1041.30	1041.30
SOILCEMENT	Existing Soil Cement Areas on the Slopes of the Active Channel	33.90	33.90	16.30	16.30	16.30	33.90	33.90	33.90	33.90	33.90

Code	Description	Target Year - No Action Alternative					Target Year - Alternative F				
		2002	2008	2013	2033	2058	2002	2008	2013	2033	2058
		0	1	6	26	51	0	1	6	26	51
URBAN	Existing Residential, Industrial and Transportation Avenues	341.60	341.60	629.80	629.80	629.80	341.60	341.00	341.00	341.00	341.00
	TOTALS:	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60

Table 5.3-2. Comparison of Habitat Types (Acres): No-Action Alternative and Alternative N

Code	Description	Target Year - No Action Alternative					Target Year - Alternative N				
		2002	2008	2013	2033	2058	2002	2008	2013	2033	2058
		0	1	6	26	51	0	1	6	26	51
AGCROP	Farms and Croplands - Dairy, Cotton, and Alfalfa	249.70	249.70	247.40	247.40	247.40	249.00	235.90	235.90	235.90	235.90
BUFFER	Existing Buffer Zones - Mesquite, Ironwood, Triangle Bursage, Quailbush, Cat-claw Acacia, Paloverde, and Creosote	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CTWWFOR	Existing Cottonwood-Willow Forests in the Active Channel	69.50	69.50	30.60	30.60	0.00	69.50	67.20	67.20	67.20	67.20
DESERT	Desert Areas - Bare Earth, Cacti, Rabbit brush, Triangle bursage, Acacia	961.90	961.90	931.90	931.90	931.90	961.90	393.40	393.40	393.40	393.40
DITCHES	Ditches	56.50	56.50	47.20	47.20	47.20	56.50	54.50	54.50	54.50	54.50
MESQUITE	Existing Mesquite Woodlands - on the Terraces and in the Active Channel	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10

Code	Description	Target Year - No Action Alternative					Target Year - Alternative N				
		2002	2008	2013	2033	2058	2002	2008	2013	2033	2058
		0	1	6	26	51	0	1	6	26	51
NEWBUFFER	Newly Developed Upland Buffer Zones - Mesquite, Ironwood, Triangle Bursage, Quailbush, Cat-claw Acacia, Paloverde, and Creosote	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NEWCWWFOR	Newly Developed Cottonwood-Willow Forests in the Active Channel	0.00	0.00	0.00	0.00	0.00	0.00	853.10	853.10	853.10	853.10
NEWMESQUIT	Newly Developed Mesquite Woodlands - on the Terraces and in the Active Channel	0.00	0.00	0.00	0.00	0.00	0.00	379.70	379.70	379.70	379.70
NEWOPENWAT	Newly Developed Open Water Areas in the Active Channel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NEWRVRBOTM	Newly Developed River Bottom Areas in the Active Channel - Largely Unvegetated (Includes Emergents)	0.00	0.00	0.00	0.00	30.60	0.00	331.80	331.80	331.80	331.80
NEWSCRUB	Newly Developed Scrub-Shrublands in the Active Channel	0.00	0.00	0.00	0.00	0.00	0.00	23.60	23.60	23.60	23.60

Code	Description	Target Year - No Action Alternative					Target Year - Alternative N				
		2002	2008	2013	2033	2058	2002	2008	2013	2033	2058
		0	1	6	26	51	0	1	6	26	51
OPENWATER	Existing Open Water Areas in the Active Channel - Inactive Sand and Gravel Operations	100.50	100.50	79.90	79.90	79.90	100.50	85.00	85.00	85.00	85.00
PARKS	Parks and Recreation Areas	9.60	9.60	9.60	9.60	9.60	9.60	9.60	9.60	9.60	9.60
RIVERBOTTM	Existing River Bottom Areas in the Active Channel - Largely Unvegetated (Includes Emergents)	334.60	334.60	216.30	216.30	216.30	334.60	274.40	274.40	274.40	274.40
SANDGRAVEL	Existing Sand and Gravel Operations/Extractions in the Active Channel	1651.60	1651.60	1621.60	1621.60	1621.60	1651.60	1252.60	1252.60	1252.60	1252.60
SCRUBSHRUB	Existing Scrub-Shrublands in the Active Channel - Triangle Bursage, Quailbush, Ironwood, and Saltbush	2057.10	2057.10	2035.90	2035.90	2035.90	2057.10	1545.90	1545.90	1545.90	1545.90
SOILCEMENT	Existing Soil Cement Areas on the Slopes of the Active Channel	33.90	33.90	16.30	16.30	16.30	33.90	33.10	33.10	33.10	33.10

Code	Description	Target Year - No Action Alternative					Target Year - Alternative N				
		2002	2008	2013	2033	2058	2002	2008	2013	2033	2058
		0	1	6	26	51	0	1	6	26	51
URBAN	Existing Residential, Industrial and Transportation Avenues	341.60	341.60	629.80	629.80	629.80	341.60	326.70	326.70	326.70	326.70
	Totals:	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60

Table 5.3-3. Comparison of Habitat Types (Acres): No-Action Alternative and Alternative O

Code	Description	Target Year - No Action Alternative					Target Year - Alternative O				
		2002	2008	2013	2033	2058	2002	2008	2013	2033	2058
		0	1	6	26	51	0	1	6	26	51
AGCROP	Farms and Croplands - Dairy, Cotton, and Alfalfa	249.7	249.7	247.4	247.4	247.4	249.7	235.9	235.9	235.9	235.9
BUFFER	Existing Buffer Zones - Mesquite, Ironwood, Rabbitbush, Quailbush, Cat-claw Acacia, Palo Verde, and Creosote	0	0	0	0	0	0	0	0	0	0
CTWWFOR	Existing Cottonwood-Willow Forests in the Active Channel	69.5	69.5	30.6	30.6	0	69.5	67.2	67.2	67.2	67.2
DESERT	Desert Areas - Bare Earth, Cacti, Rabbitbush, Acacia	961.9	961.9	931.9	931.9	931.9	961.9	393.4	393.4	393.4	393.4
DITCHES	Ditches	56.5	56.5	47.2	47.2	47.2	56.5	54.5	54.5	54.5	54.5
MESQUITE	Existing Mesquite Woodlands - on the Terraces and in the Active Channel	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
NEWBUFFER	Newly Developed Upland Buffer Zones - Mesquite, Ironwood, Rabbitbush, Quailbush, Cat-claw Acacia, Palo Verde, and Creosote	0	0	0	0	0	0	0	0	0	0
NEWCWWFOR	Newly Developed Cottonwood-Willow Forests in the Active Channel	0	0	0	0	0	0	883.4	883.4	883.4	883.4

Code	Description	Target Year - No Action Alternative					Target Year - Alternative O				
		2002	2008	2013	2033	2058	2002	2008	2013	2033	2058
		0	1	6	26	51	0	1	6	26	51
NEWMESQUIT	Newly Developed Mesquite Woodlands - on the Terraces and in the Active Channel	0	0	0	0	0	0	379.7	379.7	379.7	379.7
NEWOPENWAT	Newly Developed Open Water Areas in the Active Channel	0	0	0	0	0	0	0	0	0	0
NEWRVRBOTM	Newly Developed River Bottom Areas in the Active Channel - Largely Unvegetated (Includes Emergents)	0	0	0	0	30.6	0	425.1	425.1	425.1	425.1
NEWSCRUB	Newly Developed Scrub-Shrublands in the Active Channel	0	0	0	0	0	0	23.6	23.6	23.6	23.6
OPENWATER	Existing Open Water Areas in the Active Channel - Inactive Sand and Gravel Operations	100.5	100.5	79.9	79.9	79.9	100.5	85	85	85	85
PARKS	Parks and Recreation Areas	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
RIVERBOTTM	Existing River Bottom Areas in the Active Channel - Largely Unvegetated (Includes Emergents)	334.6	334.6	216.3	216.3	216.3	334.6	254.5	254.5	254.5	254.5
SANDGRAVEL	Existing Sand and Gravel Operations/Extractions in the Active Channel	1651.6	1651.6	1621.6	1621.6	1621.6	1651.6	1201	1201	1201	1201

Code	Description	Target Year - No Action Alternative					Target Year - Alternative O				
		2002	2008	2013	2033	2058	2002	2008	2013	2033	2058
		0	1	6	26	51	0	1	6	26	51
SCRUBSHRUB	Existing Scrub-Shrublands in the Active Channel - Rabbitbush, Quailbush, Ironwood, and Saltbush	2057.1	2057.1	2035.9	2035.9	2035.9	2057.1	1496.7	1496.7	1496.7	1496.7
SOILCEMENT	Existing Soil Cement Areas on the Slopes of the Active Channel	33.9	33.9	16.3	16.3	16.3	33.9	32	32	32	32
URBAN	Existing Residential, Industrial and Transportation Avenues	341.6	341.6	629.8	629.8	629.8	341.6	324.9	324.9	324.9	324.9
	TOTALS:	5870.6	5870.6	5870.6	5870.6	5870.6	5870.6	5870.6	5870.6	5870.6	5870.6

Table 5.3-4. Comparison of Habitat Types (Acres): No-Action Alternative and Alternative E

Code	Description	Target Year - No Action Alternative					Target Year - Alternative E				
		2002	2008	2013	2033	2058	2002	2008	2013	2033	2058
		0	1	6	26	51	0	1	6	26	51
GCROP	Farms and Croplands - Dairy, Cotton, and Alfalfa	249.70	249.70	247.40	247.40	247.40	249.70	238.20	238.20	238.20	238.20
BUFFER	Existing Buffer Zones - Mesquite, Ironwood, Triangle Bursage, Quailbush, Cat-claw Acacia, Paloverde, and Creosote	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CTWWFOR	Existing Cottonwood-Willow Forests in the Active Channel	69.50	69.50	30.60	30.60	0.00	69.50	69.30	69.30	69.30	69.30
DESERT	Desert Areas - Bare Earth, Cacti, Triangle Bursage, Acacia	961.90	961.90	931.90	931.90	931.90	961.90	359.20	359.20	359.20	359.20
DITCHES	Ditches	56.50	56.50	47.20	47.20	47.20	56.50	53.80	53.80	53.80	53.80
MESQUITE	Existing Mesquite Woodlands - on the Terraces and in the Active Channel	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10
NEWBUFFER	Newly Developed Upland Buffer Zones - Mesquite, Ironwood, Triangle Bursage, Quailbush, Cat-claw Acacia, Paloverde, and Creosote	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Code	Description	Target Year - No Action Alternative					Target Year - Alternative E				
		2002	2008	2013	2033	2058	2002	2008	2013	2033	2058
		0	1	6	26	51	0	1	6	26	51
NEWCWWFOR	Newly Developed Cottonwood-Willow Forests in the Active Channel	0.00	0.00	0.00	0.00	0.00	0.00	286.40	286.40	286.40	286.40
NEWMESQUIT	Newly Developed Mesquite Woodlands - on the Terraces and in the Active Channel	0.00	0.00	0.00	0.00	0.00	0.00	296.00	296.00	296.00	296.00
NEWOPENWAT	Newly Developed Open Water Areas in the Active Channel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NEWRVRBOTM	Newly Developed River Bottom Areas in the Active Channel - Largely Unvegetated (Includes Emergents)	0.00	0.00	0.00	0.00	30.60	0.00	340.80	340.80	340.80	340.80
NEWSCRUB	Newly Developed Scrub-Shrublands in the Active Channel	0.00	0.00	0.00	0.00	0.00	0.00	808.00	808.00	808.00	808.00
OPENWATER	Existing Open Water Areas in the Active Channel - Inactive Sand and Gravel Operations	100.50	100.50	79.90	79.90	79.90	100.50	84.90	84.90	84.90	84.90
PARKS	Parks and Recreation Areas	9.60	9.60	9.60	9.60	9.60	9.60	9.60	9.60	9.60	9.60
RIVERBOTTM	Existing River Bottom Areas in the Active Channel - Largely Unvegetated (Includes Emergents)	334.60	334.60	216.30	216.30	216.30	334.60	326.10	326.10	326.10	326.10

Code	Description	Target Year - No Action Alternative					Target Year - Alternative E				
		2002	2008	2013	2033	2058	2002	2008	2013	2033	2058
		0	1	6	26	51	0	1	6	26	51
SANDGRAVEL	Existing Sand and Gravel Operations/Extractions in the Active Channel	1651.60	1651.60	1621.60	1621.60	1621.60	1651.60	857.30	857.30	857.30	857.30
SCRUBSHRUB	Existing Scrub-Shrublands in the Active Channel - Rabbitbush, Quailbush, Ironwood, and Saltbush	2057.10	2057.10	2035.90	2035.90	2035.90	2057.10	1698.50	1698.50	1698.50	1698.50
SOILCEMENT	Existing Soil Cement Areas on the Slopes of the Active Channel	33.90	33.90	16.30	16.30	16.30	33.90	33.90	33.90	33.90	33.90
URBAN	Existing Residential, Industrial and Transportation Avenues	341.60	341.60	629.80	629.80	629.80	341.60	313.70	313.70	313.70	313.70
	TOTALS:	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60

Table 5.3-5. Comparison of Habitat Types (Acres): No-Action Alternative and Alternative A

Code	Description	Target Year - No Action Alternative					Target Year - Alternative A				
		2002	2008	2013	2033	2058	2002	2008	2013	2033	2058
		0	1	6	26	51	0	1	6	26	51
AGCROP	Farms and Croplands - Dairy, Cotton, and Alfalfa	249.70	249.70	247.40	247.40	247.40	249.70	243.80	243.80	243.80	243.80
BUFFER	Existing Buffer Zones - Mesquite, Ironwood, Triangle Bursage, Quailbush, Cat-claw Acacia, Paloverde, and Creosote	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CTWWFOR	Existing Cottonwood-Willow Forests in the Active Channel	69.50	69.50	30.60	30.60	0.00	69.50	69.30	69.30	69.30	69.30
DESERT	Desert Areas - Bare Earth, Cacti, Triangle Bursage, Acacia	961.90	961.90	931.90	931.90	931.90	961.90	613.10	613.10	613.10	613.10
DITCHES	Ditches	56.50	56.50	47.20	47.20	47.20	56.50	53.80	53.80	53.80	53.80
MESQUITE	Existing Mesquite Woodlands - on the Terraces and in the Active Channel	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10
NEWBUFFER	Newly Developed Upland Buffer Zones - Mesquite, Ironwood, Triangle Bursage, Quailbush, Cat-claw Acacia, Paloverde, and Creosote	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NEWCWWFOR	Newly Developed Cottonwood-Willow Forests in the Active Channel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NEWMESQUIT	Newly Developed Mesquite Woodlands - on the Terraces and in the Active Channel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NEWOPENWAT	Newly Developed Open Water Areas in the Active Channel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Code	Description	Target Year - No Action Alternative					Target Year - Alternative A				
		2002	2008	2013	2033	2058	2002	2008	2013	2033	2058
		0	1	6	26	51	0	1	6	26	51
NEWRVRBOTM	Newly Developed River Bottom Areas in the Active Channel - Largely Unvegetated (Includes Emergents)	0.00	0.00	0.00	0.00	30.60	0.00	152.30	152.30	152.30	152.30
NEWSCRUB	Newly Developed Scrub-Shrublands in the Active Channel	0.00	0.00	0.00	0.00	0.00	0.00	495.80	495.80	495.80	495.80
OPENWATER	Existing Open Water Areas in the Active Channel - Inactive Sand and Gravel Operations	100.50	100.50	79.90	79.90	79.90	100.50	100.50	100.50	100.50	100.50
PARKS	Parks and Recreation Areas	9.60	9.60	9.60	9.60	9.60	9.60	9.60	9.60	9.60	9.60
RIVERBOTTM	Existing River Bottom Areas in the Active Channel - Largely Unvegetated (Includes Emergents)	334.60	334.60	216.30	216.30	216.30	334.60	332.10	332.10	332.10	332.10
SANDGRAVEL	Existing Sand and Gravel Operations/Extractions in the Active Channel	1651.60	1651.60	1621.60	1621.60	1621.60	1651.60	1352.10	1352.10	1352.10	1352.10
SCRUBSHRUB	Existing Scrub-Shrublands in the Active Channel - Rabbitbush, Quailbush, Ironwood, and Saltbush	2057.10	2057.10	2035.90	2035.90	2035.90	2057.10	2057.10	2057.10	2057.10	2057.10
SOILCEMENT	Existing Soil Cement Areas on the Slopes of the Active Channel	33.90	33.90	16.30	16.30	16.30	33.90	33.90	33.90	33.90	33.90
URBAN	Existing Residential, Industrial and Transportation Avenues	341.60	341.60	629.80	629.80	629.80	341.60	353.10	353.10	353.10	353.10
	TOTALS:	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60	5870.60

5.3.2 ENVIRONMENTAL IMPACTS

5.3.2.1 No Action

Under the No-Action Alternative, riparian and wetland habitats would not be restored and immediate conditions would not change from those documented in baseline studies. Alternative O would result in no change, or possibly a decrease, in the AAFCUs available.

Impact: Long-Term Increase in Saltcedar and Decrease in Cottonwood/Willow Vegetation

The No-Action Alternative would result in a long-term increase in saltcedar. Cottonwood/willow habitat would be expected to decline. Though undesirable, this would still be considered a less-than-significant impact to biological resources in the project area.

Mitigation Measure: No mitigation required.

Impact: Long-Term Decrease in Wildlife Habitat

Implementation of the No-Action Alternative would result in long-term habitat degradation. The increase in saltcedar and decrease in cottonwood/willow habitat would diminish habitat values of vegetation available to riparian-obligate wildlife. The decline of cottonwood/willow habitat value would result in the eventual decrease of optimal habitat available to the southwestern willow flycatcher. However, saltcedar is utilized by southwestern willow flycatchers and its spread would constitute a less-than-significant impact.

Mitigation Measure: No mitigation required.

5.3.2.2 Alternative F

Alternative F would result in a substantial increase in the cottonwood/willow, new river bottom (including freshwater marsh), and open water communities compared to future conditions without the project (Figure 3-6). Alternative F would result in an expected increase of nearly 1,035 AAFCUs.

This alternative would substantially increase the habitat values of the area, including preventing the anticipated decrease in cottonwood/willow habitat and corresponding increase in saltcedar. This alternative would also result in the physical removal of non-native saltcedar habitat in areas where the new habitat cells would be created. On a long-term basis, a substantial improvement in vegetation communities in the area would result.

Impact: Substantial Short-Term Impacts on Vegetation

Implementation of Alternative F would also result in substantial short-term impacts on vegetation. The major disruption would be to saltcedar habitat, which would be removed in some areas. There is also the potential for other communities to be indirectly disturbed during grading and restoration. This would be a potentially significant impact but can be mitigated through the implementation of Mitigation Measure BR-1.

Mitigation Measure BR-1: Minimize Disturbance of Vegetation during Construction

During the final design of the project, disturbances to areas of existing vegetation that are not within the project footprint can be minimized through careful phasing of the project construction. Areas of desirable vegetation can be delineated on construction plans as areas that are not to be disturbed. Additionally, vegetation removal would occur outside of the spring breeding season (usually late January to early April) to ensure adequate time for a majority of the avian offspring to disperse prior to construction activities.

Impact: Substantial Increase in Wildlife Habitat

On a long-term basis, habitat value in the region would increase substantially. The primary benefit would be to riparian-obligate bird species due to increases in cottonwood/willow and mesquite communities. There would also be a substantial increase in habitat for shorebirds and waterfowl associated with the constructed wetlands. In addition, it is anticipated that amphibian species would benefit from implementation of Alternative F, and that this alternative would increase foraging habitat for raptors and mammalian carnivores. This is a beneficial impact.

Mitigation Measure: No mitigation required.

Impact: Short-Term Impact on Common Wildlife Species

Construction and restoration activities may have a potentially significant short-term impact on common wildlife. Of particular concern is the disruption of nesting and nesting habitat for riparian-obligate species. Even saltcedar, an exotic weed species proposed for removal, provides some nesting habitat for these species.

Noise and other construction activities may also tend to cause wildlife to avoid the area. Although the short-term effects may be considerable, with the exception of listed wildlife species, the species that would be affected are locally abundant and would only be displaced on a temporary basis. In addition, mitigation described below for listed wildlife species would also have benefits for common wildlife in the project study area. Therefore, this is not considered a significant impact.

Mitigation Measure BR-1: Minimize Disturbance of Vegetation during Construction

During the final design of the project, disturbances to areas of existing vegetation that are not within the project footprint can be minimized through careful phasing of the project construction. Areas of desirable vegetation can be delineated on construction plans as areas that are not to be disturbed. Additionally, vegetation removal would occur outside of the spring breeding season (usually late January to early April) to ensure adequate time for a majority of the avian offspring to disperse prior to construction activities.

Impact: Short-Term Impact on Habitat for Listed Species

Suitable habitat for the Yuma clapper rail is present adjacent to the SR 101/202 interchange. Surveys conducted in 2003 of the wetland habitat in this location did not detect the presence of clapper rails. Bald eagles are not known to nest in the project area; however, bald eagles foraging within the project area could experience short-term impacts due to the removal of vegetation used as cover and foraging habitat by bald eagle prey. This impact can be mitigated through the implementation of Mitigation Measure BR-1, which will be timed to occur during the bald eagle nesting season and when the likelihood of bald eagles foraging within the project area is decreased.

Tamarisk vegetation provides habitat for breeding populations of southwestern willow flycatchers and western yellow-billed cuckoos. While isolated patches of this type of vegetation are present within the project area, there are no known occurrences of breeding flycatchers or cuckoos within the project area (Corman pers. comm.). Removal of exotic tamarisk would not impact either of these two species.

Prior to construction, the Corps will reevaluate the suitability of vegetation communities located within the project area to support threatened and endangered species. If suitable habitat has developed that was not part of the original Section 7 consultation, the Corps will coordinate with USFWS to determine the necessity of of surveys.

Mitigation Measure BR-1: Minimize Disturbance of Vegetation during Construction

During the final design of the project, disturbances to areas of existing vegetation that are not within the project footprint can be minimized through careful phasing of the project construction. Areas of desirable vegetation can be delineated on construction plans as areas that are not to be disturbed. Additionally, vegetation removal would occur outside of the spring breeding season (usually late January to early April) to ensure adequate time for a majority of the avian offspring to disperse prior to construction activities.

Impact: Long-Term Increase in Habitat for Listed Wildlife Species

On a long-term basis, a substantial increase in nesting and foraging habitat for the southwestern willow flycatcher, the western yellow-billed cuckoo, and the Yuma clapper rail is anticipated. Implementation of Alternative F is also expected to increase potential habitat for the cactus ferruginous pygmy-owl and increase foraging habitat for sensitive raptor species such as the peregrine falcon and the bald eagle. A substantial beneficial impact on the sensitive species occurring or potentially occurring in the study area is expected in the long term.

Mitigation Measure: No mitigation required.

Impact: Potential Impact on Vegetation, Wildlife, and Sensitive Species during Long-Term O&M Activities

As described in Section 3.2.1.5, long-term maintenance activities would be needed to maintain flood protection capacity and retain the habitat values of the restored vegetation. The implementation of this alternative would result in increased habitat values and would create high-quality habitat for the southwestern willow flycatcher and the Yuma clapper rail. The O&M activities have the potential to affect the restored habitat and sensitive species. Channel and drainage maintenance, vector control, sediment removal from restoration features, and removal of saltcedar regrowth can produce potentially significant short-term impacts.

The greatest potentially significant impact would be the necessary removal of sediment from the open water and marsh habitat. Although this activity is necessary to maintain the habitat, there would be short-term loss of marsh vegetation and potential loss of Yuma clapper rail habitat. This activity may also disturb nesting southwestern willow flycatchers in cottonwood/willow habitat by creating substantial noise. Other activities may also create short-term disturbances to this habitat. Implementation of Mitigation Measure BR-2 would reduce these impacts to a less-than-significant level.

Mitigation Measure BR-2: Conduct Long-Term Maintenance Activities on a Rotating Basis and Only During Non-Nesting Periods

Sediment removal activities and other activities would only be conducted during non-nesting periods of the southwestern willow flycatcher, the yellow-billed cuckoo, and the Yuma clapper rail. In the case of sediment removal, these activities would be conducted on a rotating basis so that no more that 25% of the marsh area would be affected in any one year.

Impact: Short-Term Impacts on Waters of the United States

Alternative F would result in disturbance of waters of the United States during the construction phase as habitat areas located between the riverbanks. However, these areas would only be disturbed during the construction phase. Once constructed, these areas would gradually provide high-quality habitat to replace the existing degraded areas. No permanent loss of jurisdictional waters would occur; thus, this is not considered a significant impact.

Mitigation Measure: No mitigation required.

Impact: Short-Term Impacts on Waters of the United States during O&M Activities

O&M activities required to maintain the habitat cells and supporting features have the potential to affect jurisdictional waters within the project footprint. However, these effects would be short-term in duration and are required to ensure that the new habitat areas remain viable. Implementation of Mitigation Measure BR-3 would reduce this impact to a less-than-significant level.

Mitigation Measure BR-3: Minimize Disturbance to Waters of the United States

During O&M activities, care would be taken to minimize any necessary disturbance to waters of the United States and to ensure that such activities comply with the provisions of Section 404 of the Clean Water Act and its associated regulations.

5.3.2.3 Alternative N

As with Alternative F, Alternative N would result in a substantial increase in the cottonwood/willow, new river bottom (including freshwater marsh), and open water communities compared to future conditions without the project (Figure 3-6). This alternative would substantially increase the habitat values of the area, including preventing the anticipated decrease in cottonwood/willow habitat and the subsequent increase in saltcedar. This alternative would also result in the physical removal of non-native saltcedar habitat in areas where the new habitat cells would be created. As a result, an increase of nearly 913 AAFCUs is expected with the implementation of Alternative N. On a long-term basis, a substantial improvement in vegetation communities in the area would result.

Impact: Substantial Short-Term Impacts on Vegetation

As with Alternative F, implementation of Alternative N would also result in substantial short-term impacts on vegetation. The major disruption would be to saltcedar habitat, which would be removed in some areas. There is also the potential for other communities to be indirectly disturbed during grading and restoration. This would be a potentially significant impact but can be mitigated through the implementation of Mitigation Measure BR-1.

Mitigation Measure BR-1: Minimize Disturbance of Vegetation during Construction

See Alternative F for a description of this mitigation measure.

Impact: Substantial Increase in Wildlife Habitat

As with Alternative F, on a long-term basis, habitat value in the region would increase substantially. The primary benefit would be to riparian-obligate bird species due to increases in cottonwood/willow and mesquite communities. There would also be a substantial increase in habitat for shorebirds and waterfowl associated with the constructed wetlands. It is also anticipated that amphibian species would benefit from implementation of Alternative N, and that this alternative would increase foraging habitat for raptors and mammalian carnivores. This is a beneficial impact.

Mitigation Measure: No mitigation required.

Impact: Short-Term Impact on Common Wildlife Species

As with Alternative F, construction and restoration activities may have a potentially significant short-term impact on common wildlife. Of particular concern is the disruption of nesting and nesting habitat for riparian-obligate species. Even saltcedar, an exotic weed species proposed for removal, provides some nesting habitat for these species.

Noise and other construction activities may also tend to cause wildlife to avoid the area. Although the short-term effects would be considerable, with the exception of listed wildlife species, the species that would be affected are locally abundant and would only be displaced on a temporary basis. In addition, mitigation described below for listed wildlife species would also have benefits for common wildlife in the project study area. Therefore, this is not considered a significant impact.

Mitigation Measure BR-1: Minimize Disturbance of Vegetation during Construction

See Alternative F for a description of this mitigation measure.

Impact: Short-Term Impact on Habitat for Listed Species

Suitable habitat for the Yuma clapper rail is present adjacent to the SR 101/202 interchange. Surveys conducted in 2003 of the wetland habitat in this location did not detect the presence of clapper rails. Bald eagles are not known to nest in the project area; however, as with Alternative F, bald eagles foraging within the project area could experience short-term impacts due to the removal of vegetation used as cover and foraging habitat by bald eagle prey. This impact can be mitigated through the implementation of Mitigation Measure BR-1, which will be timed to occur during the bald eagle nesting season and when the likelihood of bald eagles foraging within the project area is decreased.

Tamarisk vegetation provides habitat for breeding populations of southwestern willow flycatchers and western yellow-billed cuckoos. While isolated patches of this type of vegetation are present within the project area, there are no known occurrences of breeding flycatchers or cuckoos within the project area (Corman pers. comm.). Removal of exotic tamarisk would not impact either of these two species.

Prior to construction, the Corps will reevaluate the suitability of vegetation communities located within the project area to support threatened and endangered species. If suitable habitat has developed that was not part of the original Section 7 consultation, the Corps will coordinate with USFWS to determine the necessity of of surveys.

Mitigation Measure BR-1: Minimize Disturbance of Vegetation during Construction

See Alternative F for a description of this mitigation measure.

Impact: Long-Term Increase in Habitat for Listed Wildlife Species

As with Alternative F, on a long-term basis, a substantial increase in nesting and foraging habitat for the southwestern willow flycatcher, the western yellow-billed cuckoo, and the Yuma clapper rail is anticipated. Implementation of Alternative N is also expected to increase potential habitat for the cactus ferruginous pygmy-owl and increase foraging habitat for sensitive raptor species such as the peregrine falcon and the bald eagle. A substantial beneficial impact on the sensitive species occurring or potentially occurring in the study area is expected in the long term.

Mitigation Measure: No mitigation required.

Impact: Potential Impact on Vegetation, Wildlife, and Sensitive Species during Long-Term O&M Activities

As described in Section 3.2.1.5, long-term maintenance activities would be needed to maintain flood protection capacity and retain the habitat values of the restored vegetation. The implementation of this alternative would result in increased habitat values and would create high-quality habitat for the southwestern willow flycatcher and the Yuma clapper rail. The O&M activities have the potential to affect the restored habitat and sensitive species. Channel and drainage maintenance, vector control, sediment removal from restoration features, and removal of saltcedar regrowth can produce potential short-term impacts.

The greatest potential impact would be the necessary removal of sediment from the open water and marsh habitat. Although this activity is necessary to maintain the habitat, there would be short-term loss of marsh vegetation and potential loss of Yuma clapper rail habitat. This activity may also disturb nesting southwestern willow flycatchers in cottonwood/willow habitat by creating substantial noise. Other activities may also create short-term disturbances to this habitat. However, implementation of Mitigation Measure BR-2 would reduce these impacts to a less-than-significant level.

Mitigation Measure BR-2: Conduct Long-Term Maintenance Activities on a Rotating Basis and Only During Non-Nesting Periods

See Alternative F for a description of this mitigation measure.

Impact: Short-Term Impacts on Waters of the United States

As with Alternative F, Alternative N would result in disturbance of waters of the United States during the construction phase as habitat areas located between the riverbanks. However, these areas would only be disturbed during the construction phase. Once constructed, these areas would gradually provide high-quality habitat to replace the existing degraded areas. No permanent loss of jurisdictional waters would occur; thus, this is not considered a significant impact.

Mitigation Measure: No mitigation required.

Impact: Short-Term Impacts on Waters of the United States during O&M Activities

As with Alternative F, O&M activities required to maintain the habitat cells and supporting features have the potential to affect jurisdictional waters within the project footprint. However, these effects would be short-term in duration and are required to ensure that the new habitat areas remain viable. Implementation of Mitigation Measure BR-3 would reduce this impact to a less-than-significant level.

Mitigation Measure: BR-3: Minimize Disturbance to Waters of the United States

See Alternative F for a description of this mitigation measure.

5.3.2.4 Alternative O (Preferred Alternative)

As with Alternative F, Alternative O would result in a substantial increase in the cottonwood/willow, new river bottom (including freshwater marsh), and open water communities compared to future conditions without the project. This alternative would substantially increase the habitat values of the area, including preventing the anticipated decrease in cottonwood/willow habitat and the subsequent increase in saltcedar. This alternative would also result in the physical removal of non-native saltcedar habitat in areas where the new habitat cells would be created. As a result, an increase of nearly 963 AAFCUs is expected with the implementation of Alternative O. On a long-term basis, a substantial improvement in vegetation communities in the area would result.

Impact: Substantial Short-Term Impacts on Vegetation

As with Alternative F, implementation of Alternative O would also result in substantial short-term impacts on vegetation. The major disruption would be to saltcedar habitat, which would be removed in some areas. There is also the potential for other communities to be indirectly disturbed during grading and restoration. This would be a potentially significant impact but can be mitigated through the implementation of Mitigation Measure BR-1.

Mitigation Measure BR-1: Minimize Disturbance of Vegetation during Construction

See Alternative F for a description of this mitigation measure.

Impact: Substantial Increase in Wildlife Habitat

As with Alternative F, on a long-term basis, habitat value in the region would increase substantially. The primary benefit would be to riparian-obligate bird species due to increases in cottonwood/willow and mesquite communities. There would also be a substantial increase in habitat for shorebirds and waterfowl associated with the constructed wetlands. It is also anticipated that amphibian species would benefit from implementation of Alternative O, and that this alternative would increase foraging habitat for raptors and mammalian carnivores. This is a beneficial impact.

Mitigation Measure: No mitigation required.

Impact: Short-Term Impact on Common Wildlife Species

As with Alternative F, construction and restoration activities may have a potentially significant short-term impact on common wildlife. Of particular concern is the disruption of nesting and nesting habitat for riparian-obligate species. Even saltcedar, an exotic weed species proposed for removal, provides some nesting habitat for these species.

Noise and other construction activities may also tend to cause wildlife to avoid the area. Although the short-term effects would be considerable, with the exception of listed wildlife species, the species that would be affected are locally abundant and would only be displaced on a temporary basis. In addition, mitigation described below for listed wildlife species would also have benefits for common wildlife in the project study area. Therefore, this is not considered a significant impact.

Mitigation Measure BR-1: Minimize Disturbance of Vegetation during Construction

See Alternative F for a description of this mitigation measure.

Impact: Short-Term Impact on Habitat for Listed Species

Suitable habitat for the Yuma clapper rail is present adjacent to the SR 101/202 interchange. Surveys conducted in 2003 of the wetland habitat in this location did not detect the presence of clapper rails. Bald eagles are not known to nest in the project area; however, as with Alternative N, bald eagles foraging within the project area could experience short-term impacts due to the removal of vegetation used as cover and foraging habitat by bald eagle prey. This impact can be mitigated through the implementation of Mitigation Measure BR-1, which will be timed to occur during the bald eagle nesting season and when the likelihood of bald eagles foraging within the project area is decreased.

Tamarisk vegetation provides habitat for breeding populations of southwestern willow flycatchers and western yellow-billed cuckoos. While isolated patches of this type of vegetation are present within the project area, there are no known occurrences of breeding flycatchers or cuckoos within the project area (Corman pers. comm.). Removal of exotic tamarisk would not impact either of these two species.

Prior to construction, the Corps will reevaluate the suitability of vegetation communities located within the project area to support threatened and endangered species. If suitable habitat has developed that was not part of the original Section 7 consultation, the Corps will coordinate with USFWS to determine the necessity of of surveys.

Mitigation Measure BR-1: Minimize Disturbance of Vegetation during Construction

See Alternative F for a description of this mitigation measure.

Impact: Long-Term Increase in Habitat for Listed Wildlife Species

As with Alternative F, on a long-term basis, a substantial increase in nesting and foraging habitat for the southwestern willow flycatcher, the western yellow-billed cuckoo, and the Yuma clapper rail is anticipated. Implementation of Alternative F is also expected to increase potential habitat for the cactus ferruginous pygmy-owl and increase foraging habitat for sensitive raptor species such as the peregrine falcon and the bald eagle. A substantial beneficial impact on the sensitive species occurring or potentially occurring in the study area is expected in the long term.

Mitigation Measure: No mitigation required.

Impact: Potential Impact on Vegetation, Wildlife, and Sensitive Species during Long-Term O&M Activities

As described in Section 3.2.1.5, long-term maintenance activities would be needed to maintain flood protection capacity and retain the habitat values of the restored vegetation. The implementation of this alternative would result in increased habitat values and would create high-quality habitat for the southwestern willow flycatcher and the Yuma clapper rail. The O&M activities have the potential to affect the restored habitat and sensitive species. Channel and drainage maintenance, vector control, sediment removal from restoration features, and removal of saltcedar regrowth can produce potential short-term impacts.

The greatest potential impact would be the necessary removal of sediment from the open water and marsh habitat. Although this activity is necessary to maintain the habitat, there would be short-term loss of marsh vegetation and potential loss of Yuma clapper rail habitat. This activity may also disturb nesting southwestern willow flycatchers in cottonwood/willow habitat by creating substantial noise. Other activities may also create short-term disturbances to this habitat. However, implementation of Mitigation Measure BR-2 would reduce these impacts to a less-than-significant level.

Mitigation Measure BR-2: Conduct Long-Term Maintenance Activities on a Rotating Basis and Only During Non-Nesting Periods

See Alternative F for a description of this mitigation measure.

Impact: Short-Term Impacts on Waters of the United States

As with Alternative F, Alternative O would result in disturbance of waters of the United States during the construction phase as habitat areas located between the riverbanks. However, these areas would only be disturbed during the construction phase. Once constructed, these areas would gradually provide high-quality habitat to replace the existing degraded areas. No permanent loss of jurisdictional waters would occur; thus, this is not considered a significant impact.

Mitigation Measure: No mitigation required.

Impact: Short-Term Impacts on Waters of the United States during O&M Activities

As with Alternative F, O&M activities required to maintain the habitat cells and supporting features have the potential to affect jurisdictional waters within the project footprint. However, these effects would be short-term in duration and are required to ensure that the new habitat areas remain viable. Implementation of Mitigation Measure BR-3 would reduce this impact to a less-than-significant level.

Mitigation Measure: BR-3: Minimize Disturbance to Waters of the United States

See Alternative F for a description of this mitigation measure.

5.3.2.5 Alternative E

Alternative E would result in impacts similar to Alternative F. A substantial increase in cottonwood/willow, new river bottom (including freshwater marsh), and open water communities is expected (Figure 3-7). The alternative would substantially increase habitat values of the area and limit the spread of saltcedar. An increase of nearly 926 AAFCUs would be expected with the implementation of Alternative E.

Impact: Substantial Short-Term Impacts on Vegetation

As with Alternative F, implementation of Alternative E would result in substantial short-term impacts on vegetation, including removal of saltcedar in some areas. Indirect disturbance of other communities during grading and restoration may be potentially significant but can be mitigated through Mitigation Measure BR-1.

Mitigation Measure BR-1: Minimize Disturbance of Vegetation during Construction

See Alternative F for a description of this mitigation measure.

Impact: Substantial Increase in Wildlife Habitat

As with Alternative F, habitat value in the region would increase substantially over the long term. The primary benefit would be to riparian-obligate bird species dues to increases in cottonwood/willow and mesquite communities. There will also be a substantial increase in habitat for shorebirds and waterfowl associated with the constructed wetlands. It is also anticipated that amphibians will benefit from implementation of this alternative. This alternative is also expected to increase foraging habitat for raptors and mammalian carnivores. This is a beneficial impact.

Mitigation Measure: No mitigation required.

Impact: Short-Term Impact on Common Wildlife Species

Construction and restoration activities may have a substantial short-term impact on common wildlife resources as described for Alternative F. Of particular concern is the short-term disruption of nesting and nesting habitat for riparian-obligate species. Even saltcedar, an exotic species proposed for removal, provides nesting habitat for these species. Noise and other construction activities may cause wildlife to avoid the area. With the exception of listed wildlife species, the species that would be affected are locally abundant and would only be displaced on a temporary basis; therefore, this is not considered a significant impact. Mitigation described below for listed wildlife species would also have benefits for common wildlife in the project study area.

Mitigation Measure BR-1: Minimize Disturbance of Vegetation during Construction

See Alternative F for a description of this mitigation measure.

Impact: Short-Term Impact on Habitat for Listed Wildlife Species

Suitable habitat for the Yuma clapper rail is present adjacent to the SR 101/202 interchange. Surveys conducted in 2003 of the wetland habitat in this location did not detect the presence of clapper rails. Bald eagles are not known to nest in the project area; however, as with Alternative O, bald eagles foraging within the project area could experience short-term impacts due to the removal of vegetation used as cover and foraging habitat by bald eagle prey. This impact can be mitigated through the implementation of Mitigation Measure BR-1, which will be timed to occur during the bald eagle nesting season when the likelihood of bald eagles foraging within the project area is decreased.

Tamarisk vegetation provides habitat for breeding populations of southwestern willow flycatchers and western yellow-billed cuckoos. While isolated patches of this type of vegetation are present within the project area, there are no known occurrences of breeding flycatchers or cuckoos within the project area (Corman pers. comm.). Removal of exotic tamarisk would not impact either of these two species.

Prior to construction, the Corps will reevaluate the suitability of vegetation communities located within the project area to support threatened and endangered species. If suitable habitat has developed that was not part of the original Section 7 consultation, the Corps will coordinate with USFWS to determine the necessity of of surveys.

Mitigation Measure BR-1: Minimize Disturbance of Vegetation During Construction

See Alternative F for a description of this mitigation measure.

Impact: Long-Term Increase in Habitat for Listed Wildlife Species

On a long-term basis, a substantial increase in habitat is anticipated for the southwestern willow flycatcher, the western yellow-billed cuckoo, and the Yuma clapper rail. Implementation of Alternative E would also increase potential habitat for the cactus ferruginous pygmy-owl and increase foraging habitat for sensitive raptor species such as the peregrine falcon and the bald eagle. A substantial beneficial impact on the sensitive species occurring or potentially occurring in the study area is expected in the long term.

Mitigation Measure: No mitigation required.

Impact: Potential Impact on Vegetation, Wildlife, and Sensitive Species during Long-Term O&M Activities

O&M activities have the potential to affect restored habitat and sensitive species as discussed for Alternative F. Removal of sediment from open water and marsh habitat would result in potential loss of Yuma clapper rail habitat and noise disturbance of nesting southwestern willow flycatchers. However, implementation of Mitigation Measure BR-2 would reduce these impacts to a less-than-significant level.

Mitigation Measure BR-2: Conduct Long-Term Maintenance Activities on a Rotating Basis and Only during Non-Nesting Periods

See Alternative F for a description of this mitigation measure.

Impact: Short-Term Impacts on Waters of the United States

As with Alternative F, Alternative E would result in disturbance of waters of the United States during the construction phase as habitat areas located between the riverbanks are constructed. However, these areas would only be disturbed during the construction phase. Once constructed, these areas would gradually provide high-quality habitat to replace the existing degraded areas. No permanent loss of jurisdictional waters would occur; therefore, this is not considered a significant impact.

Mitigation Measure: No mitigation required.

Impact: Short-Term Impacts on Waters of the United States during O&M Activities

As with Alternative F, O&M activities required to maintain the habitat cells and supporting features have the potential to affect jurisdictional waters within the project footprint. However, these effects would be short-term in duration and are required to ensure that the new habitat areas remain viable. This would not constitute a significant impact.

Mitigation Measure BR-3: Minimize Disturbance to Waters of the United States

See Alternative F for a description of this mitigation measure.

5.3.2.6 Alternative A

Implementation of Alternative A would result in a long-term increase in the cottonwood/willow, because of the removal of saltcedar (Figure 3-8). As with Alternative F, this alternative would increase the habitat values of the area, though not to the magnitude of the other alternatives. This alternative would, in affect, prevent an increase in saltcedar. An increase of nearly 373 AAFCUs is predicted with the implementation of Alternative A.

Impact: Substantial Short-Term Impacts on Vegetation

Potentially significant short-term impacts on vegetation would result under this alternative, as under Alternative F. Saltcedar habitat would be removed in some areas, and grading could indirectly disturb other communities. This impact can be mitigated through Mitigation Measure BR-1.

Mitigation Measure BR-1: Minimize Disturbance of Vegetation During Construction

See Alternative F for a description of this mitigation measure.

Impact: Increase in Wildlife Habitat

An increase in habitat value in the region is expected with Alternative A, as for the other action alternatives. Riparian-obligate bird species would benefit from the removal of saltcedar to allow for cottonwood/willow growth. This is a beneficial impact.

Mitigation Measure: No mitigation required.

Impact: Short-Term Impact on Common Wildlife Species

Construction and restoration would have a less-than-significant impact on common wildlife resources. The species that would be affected are locally abundant and would only be displaced on a temporary basis.

Mitigation Measure: No mitigation required.

Impact: Short-Term Impact on Habitat for Listed Species

Suitable habitat for the Yuma clapper rail is present adjacent to the SR 101/ 202 interchange. Surveys conducted in 2003 of the wetland habitat in this location did not detect the presence of clapper rails. Bald eagles are not known to nest in the project area; however, as with Alternative E, bald eagles foraging within the project area could experience short-term impacts due to the removal of vegetation used as cover and foraging habitat by bald eagle prey. This impact can be mitigated through the implementation of Mitigation Measure BR-1, which will be timed to occur during the bald eagle nesting season when the likelihood of bald eagles foraging within the project area is decreased.

Tamarisk vegetation provides habitat for breeding populations of southwestern willow flycatchers and western yellow-billed cuckoos. While isolated patches of this type of vegetation are present within the project area, there are no known occurrences of breeding flycatchers or cuckoos within the project area (Corman pers. comm.). Removal of exotic tamarisk would not impact either of these two species.

Prior to construction, the Corps will reevaluate the suitability of vegetation communities located within the project area to support threatened and endangered species. If suitable habitat has developed that was not part of the original Section 7 consultation, the Corps will coordinate with USFWS to determine the necessity of of surveys.

Mitigation Measure BR-1: Minimize Disturbance of Vegetation During Construction

See Alternative F for a description of this mitigation measure.

Impact: Long-Term Increase in Habitat for Listed Wildlife Species

Habitat for the southwestern willow flycatcher, the western yellow-billed cuckoo, and the Yuma clapper rail would increase over the long term, as with Alternative F. Implementation of Alternative A is also expected to increase potential habitat for the cactus ferruginous pygmy-owl and increase foraging habitat for sensitive raptors such as the peregrine falcon and bald eagle. Sensitive species occurring or potentially occurring in the study area would benefit over the long term.

Mitigation Measure: No mitigation required.

Impact: Potential Impact on Vegetation, Wildlife, and Sensitive Species during Long-Term O&M Activities

Maintenance activities to retain flood protection capacity and habitat values of the restored wetlands have the potential to affect restored habitat and sensitive species. Channel and drainage maintenance, vector control, sediment removal from restoration features, and removal of saltcedar regrowth can produce potential short-term impacts as described for Alternatives F, N, and E. Removal of sediment from open water and marsh habitat may result in loss of Yuma clapper rail habitat and disturbance of nesting southwestern willow flycatchers. However, implementation of Mitigation Measure BR-2 would reduce this impact to a less-than-significant level.

Mitigation Measure BR-2: Conduct Long-Term Maintenance Activities on a Rotating Basis and Only during Non-Nesting Periods.

See Alternative F for a description of this mitigation measure.

Impact: Short-Term Impacts on Waters of the United States

As with Alternative F, Alternative A would result in disturbance of waters of the United States during the construction phase as habitat areas located between the riverbanks are constructed. However, these areas would only be disturbed during the construction phase. Once constructed, these areas would gradually provide high-quality habitat to replace the existing degraded areas. No permanent loss of jurisdictional waters would occur; therefore, this is not considered a significant impact.

Mitigation Measure: No mitigation required.

Impact: Short-Term Impacts on Waters of the United States during O&M Activities

As with Alternative F, O&M activities required to maintain the habitat cells and supporting features have the potential to affect jurisdictional waters within the project footprint. However, these effects would be short-term in duration and are required to ensure that the new habitat areas remain viable. Implementation of Mitigation Measure BR-3 would reduce these impacts to a less-than-significant level.

Mitigation Measure BR-3: Minimize Disturbance to Waters of the United States

See Alternative F for a description of this mitigation measure.

5.4 CULTURAL RESOURCES

5.4.1 APPROACH AND METHODOLOGY

5.4.1.1 Significance Criteria

Adverse effects to sites and properties listed on, or eligible for inclusion in the National Register of Historic Places (NRHP) are evaluated based on the *Criteria of Adverse Effect* as outlined in 36 Code of Federal Regulations (CFR) 800.5 of the regulations implementing Section 106 of the National Historic Preservation Act (NHPA). These regulations were recently amended and became final in 2000. The *Criteria of Adverse Effect* are described as follows:

> An adverse effect is found when an undertaking may alter, directly or indirectly, the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative. Adverse effects on historic properties include, but are not limited to:
>
> (I) Physical destruction of or damage to all or part of the property; (ii) Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation and provision of handicapped access, that is not consistent with the Secretary's Standards for the Treatment of Historic Properties (36 CFR part 68) and applicable guidelines; (iii) Removal of the property from its historic location; (iv) Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance; (v) Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features; (vi) Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and (vii) Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

5.4.1.2 Coordination and Preliminary Archaeological Surveys

To meet the requirements of Section 106 of the NHPA, as implemented by 36 CFR 800, the Corps has conducted a records and literature search and field survey of the areas of potential effect for each of the project alternatives. NRHP evaluations have been made for some of the prehistoric and historic sites that have been identified. If any resources are determined to be NRHP eligible, and avoidance is not feasible, mitigation measures would be detailed in a Memorandum of Agreement (MOA) between the Corps, the SRPMIC, the City of Mesa, and the Arizona State Historic Preservation Officer (SHPO). Initial informal consultations with the SHPO have been initiated towards compliance with the NHPA.

Results of the archival studies and archeological surveys, along with the Corps' determinations of NRHP eligibility, will be sent to the Arizona SHPO for review and comment. If it is determined that the project will have an adverse effect on NRHP-listed or eligible properties, the Advisory Council on Historic Preservation will be afforded the opportunity to comment on the project in accordance with Section 106 of the NHPA.

All archival and archeological studies will be provided to the Salt River Pima-Maricopa Indian Community.

5.4.2 ENVIRONMENTAL IMPACTS

5.4.2.1 No Action

Implementation of the No-Action Alternative will not result in any direct impacts on cultural resources. It is probable, however, that sites may be disturbed or lost both by other human actions that are not project related and through natural processes such as erosion.

5.4.2.2 Alternative F

Activities involved in constructing features to accomplish ecosystem restoration under this alternative would involve ground disturbance to varying degrees, depending on specific location within the project area. Defined activities necessary for ecosystem restoration under this alternative include reshaping and grading for irrigation, planting of vegetation, river channelization, construction of grade control structures, and bank stabilization. All of these activities would have an adverse effect on NRHP sites.

Impact: Potential Disturbance or Loss of Properties Listed or Eligible for Listing on the National Register

The restoration activities described above would move artifacts, ecofactual materials, and features from their original provenance. This displacement would either destroy or significantly diminish the scientific value of any information potential, and hence adversely affect NRHP eligibility. Additionally, the newly planted vegetation would create adverse affects as the plants grow and develop root systems. Roots are a common form of archeological site disturbance (bioturbation). Increasing the levels of water in the soil would change the soil chemistry, and possibly increase the degradation of important perishable ecofactual remains.

Under Alternative F, several known cultural sites have the potential to be adversely affected. This represents a significant and unavoidable impact. The exact number is being updated based on recent survey and subsurface testing. This represents a significant and unavoidable impact if any of them are determined to be eligible for the NRHP. The list of NRHP sites to be affected may be reduced or eliminated as the design of the project is refined. There may be opportunities to incorporate site preservation into project plans that would result in beneficial effects to cultural sites. This might be accomplished by providing for avoidance and/or isolation from future human impacts.

Mitigation Measure CR-1: Ensure Compliance with Section 106 of National Historic Preservation Act

Compliance with Section 106 of the NHPA as implemented by 36 CFR 800 will potentially require additional field surveys, subsurface test excavations, and other studies. The results of all studies will be coordinated with the SHPO.

Mitigation Measure CR-2: Conclude Memorandum of Agreement to Complete Field Surveys and Conduct Testing and Data Recovery Activities as Appropriate

In the event that NRHP-eligible cultural resources cannot be avoided, an MOA shall be executed between the Corps, the SHPO, SRPMIC, and the City of Mesa. The MOA will detail the mitigation measures that will be implemented prior to construction.

Mitigation Measure CR-3: Monitor Construction Activities for Potential Impact on Cultural Resources

A qualified archeologist meeting the Secretary of the Interior's standards will monitor construction activities. In the event that previously unknown cultural resources are found, the Corps will comply with the procedures contained in 36 CFR 800.13(d).

5.4.2.3 Alternative N

Since Alternative N does not include channelization or bank stabilization, the area of potential effect for Alternative N is slightly smaller than the area of potential effect for Alternative F. Under this alternative, several cultural sites have the potential to be adversely affected. The exact number is being updated based on recent surface and subsurface testing. Impacts and mitigation measures that are discussed above under Alternative F would be applicable to this alternative. Implementation of Alternative N would still represent a significant and unavoidable impact to cultural resources in the project area, in the event that any of these sites are determined to be NRHP eligible.

5.4.2.4 Alternative O (Preferred Alternative)

Under Alternative O, potential effects are similar to Alternative N because the alternative does not include channelization or bank stabilization. Similar to Alternatives F and N, several cultural sites have the potential to be adversely affected. The exact number is being updated based on recent surface and subsurface testing. Impacts and mitigation measures that are discussed above under Alternative F would be applicable to this alternative. Implementation of Alternative O would still represent a significant and unavoidable impact to cultural resources in the project area, in the event that any of these sites are determined to be NRHP eligible.

5.4.2.5 Alternative E

The potential impacts of Alternative E to cultural resources are similar to, but slightly smaller than, the impacts of Alternatives F and N, since, due to a more limited work area, the area of potential effect is smaller. Under this alternative, several cultural sites have the potential to be adversely affected. The exact number is being updated based on recent surface and subsurface testing. This would still constitute a significant and unavoidable impact to cultural resources in the project area, in the event that any of these sites are determined to be NRHP eligible.

Impacts and mitigation measures that are discussed above under Alternative F would be applicable to this alternative.

5.4.2.6 Alternative A

Restoration activities under Alternative A are more limited in scope than under Alternatives F, N, and E, and would thus have the potential to affect fewer known cultural resources. Under this alternative, several cultural sites have the potential to be adversely affected. The exact number is being updated based on recent surface and subsurface testing. This would represent a significant and unavoidable impact to cultural resources in the project area, in the event that any of these sites are determined to be NRHP eligible.

Impacts and mitigation measures that are discussed above under Alternative F would also be applicable to this alternative.

5.4.3 COMMITMENTS

An archeological survey (surface and subsurface) of the entire project's area of potential effect has been conducted. If additional areas are needed at a later date, additional surveys would be required. If sites cannot be avoided by the project, evaluation studies regarding NRHP eligibility are required. Mitigation measures for any cultural resource listed or eligible for listing in the NRHP that will be affected by the proposed action will be negotiated with the Corps, the SRPMIC, the City of Mesa, and the SHPO, resulting in a Memorandum of Agreement. Mitigation measures will be implemented prior to construction.

All construction activities will be monitored by qualified archaeologists. If cultural resources are discovered during construction and cannot be avoided, work will be suspended in that area until the properties are evaluated for eligibility for listing in the NRHP in consultation with the Arizona SHPO. If the properties are determined to be eligible for the NRHP, the effects of the proposed construction will be taken into consideration in consultation with the SRPMIC, the City of Mesa, and the SHPO, and the SHPO will be provided the opportunity to comment in accordance with 36 CFR 800.13.

5.5 AESTHETIC RESOURCES

5.5.1 APPROACH AND METHODOLOGY

Impacts to aesthetic resources are evaluated based on the potential for permanent degradation to the scenic beauty of the project area. Long-term degradation, either as direct or indirect impact of the proposed project, would be considered a significant impact. Each action alternative includes features that would restore and enhance the river corridor. Incidental to the objectives of the project are the aesthetic improvements associated with restoration. Potential impacts were identified by qualitatively evaluating the project components for each of the alternatives against the existing aesthetic conditions within the project area.

5.5.2 ENVIRONMENTAL IMPACTS

5.5.2.1 No Action

Under the No-Action Alternative, the existing aesthetic environment would remain relatively unaffected, with the exception of natural changes occurring from flood events over time. With the No-Action Alternative, there would be no short-term impacts on aesthetic resources that are associated with construction activities. However, long-term aesthetic improvements would not be realized with this alternative.

5.5.2.2 Alternative F

Impact: Potential Short-Term Adverse Aesthetic Effects

This alternative involves excavation and grading in the river corridor; construction of diversion and grade control structures; installation of constructed wetlands; and development of cottonwood/willow, mesquite, and Sonoran Desert habitat. These temporary activities could result in impacts on the aesthetic quality of the area. Passersby on adjacent streets and the Red Mountain Freeway may experience temporary views of construction activities and construction equipment in the river corridor and nearby areas. However, there are relatively limited viewing/access points from adjacent roadways and construction activities would not appear to be much different to the casual observer than the current sand and gravel mining activities. The potential impacts from these construction-related activities would be less than significant. In addition, the long-term environmental and aesthetic benefits of the project would outweigh temporary adverse construction-related effects.

Mitigation Measure: No mitigation required.

Impact: Potential Long-Term Adverse Aesthetic Effects

This alternative includes diversion structures in several locations. The structures will require riprap or soil cement on the river side to provide necessary stability to the channel during flood events. These structures are generally located away from the edges of the project area, and the soil cement or riprap would be placed on the bank below the adjacent ground surface elevation. The diversion structures should not be highly visible from nearby areas and the view of the structures will be reduced as vegetation matures in the adjacent habitats. Thus, the installation of diversion structures is not considered a significant impact.

Mitigation Measure: No mitigation required.

Impact: Long-Term Aesthetic Benefits

The proposed action includes the restoration and enhancement of environmental resources in the Salt River. The project would include provision of open water and marsh habitat, cottonwood/willow riparian corridors, and constructed wetland areas. Additionally, removal of saltcedar, an invasive vegetation species, would improve habitat values and increase biodiversity in the project study area. Structural features associated with the proposed action would be visually softened with vegetation where possible.

Although the study area currently exists as passive open space, the proposed action would further improve the aesthetic quality. Additional riparian vegetation corridors, wetland and upland habitats, and increased wildlife would contribute to the aesthetic quality of the area. Long-term aesthetic improvements would result from restoration and enhancement efforts. This is considered a beneficial effect.

Mitigation Measure: No mitigation required.

5.5.2.3 Alternative N

The aesthetic impacts of Alternative N are similar to those described for Alternative F. The lack of bank stabilization elements would diminish potential short-term impacts from construction because of the reduced amount of grading. While there would be slightly less mesquite and cottonwood/willow habitat, the visual mosaic of habitats would be similar to Alternative F and ultimately be a long-term beneficial impact.

5.5.2.4 Alternative O (Preferred Alternative)

The aesthetic impacts of Alternative O are similar to those described for Alternative F. The lack of bank stabilization elements would diminish potential short-term impacts from construction because of the reduced amount of grading. While there would be slightly less mesquite and slightly more cottonwood/willow habitat, the visual mosaic of habitats would be similar to Alternative F. The additional cottonwood/willow habitat is primarily located in Reaches 1 and 2 at the west end of the project and would enhance the visual character on the vicinity of the

SR 101/202 interchange. As with Alternative F, the habitat restoration would ultimately be a long-term beneficial impact to the visual character of the area.

5.5.2.5 Alternative E

This alternative is similar to Alternative F with respect to aesthetics. Potential short-term impacts from construction would be diminished because of the reduced amount of grading and excavation. This alternative relies more heavily on the Sonoran Desert vegetation habitat, with a corresponding reduced emphasis on cottonwood/willow and wetland habitats. Long-term aesthetic quality will be enhanced by these restoration efforts.

5.5.2.6 Alternative A

Under Alternative A, aesthetic impacts would be limited to the central and eastern portions of the project area. There would be minimal short-term impacts from construction; however, the lack of diverse habitats such as cottonwood/willow and wetlands would somewhat diminish long-term aesthetic improvements. The existing aesthetic environment in the western portion of the project would remain relatively unaffected, with the exception of natural changes occurring from flood events over time. Although limited, restoration activities under this alternative are considered beneficial with regard to aesthetic values.

5.6 AIR QUALITY

5.6.1 APPROACH AND METHODOLOGY

Implementation of any of the proposed alternatives would generate construction-related emissions composed of fugitive dust from exposed disturbed soil, exhaust emissions produced by the use of heavy construction equipment, and exhaust emissions from construction worker commute trips. Operation and maintenance (O&M) of any alternative other than the No-Action Alternative would also generate exhaust and dust emissions from vehicles driven by workers and recreational visitors.

As discussed in Section 4.6, "Air Quality," federal projects must be evaluated to determine whether they conform to applicable state implementation plans (SIPs). Total project emissions of ozone precursors, carbon monoxide (CO), oxides of nitrogen (NOx), and fugitive dust (PM10) associated with each alternative are thus compared to *de minimis* thresholds. Air quality impacts would be considered significant if the proposed action results in exceeding any of these emission thresholds.

Detailed information on the methods and assumptions used to estimate air pollutant emissions is provided in Appendix G. To calculate construction and O&M emissions, emission factors developed by EPA's AP-42, *Compilation of Air Pollutant Emission Factors*, have been used to calculate exhaust and fugitive dust emissions. Calculations are also based on construction information provided in the feasibility study. The following types of air pollutant emission sources were included in the calculations:

- Fugitive dust emissions from haul trucks and passenger cars on unpaved roads were estimated based on the assumed number of vehicle trips and travel distance, using AP-42 emission factors applicable for the western United States. For the construction phases, it was assumed unpaved haul roads would be aggressively watered to reduce dust emissions. During restoration (revegetation) activities and normal maintenance subsequent to project completion, it was assumed the unpaved haul roads would not be watered.
- Fugitive dust emissions from excavating, loading, dumping, and spreading of bulk soil during channel excavation and bank stabilization were estimated based on the assumed earthwork volumes, using AP-42 emission factors for surface mining operations.
- Emissions from construction equipment tailpipes were estimated based on the type and number of equipment, using recent emission factors for off-road equipment.

5.6.2 ENVIRONMENTAL IMPACTS

5.6.2.1 No Action

Under the No-Action Alternative, no project-related construction activities would take place and no new construction-related commute trips would occur. Thus, no construction-related emissions would be generated. Recreational use of the site would likely remain about the same, with no increases in criteria emissions resulting from new recreational use of the Va Shly'ay Akimel site.

5.6.2.2 Alternative F

Impact: Generation of Construction-Related and Operational Tailpipe Emissions (ROG, NO_x and CO Emissions)

Construction and O&M activities would generate emissions of ozone precursors and CO in the form of tailpipe emissions. Construction emissions would originate from a combination of construction equipment activities, vegetation burning, material screening, and construction worker commute trips. O&M activities would generate emissions from recreational vehicle trips, employee trips, and a variety of maintenance activities.

Table 5.6-1 summarizes the estimated emissions associated with implementation of Alternative F. Annual emissions of reactive organic gases (ROG), NOx, and CO would be below federal conformity *de minimis* levels during each year of project construction and operation; thus, this impact is considered less than significant.

The construction contractor would be required to obtain appropriate air pollution permits for stationary processing equipment used for the project, as required under local air quality regulations.

Mitigation Measure: No mitigation is required.

Impact: Generation of Construction-Related and Operational Fugitive Dust (PM10) Emissions

Channel excavation and bank stabilization would generate PM10 as a component of tailpipe emissions from construction equipment and construction worker commute vehicles, as well as fugitive dust generated by activities at the construction site. O&M activities would also generate PM10 emissions.

Table 5.6-1 summarizes the estimated emissions that are associated with implementation of Alternative F. Annual PM10 emissions during the maximum construction year would be less than federal *de minimis* thresholds for General Conformity. As described by the detailed emission calculations provided in Appendix G, most of the PM10 emissions would be caused by fugitive dust generated by excavation of and spreading of riverbed material, and from haul trucks on unpaved roads.

The construction contractor would be required to obtain appropriate air pollution permits for stationary processing equipment (e.g., rock crushers and screens) as required under local air quality regulations. The contractors would also be required to implement stringent fugitive dust controls in accordance with Maricopa County Air Quality Rule 310.

As listed in Table 5.6-1, the estimated annual PM10 emissions during the restoration activities and long-term recreational usage would be less than the federal *de minimus* thresholds for General Conformity.

Implementation of Mitigation Measure AQ-1 would reduce these emissions and potential nuisance effects from dust to a less-than-significant level.

Mitigation Measure AQ-1: Implement PM10-Reducing Measures During Channel Excavation and Bank Stabilization

All construction activities would be required to include fugitive dust control measures in accordance with Maricopa County Air Quality Rule 310. The Corps would implement an appropriate combination of the following PM10-reducing construction practices throughout the construction period and during O&M activities:

- Apply water to unpaved haul roads at a frequency adequate to maintain visible surface moisture. Alternatively, apply nontoxic binders (e.g., latex acrylic copolymer) to supplement road watering.
- Minimize vehicle speed on unpaved roads.
- Water active storage piles at least twice daily.
- Cover inactive storage piles.
- Cover haul trucks securely or maintain at least 2 feet of freeboard on all haul trucks when transporting materials.
- Water all active construction sites at least twice daily. Frequency should be increased if wind speeds exceed 15 mph.
- Prohibit all grading activities during periods of high wind (i.e., winds greater than 30 mph).
- Apply nontoxic chemical soil stabilizers to inactive construction areas (i.e., disturbed lands within construction areas that are unused for at least 4 consecutive days), or water at least twice daily.
- Apply nontoxic binders (e.g., latex acrylic copolymer) to exposed areas after cut-and-fill operations and hydroseed the areas if appropriate for the project location.
- Install wheel washers for all exiting trucks.

- Sweep public streets serving the construction sites if visible soil material is carried onto adjacent public roads.

These practices would be made a condition of the construction contract and would be enforced through weekly inspection by the Corps.

5.6.2.3 Alternative N

Air quality impact mechanisms associated with construction of Alternative N would be similar to those occurring under Alternative F. However, the total quantities of emissions from channel excavation, bank stabilization, and riverbank restoration would be lower under Alternative N than they would be under Alternative F.

Impact: Generation of Construction-Related and Operational Tailpipe Emissions (ROG, NO_x and CO Emissions)

ROG, NOx, and CO emissions would be below federal conformity *de minimis* levels during each year of project construction and operation for Alternative N (Table 5.6-1). Therefore, this is not considered a significant impact.

Mitigation Measure: No mitigation is required.

Impact: Generation of Construction-Related and Operational Fugitive Dust (PM10) Emissions

Annual PM10 emissions during the maximum construction year would be less than *de minimus* thresholds for General Conformity (Table 5.6-1). Implementation of Mitigation Measure AQ-1 would reduce these emissions and limit potential nuisance effects from dust to a less-than-significant level.

Mitigation Measure AQ-1: Implement PM10-Reducing Measures During Channel Excavation and Bank Stabilization

See Alternative F for a description of this mitigation measure.

5.6.2.4 Alternative O (Preferred Alternative)

Air quality impact mechanisms associated with construction of Alternative N would be similar to those occurring under Alternative F. However, the total quantities of emissions from channel excavation, bank stabilization, and riverbank restoration would be less under Alternative O than they would be under Alternative F because Alternative O entails lower volumes of earthwork, haul truck usage, and commute travel.

Impact: Generation of Construction-Related and Operational Tailpipe Emissions (ROG, NO_x and CO Emissions)

ROG, NOx, and CO emissions would be below federal conformity *de minimis* levels during each year of project construction and operation for Alternative O (Table 5.6-1). Therefore, this is not considered a significant impact.

Mitigation Measure: No mitigation is required.

Impact: Generation of Construction-Related and Operational Fugitive Dust (PM10) Emissions

Annual PM10 emissions during the maximum construction year would be less than *de minimus* thresholds for General Conformity (Table 5.6-1). Implementation of Mitigation Measure AQ-1 would reduce these emissions and limit potential nuisance effects from dust to a less-than-significant level.

Mitigation Measure AQ-1: Implement PM10-Reducing Measures During Channel Excavation and Bank Stabilization

See Alternative F for a description of this mitigation measure.

5.6.2.5 Alternative E

Air quality impact mechanisms associated with construction of Alternative E would be similar to those occurring under Alternative F. However, the total quantities of emissions from channel excavation, bank stabilization, and riverbank restoration would be lower under Alternative E than they would be under Alternative F.

Impact: Generation of Construction-Related and Operational Tailpipe Emissions (ROG, NO_x and CO Emissions)

ROG, NOx, and CO emissions would be below federal conformity *de minimis* levels during each year of project construction and operation for Alternative E (Table 5.6-1). Therefore, this is not considered a significant impact.

Mitigation Measure: No mitigation is required.

Impact: Generation of Construction-Related and Operational Fugitive Dust (PM10) Emissions

Annual PM10 emissions during the maximum construction year would exceed *de minimus* thresholds for Alternative E (Table 5.6-1). Mitigation Measure AQ-1 would reduce these emissions and limit potential nuisance effects from dust to a less-than-significant level.

Mitigation Measure AQ-1: Implement PM10-Reducing Measures During Channel Excavation and Bank Stabilization

See Alternative F for a description of this mitigation measure.

5.6.2.6 Alternative A

Air quality impact mechanisms associated with construction of Alternative A would be similar to those under Alternative F. However, the total quantities of emissions from construction activities would differ (Table 5.6-1). Post-construction mobile source emissions would be the same as described for Alternative F.

Impact: Generation of Construction-Related and Operational Tailpipe Emissions (ROG, NO_x and CO Emissions)

ROG, NOx, and CO emissions would be below federal conformity *de minimis* levels during each year of project construction and operation for Alternative A. Therefore, this is not considered a significant impact.

Mitigation Measure: No mitigation is required.

Impact: Generation of Construction-Related and Operational Fugitive Dust (PM10) Emissions

Although PM10 emissions would be well below conformity thresholds under Alternative A (Table 5.6-1 on the following page), Mitigation Measure AQ-1 would further reduce these emissions and limit potential nuisance effects from dust to a less-than-significant level.

Mitigation Measure AQ-1: Implement PM10-Reducing Measures During Channel Excavation and Bank Stabilization

See Alternative F for a description of this mitigation measure.

Table 5.6-1. Estimated Annual Air Pollutant Emissions (tpy) Associated with Alternatives F, N, O, E, A

Pollutants of Concern	Max. Construction Year Channel Excavation, Bank Stabilization, and Wetlands Construction	Restoration and Maintenance	Long-Term Recreational Use	*De Minimus* Thresholds for General Conformity
Alternative F				
ROG	6	1	1	50
NOx	46	4	3	50
CO	41	6	32	100
PM10	40	8	48	70
Alternative N				
ROG	5	1	1	50
NOx	39	4	3	50
CO	44	5	32	100
PM10	24	5	48	70
Alternative O				
ROG	5	1	1	50
NOx	39	4	3	50
CO	44	5	32	100
PM10	23	5	48	70
Alternative E				
ROG	5	1	1	50
NOx	38	4	3	50
CO	40	5	32	100
PM10	26	5	48	70
Alternative A				
ROG	5	1	1	50
NOx	36	4	3	50
CO	36	5	32	100
PM10	10	3	48	70

Note: Assumptions used to estimate emissions are provided in Appendix G

5.7 NOISE

5.7.1 APPROACH AND METHODOLOGY

The evaluation of noise impacts is highly subjective. Therefore, determining the level of significance for noise impacts is highly dependent on the particular scope and location of the project. For the project area, noise impacts were considered significant if the ambient noise level was permanently raised to a detectable level as a result of the proposed project.

Noise impacts were analyzed using standard noise modeling methods. First, potential sources of noise were identified. Then, noise levels for each source were identified from standard references or monitoring data for similar sources. The distance from sources to noise-sensitive receptors was determined, and the projected sound level of sources at the receptor was calculated, taking into account attenuation factors such as distance and atmospheric effects. Resulting sound levels at receptors were compared to relevant sound level criteria to determine the relative magnitude of a noise effect.

For each of the project alternatives below, except for Alternative O (the Preferred Alternative), noise effects would occur during the construction phase of the selected alternative, during post-construction use of the site by recreationists in the form of increased traffic noise in the project study area, and during periodic O&M activities.

5.7.2 ENVIRONMENTAL IMPACTS

5.7.2.1 No Action

Under the No-Action Alternative, no changes to ambient noise conditions in the project study area would occur. No construction-related noise would be generated, no new project-related traffic would use area roadways, and there would be no follow-on maintenance. For these reasons, there would be no adverse noise impacts associated with this alternative.

5.7.2.2 Alternative F

Activities under this alternative include the creation of irrigation and drainage ditches, spillways, bank armors, constructed wetlands, a low-flow channel, a grade control structure west of Gilbert Road at the center point of the old Gilbert Quarry, and a water distribution channel. Many of the procedures would involve excavation, grading, and other heavy construction activities at multiple sites throughout the project area.

Impact: Exposure of Sensitive Land Uses to Construction Noise

Residential uses adjacent to or near the areas that would be subject to construction would be exposed to noise from construction activities. Typical equipment used during construction would include graders, loaders, rollers, bulldozers, trucks, scrapers, pumps, and generators.

Specific information on when and how long equipment would be used has not yet been determined. Table 5.7-1 on the following page summarizes typical noise emissions levels for construction equipment. A reasonable worst-case assumption is that the three loudest pieces of equipment would operate simultaneously and continuously over a 1-hour period. The combined sound level of three of the loudest pieces of equipment listed in Table 5.7-1 is 92 dBA L_{eq} measured at 50 feet. Table 5.7-2, which follows Table 5.7-1, assumes this combined source level, summarizes predicted noise levels at various distances from an active construction site. These estimations take into account distance attenuation, attenuation from molecular absorption, and anomalous excess attenuation.

The study area has moderate activity levels and several sources of adverse noise. The principle sources of noise in the study area are sand and gravel mining operations. This is the largest contributor to ambient noise in the area.

Table 5.7-1. Noise Emission Levels Typical for Construction Equipment

Equipment	Typical Noise Level (dBA) 50 feet from Source
Grader	85
Loader	85
Roller	75
Bulldozer	85
Truck	88
Scraper	89

dBA = A-weighted decibel scale.
Source: Federal Transit Administration 1995.

Automobiles traversing SR 202 and SR 101 are another contributor of ambient noise in the area. Traffic noise in the area may be characterized as moderately loud. Aircraft departing from and entering Phoenix Sky Harbor Airport contribute to the ambient noise in the study area. The airport is not within the immediate vicinity of the study area, though the study area runs generally parallel to the airport's takeoff and approach zone. However, because aircraft produce intense noise and pass over the area at relatively low altitudes, these aircraft are considered to be moderate noise sources. As indicated in Table 5.7-2, noise conditions at sensitive receptors would be increased in comparison to the 45 to 55 dBA L_{eq} ambient noise levels typical for this area.

Sensitive receptors for noise in the study area consist of residential uses located to the south of the river channel and a few scattered houses on the north side of the river channel. Some sensitive residential receptors are located within 1,000 feet of construction activities and would be exposed to noise levels over 64 dB. Most of these exposed sensitive sensors are also located within 1,000 feet of either the SR 202 corridor or existing sand and gravel operations, meaning that construction activities would not substantially increase detectable noise levels. The exception is that Reaches 4 and 5 are farther away from the SR 202 corridor (which is generally about 1 mile to the south) and are not near sand and gravel operations. In Reaches 4 and 5, noise levels of over 64 dB would likely be noticeable by nearby sensitive receptors.

Table 5.7-2. Estimated Construction Noise in the Vicinity of Active Construction Sites

Distance to Receptor (feet)	Sound Level at Receptor (dBA)
50	92
100	86
200	80
500	71
600	69
800	67
1,000	64
1,500	60
2,000	57
2,500	54
3,000	51
4,000	47
5,280	43
7,500	36

The following assumptions were used:

Basic sound level drop-off rate:	6.0 dB per doubling of distance
Molecular absorption coefficient:	0.7 dB per 1,000 feet
Anomalous excess attenuation:	1.0 dB per 1,000 feet
Reference sound level:	92 dBA
Distance for reference sound level:	50 feet

Note: This calculation does not include the effects, if any, of local shielding, which may reduce sound levels further.

Implementation of the following mitigation measure will reduce this impact to a less-than-significant level.

Mitigation Measure N-1: Employ Noise-Reducing Construction Measures

The Corps and their contractors shall incorporate the following measures into construction contract specifications:

- Construction within 1,000 feet of residences or other noise-sensitive uses shall be restricted to daytime hours. No construction shall be performed within 1,000 feet of an occupied dwelling on Sundays, on legal holidays, or between the hours of 7 p.m. and 7 a.m. on other days.
- All construction equipment shall have sound-control devices that are at least as effective as those devices provided on the original equipment. No equipment shall have an unmuffled exhaust.
- As directed by the Corps, the contractor shall implement appropriate additional noise mitigation, including, but not limited to, changing the location of stationary construction equipment, shutting off idling equipment, notifying adjacent residents in advance of construction work, and installing acoustic barriers around stationary construction noise sources.

Impact: Increased Traffic Noise in the Project Vicinity from Recreational Users

As described in Section 4.9, "Transportation," new vehicle trips in the project study area would be generated by recreational users traveling to visit the newly constructed site. The additional traffic would contribute to traffic noise conditions on roadways in the project study area. However, these trips would be distributed throughout a typical day and would not be concentrated during peak hours. Since expected recreation-related traffic represents a very small fraction of total traffic volume in the area, the contribution of project traffic to local noise conditions would not be considered significant.

Mitigation Measure: No mitigation is required.

Impact: Increased Noise from O&M Activities

Noise levels associated with O&M activities would be smaller in magnitude compared to noise described for initial construction activities. This noise would occur over a much shorter period of time and on an infrequent basis compared to initial construction. O&M noise would still have the potential to adversely affect sensitive receptors, but implementation of Mitigation Measure N-1 should reduce these impacts to a less-than-significant level.

Mitigation Measure N-1: Employ Noise-Reducing Construction Measures

Same as above.

5.7.2.3 Alterative N

Under Alternative N, construction-related noise associated with new construction would be similar to those described under Alternative F, since construction work would occur in nearly the same areas as in Alternative F. However, since bank stabilization and the associated heavy-construction activities are not present in Alternative N, the noise impacts would be less than for Alternative F. Post-construction noise effects from new traffic and O&M activities would likely be identical to the effects described for Alternative F. Implementation of the same mitigations as described for Alternative F would reduce these impacts to a less-than-significant level.

5.7.2.4 Alternative O (Preferred Alternative)

The construction-related noise associated with new construction under Alternative O would be similar to those described under Alternative F, since construction work would occur in nearly the same areas as in Alternative F. Post-construction noise effects from new traffic and O&M activities would likely be identical to the effects described for Alternative F. Implementation of the same mitigations as described for Alternative F would reduce these impacts to a less-than-significant level.

5.7.2.5 Alternative E

Under Alternative E, the noise impacts would be approximately the same as described under Alternative F since construction work would occur in nearly the same areas as in Alternative F. Post construction noise effects from new traffic and O&M activities would be identical to the effects described for Alternative F. Implementation of the same mitigations as described for Alternative F would reduce these impacts to a less-than-significant level.

5.7.2.6 Alternative A

Under Alternative A, construction-related noise associated with new construction would be similar to those described under Alternative F, since construction activities would occur within proximity of the same receptors and would involve the same type and quantity of construction equipment as in Alternative F. However, because the proposed construction footprint for Alternative A (approximately 650 acres) is less than a third the size of the proposed construction footprint for Alternative F (approximately 2,200 acres), the duration of construction activities and noise impacts would be less than that described for Alternative F. Post-construction noise effects from new traffic and O&M activities would be identical to the effects described for Alternative F. Implementation of the same mitigations as described for Alternative F would reduce these impacts to a less-than-significant level.

5.8 SOCIAL AND ECONOMIC RESOURCES

5.8.1 APPROACH AND METHODOLOGY

Impacts to social and economic resources are considered significant if implementation of the proposed action results in substantial changes to socioeconomic conditions, either directly or indirectly. Substantial changes are detectable increases (or decreases) to population, housing, employment or income. Potential impacts were determined by qualitatively evaluating the project components for each of the alternatives against the existing social and economic conditions within the project area. Also included in this section is a discussion on environmental justice, identifying the possible social equity concerns relating to potential impacts from the project.

5.8.2 ENVIRONMENTAL IMPACTS

5.8.2.1 No Action

Under the Alternative O, the existing social and economic resources would remain relatively unaffected, with the exception of natural changes occurring from flood events over time. With Alternative O, there would be no short-term impacts on social and economic resources that are associated with the restoration and enhancement of the river corridor. Long-term social and economic improvements would not be realized with this alternative.

5.8.2.2 Alternative F

Alternative F would not result in any significant direct or indirect impacts on social or economic resources such as population, housing, employment, or income in the area. The proposed project would not directly increase population or housing as there will be no construction of such features. No effects on employment would result from the project, as there would not be employment opportunities associated with construction of the project and it does not have the capacity to affect local or regional income levels. No impacts are anticipated.

5.8.2.3 Alternative N

Alternative N, like Alternative F, would not result in any significant direct potential effects on social or economic resources such as population, housing, employment, or income in the area. No impacts are anticipated.

5.8.2.4 Alternative O (Preferred Alternative)

Alternative O, like Alternative F, would not result in any significant direct potential effects on social or economic resources such as population, housing, employment, or income in the area. No impacts are anticipated.

5.8.2.5 Alternative E

Alternative E is similar to Alternative F with respect to social and economic resources. No impacts are anticipated.

5.8.2.6 Alternative A

Potential social and economic resource effects associated with Alternative A would be the same as described for Alternative F. No impacts are anticipated.

5.8.3 ENVIRONMENTAL JUSTICE

Project impacts were reviewed to determine whether low-income or minority neighborhoods would be disproportionately affected by the proposed action. The proposed action would not generate environmental justice impacts. Although low-income or minority neighborhoods are located in proximity to the project area, impacts would not be inequitably distributed to affect these neighborhoods to a greater degree than other neighborhoods. No impacts associated with social equity or environmental justice are anticipated.

5.9 TRANSPORTATION

5.9.1 APPROACH AND METHODOLOGY

Impacts to transportation were assessed based on how project-related construction and post-construction traffic would benefit or adversely affect existing traffic and roadway infrastructure. Impacts that increased or reduced transportation to a level where the safety or movement of people, goods, or services was impacted would be considered significant. For this analysis, it was assumed that there would be no permanent or temporary road closures associated with any of the alternatives, with the exception of occasional closures of unbridged crossings related to high flows in the main channel.

To determine impacts to transportation, traffic and circulation effects were evaluated and analyzed. The number of vehicle trips associated with construction workers commuting to the project site were based on estimates of labor hours. Furthermore, estimates of daily vehicle trips were developed using the following assumptions:

- Ten labor hours generate 1 person-round-trip.
- Each employee will commute 40 miles round trip per day.
- Vehicle occupancy rates are 1.1 people per vehicle.
- Construction activities occur year-round on approximately 200 days per year.
- An adequate supply of construction workers resides within a reasonable distance of the proposed project sites.

Because Sky Harbor Airport would not be affected by this project, no detailed analysis was performed related to this facility. Haul routes for construction equipment and materials were assumed to be either within the river channel or via local arterial streets to the freeways.

The vehicle trips per day, by alternative, are reflected in Table 5.9-1 below.

Table 5.9-1. Estimated Traffic Associated with Deliveries to the Project Area and with Commuting

Alternative	Commute Trips per Day	Haul Truck Trips per Day
F	25	144
N	15	86
O	15	86
E	15	46
A	10	16

5.9.2 ENVIRONMENTAL IMPACTS

5.9.2.1 No Action

Under the No-Action Alternative, traffic would continue to increase as the surrounding areas become more developed. The areas that will continue to grow are the SRPMIC to the north and residential and commercial infill in Mesa to the south. In addition, to accommodate the increase in traffic volumes, the roadways would continue to be widened, typically up to six lanes with a median and, at intersections, dual left-turn lanes and a right-turn lane.

There would be no short-term increases in traffic from construction, no accelerated damage to roadways from heavy vehicles, and no disruption of traffic from construction activities. No impacts on transportation would result under this alternative.

5.9.2.2 Alternative F

Activities under this alternative include the creation of irrigation and drainage ditches, spillways, bank armors, constructed wetlands, a low-flow channel, a grade control structure west of Gilbert Road, and a water distribution channel. While implementation of this alternative will not substantially contribute to area traffic, either in the construction phase or during periodic O&M activities, the potential for damage to roadways during both phases does exist.

Impact: Temporary Increase in Traffic on Existing Roadways during Project Construction

Under this alternative, 144 haul trips would occur per day to deliver materials from off-site to the project sites. Construction workers commuting to the project site would generate an additional 25 daily round trips dispersed on local arterial streets over a period of 5 years. The arterial streets have adequate capacity to accommodate this temporary, short-term increase in project-related traffic; thus, this impact is considered less than significant.

Mitigation Measure: No mitigation required.

Impact: Potential Damage to Roadway Surfaces during Project Construction

Increased truck traffic associated with construction activities could result in damage to the roadway surface on roadways used as haul routes. This is a potentially significant impact but avoidable with Mitigation Measure T-1 below.

Mitigation Measure T-1: Repair Damaged Roadways

The Corps or its contractors shall repair any damage to existing roadways caused as a result of construction activities for this project. Repair work shall be coordinated with the agencies having jurisdiction of each roadway, and with the intent to return the roadways to the conditions existing immediately prior to the commencement of the project.

Impact: Generation of Additional Vehicle Trips by Recreationists

The Va Shly'ay Akimel project area will become, upon completion of construction, a destination point for recreationists seeking various recreation opportunities. Expected vehicle trips were calculated based on the revised study prepared by the Va Shly'ay Akimel recreation technical committee (Table 5.9-2 below). It is assumed that 2.75 visitors arrive in each vehicle. Prime recreation time is defined as weekends and holidays, while nonprime time is weekdays. The greater number of recreationist trips, therefore, would occur during off-peak hours—outside the weekday commute times. No impacts are anticipated on traffic and circulation.

Mitigation Measure: No mitigation required.

Table 5.9-2. Estimated Traffic Associated with Recreational Use

Period	Daily Recreationist Trips (round trips)
Summer	
Prime	273
Non-prime	69
Winter	
Prime	409
Non-prime	137

Impact: Minor Temporary Traffic Effects Associated with Restoration and Maintenance Activities

Major construction will be followed by restoration-related activities such as clearing and grubbing, excavation, and preparation for planting. After vegetation establishment, periodic maintenance and monitoring of project features will continue to generate minor levels of traffic. Under Alternative F, approximately 500 annual haul truck trips directly associated with restoration/ revegetation would occur on unpaved roads (and 25 daily employee trips) during the first year. Installation of the irrigation network and revegetation may require the use of heavy equipment, but these activities would occur infrequently and over a brief period of time. In addition, many of the trips would occur within the channel rather than on public streets. Given the few trips on public streets, this impact is considered less than significant.

Mitigation Measure: No mitigation required.

5.9.2.3 Alternative N

Activities under this alternative would be similar to those described under Alternative F, but the lesser amount of construction activity associated with Alternative N would make for less potential damage to roadways.

Impact: Temporary Increase in Traffic on Existing Roadways during Project Construction

Under this alternative, 86 haul trips would occur per day to deliver materials from off-site to the project sites. Construction workers commuting to the project site would generate an additional 15 daily round trips on local arterial streets over a period of 5 years. The arterial streets have adequate capacity to accommodate this temporary, short-term increase in project-related traffic; thus, only minor changes in traffic conditions are expected under this alternative. This would not constitute a significant impact.

Mitigation Measure: No mitigation required.

Impact: Potential Damage to Roadway Surfaces during Project Construction

Increased truck traffic associated with construction activities could result in damage to the roadway surface on roadways used as haul routes. This is a potentially significant impact but avoidable with implementation of Mitigation Measure T-1.

Mitigation Measure T-1: Repair Damaged Roadways

See Alternative F for a description of this mitigation measure.

Impact: Generation of Additional Vehicle Trips by Recreationists

Recreational trips were assumed not to vary by alternative, so the effects of Alternative N would be the same as the effects of Alternative F.

Mitigation Measure: No mitigation required.

Impact: Minor Temporary Traffic Effects Associated with Restoration and Maintenance Activities

Major construction will be followed by restoration-related activities such as clearing and grubbing, excavation, and preparation for planting. After vegetation establishment, periodic maintenance and monitoring of project features will continue to generate minor levels of traffic. Under Alternative N, approximately 300 annual haul truck trips on unpaved roads (and 15 daily employee trips) would occur during the first year. Installation of the irrigation network and revegetation may require the use of heavy equipment, but these activities would occur infrequently and over a brief period of time. In addition, many of the trips would occur within the channel rather than on public streets. Given the few trips on public streets, this impact is considered less than significant.

Mitigation Measure: No mitigation required.

5.9.2.4 Alternative O (Preferred Alternative)

Activities under this alternative would be similar to those described under Alternative F, but the lesser amount of construction activity associated with Alternative O would make for less potential damage to roadways.

Impact: Temporary Increase in Traffic on Existing Roadways during Project Construction

Under this alternative, 86 haul trips would occur per day to deliver materials from off-site to the project sites. Construction workers commuting to the project site would generate an additional 15 daily round trips on local arterial streets over a period of 5 years. The arterial streets have adequate capacity to accommodate this temporary, short-term increase in project-related traffic; thus, only minor changes in traffic conditions are expected under this alternative. This would not constitute a significant impact.

Mitigation Measure: No mitigation required.

Impact: Potential Damage to Roadway Surfaces during Project Construction

Increased truck traffic associated with construction activities could result in damage to the roadway surface on roadways used as haul routes. This is a potentially significant impact but avoidable with implementation of Mitigation Measure T-1.

Mitigation Measure T-1: Repair Damaged Roadways

See Alternative F for a description of this mitigation measure.

Impact: Generation of Additional Vehicle Trips by Recreationists

Recreational trips were assumed not to vary by alternative, so the effects of Alternative O would be the same as the effects of Alternative F.

Mitigation Measure: No mitigation required.

Impact: Minor Temporary Traffic Effects Associated with Restoration and Maintenance Activities

Major construction will be followed by restoration-related activities such as clearing and grubbing, excavation, and preparation for planting. After vegetation establishment, periodic maintenance and monitoring of project features will continue to generate minor levels of traffic. Under Alternative O, approximately 300 annual haul truck trips on unpaved roads (and 15 daily employee trips) would occur during the first year. Installation of the irrigation network and revegetation may require the use of heavy equipment, but these activities would occur infrequently and over a brief period of time. In addition, many of the trips would occur within the channel rather than on public streets. Given the few trips on public streets, this impact is considered less than significant.

Mitigation Measure: No mitigation required.

5.9.2.5 Alternative E

Activities and, therefore, the traffic impacts of the activities would be similar to those occurring under Alternatives F, N, and O. The numbers of haul truck trips are approximately 46% lower than the numbers of haul truck trips for Alternative N, since the project characteristics for this alternative would not require that as many materials be brought in from off-site. The numbers of trips anticipated are the same for commute trips as in Alternatives N and O. The impacts are most similar to those for Alternative N.

Impact: Temporary Increase in Traffic on Existing Roadways during Project Construction

Under this alternative, 46 haul trips would occur per day to deliver materials from off-site to the project sites. Construction workers commuting to the project site would generate an additional 15 daily round trips on local arterial streets over a period of 5 years. The arterial streets have adequate capacity to accommodate this temporary, short-term increase in project-related traffic; thus, only minor changes in traffic conditions are expected under this alternative. This would not constitute a significant impact.

Mitigation Measure: No mitigation required.

Impact: Potential Damage to Roadway Surfaces during Project Construction

Increased truck traffic associated with construction activities could result in damage to the roadway surface on roadways used as haul routes. This is a potentially significant impact but avoidable with implementation of Mitigation Measure T-1.

Mitigation Measure T-1: Repair Damaged Roadways

See Alternative F for a description of this mitigation measure.

Impact: Generation of Additional Vehicle Trips by Recreationists

Recreational trips were assumed not to vary by alternative, so the effects of Alternative E would be the same as the effects of Alternative F.

Mitigation Measure: No mitigation required.

Impact: Minor Temporary Traffic Effects Associated with Restoration and Maintenance Activities

Major construction will be followed by restoration-related activities such as clearing and grubbing, excavation, and preparation for planting. After vegetation establishment, periodic maintenance and monitoring of project features will continue to generate minor levels of traffic. Under Alternative E, approximately 300 annual haul truck trips on unpaved roads (and 15 daily employee trips) would occur during the first year. Installation of the irrigation network and revegetation may require the use of heavy equipment, but these activities would occur infrequently and over a brief period of time. In addition, many of the trips would occur within the channel rather than on public streets. Given the few trips on public streets, this impact is considered less than significant.

Mitigation Measure: No mitigation required.

5.9.2.6 Alternative A

While the activities and, therefore, the traffic impacts of the activities would be similar to those occurring under Alternatives F, N, and E, the proposed construction footprint for Alternative A is less than a third the size of the footprint for Alternative F. The anticipated numbers of both construction worker commute trips and haul truck trips are less than under Alternatives F, N, and E.

Impact: Temporary Increase in Traffic on Existing Roadways during Project Construction

Under this alternative, 16 haul trips would occur per day to deliver materials from off-site to the project sites. Construction workers commuting to the project site would generate an additional 10 daily round trips on local arterial streets over a period of 1year. The arterial streets have adequate capacity to accommodate this temporary, short-term increase in project-related traffic; thus, only minor changes in traffic conditions are expected under this alternative. This would not constitute a significant impact.

Mitigation Measure: No mitigation required.

Impact: Potential Damage to Roadway Surfaces during Project Construction

Increased truck traffic associated with construction activities could result in damage to the roadway surface on roadways used as haul routes. This is a potentially significant impact but avoidable with implementation of Mitigation Measure T-1.

Mitigation Measure T-1: Repair Damaged Roadways

See Alternative F for a description of this mitigation measure.

Impact: Generation of Additional Vehicle Trips by Recreationists

Recreational trips were assumed not to vary by alternative, so the effects of Alternative A would be the same as the effects of Alternative F.

Mitigation Measure: No mitigation required.

Impact: Minor Temporary Traffic Effects Associated with Restoration and Maintenance Activities

Major construction will be followed by restoration-related activities such as clearing and grubbing, excavation, and preparation for planting. After vegetation establishment, periodic maintenance and monitoring of project features will continue to generate minor levels of traffic. Under Alternative A, approximately 200 annual dump truck trips on unpaved roads (and 10 daily employee trips) would occur during the first year. Installation of the irrigation network and revegetation may require the use of heavy equipment, but these activities would occur infrequently and over a brief period of time. In addition, many of the trips would occur within the channel rather than on public streets. Given the few trips on public streets, this impact is considered less than significant.

Mitigation Measure: No mitigation required.

5.10 LAND USE

5.10.1 APPROACH AND METHODOLOGY

Each of the alternatives includes a range of approaches to provide ecological restoration within the project study area. Potential impacts were identified by evaluating each of the alternatives against the existing land use patterns within the project study area. The alternatives were also analyzed regarding their compatibility with existing plans and policies that are relevant to the project area. Impacts that would result in inconsistencies with existing land use patterns or result in land being degraded so that it cannot be used for current or planned use were considered significant.

On the south side of the Salt River it is assumed that the possibility of direct effects upon land use should be considered for the lands where an alternative proposes any new construction. It is assumed that there is a possibility of indirect effects on the lands between the edge of new construction and SR 202. Because land uses south of SR 202 are set apart from those to the north due to the boundary effect of the highway, it is assumed that the project will have neither direct nor indirect land use effects south of SR 202.

On the north side of the Salt River it is assumed that the possibility of direct effects upon land use should be considered for the lands where an alternative proposes any new construction. It is assumed that there is a possibility of indirect effects on the lands between the edge of new construction and the outer boundary of the project area, 1 mile north of the river's thalweg. There is no boundary effect north of the Salt River comparable to that of SR 202 to the south.

5.10.2 ENVIRONMENTAL IMPACTS

5.10.2.1 No Action

Under the No-Action Alternative, land use conditions would stay substantially the same. There would be no short-term impacts from construction to affect adjacent land. Land use and planning policies to enhance and restore biological habitat and riparian areas and provide flood control and recreation opportunities in open space areas would not be fully realized.

5.10.2.2 Alternative F

To accomplish the construction required for the restoration of river-related habitat, activities under this alternative include the creation of irrigation and drainage ditches, spillways, bank armors, constructed wetlands, a low-flow channel, and a grade control structure west of Gilbert Road, and a water distribution channel. Nearby low-density development would experience temporary nuisance effects associated with noise, dust, aesthetics, and traffic, both during initial construction and occasional continued maintenance.

Impact: Temporary Adverse Effects on Land Use during Project Construction

The primary purpose of Alternative F is the restoration of river-related habitat to enhance environmental resources in the study area. The environmental restoration is expected to be beneficial and not have any substantial adverse effects; however, the nearby land uses in the study area could experience temporary adverse effects associated with construction activities. There is very limited development in the study area. Still, initial construction and occasional continued maintenance could disturb that development in the form of temporary nuisance effects of less than significant impact associated with noise, dust, aesthetics, and traffic. O&M activities would also create potential nuisance effects, but they are expected to be of less than significant impact because the activities would take place during brief periods and would affect only limited areas.

Mitigation Measure: No mitigation required.

Impact: Long-Term Beneficial Impact on Land Use Experience

While there is little existing development in the areas for which indirect effects on land use are being assessed, development will occur over the next several years both north and south of the Salt River. Considerable commercial development is expected at the SRPMIC, while some business park and general industrial development will take place in Mesa. The activities in the Salt River corridor, such as passive recreation, are beneficial and are cited in appropriate sections of this document. The absence of intensive land uses along the Salt River corridor is equally beneficial to the long-term prosperity of the area. The open space corridor will not contribute traffic, noise, limited vistas, or other effects of development, so it will make it easier for the area to absorb adjacent development.

Mitigation Measure: No mitigation required.

Impact: Compatibility with Land Use and Planning Policies of Local and Tribal Government Jurisdictions

As discussed in Section 4.10, "Land Use," in addition to the Corps having jurisdiction over the project, the project area falls within the boundaries of several local government jurisdictions, including Maricopa County, the City of Mesa, and the SRPMIC. The county and city plans governing land use and development within the respective jurisdictions incorporate relevant policies related to the following:

- a balance between conservation and development,
- protection and preservation of sensitive plant and wildlife habitat and riparian areas,
- establishment of sufficient trails, wildlife corridors, and other linear linkages between large open space areas,

- provision for adequate flood control under FEMA regulations,
- an interconnected open space system, and
- encouraging open space designs that promote integration with surrounding demographics and land uses, provide pedestrian connections to adjacent neighborhoods, and contribute to the neighborhood's character and identity.

Alternative F would have a beneficial impact due to its consistency with the goals and policies of the Maricopa County Comprehensive Plan and the City of Mesa General Plan. Specifically, Mesa's Parks and Recreation element in the General Plan contains a policy to encourage the preservation of significant natural areas such as the Salt River corridor to enhance their recreational and aesthetic value. This alternative would also have a beneficial impact due to its consistency with the SRPMIC plans for a cultural center on the north side of the river. The City of Mesa has an objective to coordinate open space plans, related improvements and implementation strategies with neighboring jurisdictions, stakeholders and user groups, and SRPMIC has similar objectives.

Mitigation Measure: No mitigation required.

5.10.2.3 Alternative N

Less overall construction activity is anticipated under Alternative N than Alternative F. While the effects would be of the same character as for Alternative F, they would be lesser in degree. Initial construction and occasional continued maintenance could disturb development in the form of temporary nuisance effects associated with noise, dust, aesthetics, and traffic. O&M activities would also create potential nuisance effects, but they are expected to be of less than significant impact because the activities would take place during brief periods and would affect only limited areas.

Impact: Temporary Adverse Effects on Land Use during Project Construction

Under Alternative N, temporary, less-than-significant impacts from construction activities will be substantially similar to those of Alternative F. There will be less river channelization than in Alternative F. More irrigation diversion structures will be constructed than for Alternative F. However, such activities will have minor effects upon surrounding land use.

Mitigation Measure: No mitigation required.

Impact: Long-Term Beneficial Effect on Land Use Experience

The long-term beneficial effect on land use will be similar to the effect of Alternative F. The slight differences in the vegetative mix between Alternatives F and N will have almost no effect and are unlikely to be apparent to most persons who frequent those portions of the project area beyond the immediate vicinity of new construction.

Mitigation Measure: No mitigation required.

Impact: Compatibility with Land Use and Planning Policies of Local and Tribal Government Jurisdictions

The compatibility with land use and planning policies will be similar to the effect of Alternative F. The many land use goals, objectives, and policies furthered by the proposed Va Shly'ay Akimel project will be advanced to the same degree despite subtle differences between Alternatives F and N.

Mitigation Measure: No mitigation required.

5.10.2.4 Alternative O (Preferred Alternative)

Less overall construction activity is anticipated under Alternative O than Alternative F. While the effects would be of the same character as for Alternative F, they would be lesser in degree. Initial construction and occasional continued maintenance could disturb development in the form of temporary nuisance effects associated with noise, dust, aesthetics, and traffic. O&M activities would also create potential nuisance effects, but they are expected to be of less than significant impact because the activities would take place during brief periods and would affect only limited areas.

Impact: Temporary Adverse Effects on Land Use during Project Construction

Under Alternative O, temporary, less-than-significant impacts from construction activities will be substantially similar to those of Alternative F. There will be less river channelization than in Alternative F. More irrigation diversion structures will be constructed than for Alternative F. However, such activities will have minor effects upon surrounding land use.

Mitigation Measure: No mitigation required.

Impact: Long-Term Beneficial Effect on Land Use Experience

The long-term beneficial effect on land use will be similar to the effect of Alternative F. The slight differences in the vegetative mix between Alternatives F and O will have almost no effect and are unlikely to be apparent to most persons who frequent those portions of the project area beyond the immediate vicinity of new construction.

Mitigation Measure: No mitigation required.

Impact: Compatibility with Land Use and Planning Policies of Local and Tribal Government Jurisdictions

The compatibility with land use and planning policies will be similar to the effect of Alternative F. The many land use goals, objectives, and policies furthered by the proposed Va Shly'ay Akimel project will be advanced to the same degree despite subtle differences between Alternatives F and O. The establishment of wetlands and cottonwood/willow on the north side of the channel at the far west of the project area can be an enhancement to the commercial development of the area by the Indian Community, with appropriate site design.

Mitigation Measure: No mitigation required.

5.10.2.5 Alternative E

Less overall construction activity is anticipated under Alternative E than Alternative F. The impacts are most similar to those for Alternative N. While the effects would be of the same character as for Alternative F, they would be lesser in degree. Initial construction and occasional continued maintenance could disturb development in the form of temporary nuisance effects associated with noise, dust, aesthetics, and traffic. O&M activities would also create potential nuisance effects, but they are expected to be of less than significant impact because the activities would take place during brief periods and would affect only limited areas.

Impact: Temporary Adverse Effects on Land Use during Project Construction

Under Alternative E, temporary, less-than-significant impacts from construction activities will be substantially similar to those of Alternative F. River channelization and WWTP diversion structures will be engineered for this alternative, in contrast to Alternative F. More irrigation diversion structures will be constructed than for Alternative F. However, such activities will have minor effects upon surrounding land use.

Mitigation Measure: No mitigation required.

Impact: Long-Term Beneficial Effect on Land Use Experience

The long-term beneficial effect on land use will be similar to the effect of Alternative F. The slight differences in the vegetative mix between Alternatives F and E will have almost no effect and are unlikely to be apparent to most persons who frequent those portions of the project area beyond the immediate vicinity of new construction.

Mitigation Measure: No mitigation required.

Impact: Compatibility with Land Use and Planning Policies of Local and Tribal Government Jurisdictions

The compatibility with land use and planning policies will be similar to the effect of Alternative F. The many land use goals, objectives, and policies furthered by the proposed Va Shly'ay Akimel project will be advanced to the same degree despite subtle differences between Alternatives F and E.

Mitigation Measure: No mitigation required.

5.10.2.6 Alternative A

While the activities and, therefore, the traffic impacts of the activities would be similar to those occurring under Alternatives F, N, and E, the proposed construction footprint for Alternative A is less than a third the size of the footprint for Alternative F. While the effects would be of the same character as for the other three alternatives, they would be lesser in degree than for any of the others. Initial construction and occasional continued maintenance could disturb development in the form of temporary nuisance effects associated with noise, dust, aesthetics, and traffic. O&M activities would also create potential nuisance effects, but they are expected to be of less than significant impact because the activities would take place during brief periods and would affect only limited areas.

Impact: Temporary Adverse Effects on Land Use during Project Construction

The temporary, less-than-significant impacts from construction activities will be somewhat less than those in Alternative F. While Alternative F comprises construction in Reaches 2 through 9, Alternative A calls for no activity in Reaches 2 through 4.

Mitigation Measure: No mitigation required.

Impact: Long-Term Beneficial Effect on Land Use Experience

Given that the western portion of the project area will have no activity, the surrounding land uses will not accrue any environmental, aesthetic, or recreational benefit from the project. The central portion of the project area will produce roughly the same land use benefit to surrounding areas as would Alternative F.

Mitigation Measure: No mitigation required.

Impact: Compatibility with Land Use and Planning Policies of Local and Tribal Government Jurisdictions

The compatibility with land use and planning policies will be similar to the effect of Alternative F, but the lack of restorative activities in the western portion of the area will advance the many land use goals, objectives, and policies furthered by the proposed Va Shly'ay Akimel project somewhat less, with subtle differences between Alternatives F and A.

Mitigation Measure: No mitigation required.

5.11 RECREATION

5.11.1 APPROACH AND METHODOLOGY

Potential impacts, both direct and indirect, to recreation resources were identified by evaluating each of the alternatives against existing recreational features within the project area. The alternatives were also analyzed regarding their compatibility with existing recreation plans and policies that are relevant to the project area. Impacts to recreation resources would be considered significant if the proposed project permanently alters recreational features in the project area, or if the proposed project anticipated outcome is found to be inconsistent with current recreation plans and/or policies.

5.11.2 ENVIRONMENTAL IMPACTS

5.11.2.1 No Action

Under the No-Action Alternative, recreational opportunities within the project area would remain substantially unchanged. There would be no short-term impacts from construction that would affect adjacent recreational activities. However, recreational experiences would also not be enhanced. Additionally, land use and planning policies to enhance and restore biological habitat and riparian areas and provide flood control and recreational opportunities in open space areas would not be realized.

5.11.2.2 Alternative F

Impact: Temporary Adverse Effects on Recreation during Project Construction

The primary purpose of Alternative F is the restoration of river-related habitat to enhance environmental resources in the project area. The environmental restoration is expected to be beneficial and not have any substantial adverse effects; however, the nearby recreation uses in the study area could experience temporary adverse effects associated with construction of restoration features and recreation facilties. Though there are very limited recreation uses in the study area, initial construction and occasional continued maintenance could preclude an ideal recreational experience by adversely affecting the character of the area. Disturbances could take the form of temporary nuisance effects associated with noise, dust, aesthetics, and traffic. O&M activities would also create potential nuisance effects, but they are expected to be minor because the activities would take place during brief periods and would affect only limited areas. Thus, impacts on recreation would be less than significant. These temporary adverse conditions are necessary to realize the long-term benefits of the project. These potential impacts are discussed in further detail in Sections 5.5, "Aesthetic Resources"; 5.6, "Air Quality"; 5.7, "Noise"; and 5.9, "Transportation."

Mitigation Measure: No mitigation required.

Impact: Long-Term Beneficial Effect on Recreational Experience

Incidental to the proposed restoration efforts of this alternative is the creation of valuable passive recreational opportunities. Although under the existing conditions there is very little recreation use in the area, the habitat restoration would create attractive open space that is conducive to the development of new recreational opportunities. The City of Mesa has identified a multi-use trail corridor along the Southern Canal in its Parks and Recreation Master Plan. The trail would be located toward the eastern end of the project site and could increase the potential for access and visitation to the Salt River by recreationists. The increase in passive open space through the implementation of Alternative F would enhance the overall experience of recreationists and O&M activities would maintain this benefit. This would be considered a long-term beneficial effect.

The proposed recreation options would enhance the long-term beneficial effects of the project through the development of multi-use trails and the Salt River Pima Maricopa Cultural Center. The cultural center would enhance the interpretive and education opportunities associated with the restoration of river habitat and SRPMIC culture. Each option would add multi-use trails in the western end of the project near the City of Mesa's recharge ponds that would connect to the City trail system under the Red Mountain Freeway. Recreation Option A would add a total of approximately 7.8 miles of multi-use trails and would also provide a connection to the City of Mesa trail along the Southern Canal n Reach 6. The effects of Option B would be somewhat reduced from Option A with a total of approximately 5.1 miles of multi-use trails. The trail on the south side of the river that would connect to the City trail along the Southern Canal would not be constructed and opportunities for connecting to the river area from the City's trail system would be reduced. Option C would significantly increase recreation opportunities with the development of approximately 13.6 miles of trails that would connect to the City trail on along the Southern Canal n Reach 6, and would also connect the cultural Center to the recharge ponds in the western end of the project with a trail along the southern side of the river.

Mitigation Measure: No mitigation required.

Impact: Compatibility with Land Use and Planning Policies of Local and Tribal Government Jurisdictions

As discussed in Section 4.11, "Recreation," in addition to the Corps having jurisdiction over the project, the project area falls within the boundaries of several local government jurisdictions, including Maricopa County, the City of Mesa, and the Salt River Pima-Maricopa Indian Community (SRPMIC). The Maricopa County and City of Mesa plans governing land use and development within the respective jurisdictions incorporate relevant policies related to the following:

- open space and natural resource conservation,
- biological habitat preservation and restoration,

- protection and enhancement of riparian areas,
- provision for adequate flood control,
- protection of water and groundwater resources, and
- provision for recreational use.

Alternative F would be consistent with the goals and policies of the Maricopa County Comprehensive Plan and the City of Mesa General Plan. Specifically, the conservation element of Mesa's general plan defines goals to preserve and enhance environmental resources and to accommodate recreational opportunities in the vicinity of the Salt River. This alternative, in conjunction with any of the proposed recreation options, would also be consistent with the SRPMIC plans for a cultural center on the north side of the river. Collaboration between the SRPMIC and the City of Mesa will help assure coordination of their recreation plans. Thus, this alternative would constitute a beneficial effect.

Mitigation Measure: No mitigation required.

5.11.2.3 Alternative N

Impact: Temporary Adverse Effects on Recreation during Project Construction

Temporary impacts from construction of restoration features and recreation facilties associated with Alternative N will be similar to those under Alternative F. Construction impacts would be somewhat reduced because of the lack of bank stabilization elements in this alternative. An old recharge site on the south side of the river in close proximity to River View Park and River View Golf Course will be converted to cottonwood/willow habitat. This site, located in Reach 1, north of SR 202, should require minimal disturbance activities. Construction activities for this area should not cause impacts above and beyond those associated with the rest of the project construction. The impacts on recreation under this alternative would be less than significant.

Mitigation Measure: No mitigation required.

Impact: Long-Term Beneficial Effect on Recreational Experience

Long-term beneficial effects of Alternative N, in conjunction with any of the proposed recreation options, will be substantially similar to those of Alternative F. Additional recreational benefits could be realized with the development of the cottonwood/ willow habitat in the old recharge site on the south side of the river in Reach 1. The beneficial effects are especially increased if recreation option C is selected, that would connect the recharge pond habitat to the cultural center. Alternative N includes higher amounts of Sonoran Desert vegetation and less cottonwood/willow than Alternative F, and could result in less wildlife diversity for recreation viewing.

Mitigation Measure: No mitigation required.

Impact: Compatibility with Land Use and Planning Policies of Local and Tribal Government Jurisdictions

Alternative N is compatible with the land use goals and policies of local government jurisdictions. The inclusion of cottonwood/willow habitat in the southern area of Reach 1 enhances recreation opportunities in the City of Mesa-owned parcel at the western end of the project area.

Mitigation Measure: No mitigation required.

5.11.2.4 Alternative O (Preferred Alternative)

Impact: Temporary Adverse Effects on Recreation during Project Construction

Temporary impacts from construction of restoration features and recreation facilties associated with Alternative O will be similar to those under Alternative F. Construction impacts would be somewhat reduced because of the lack of bank stabilization elements in this alternative. An old recharge site on the south side of the river in close proximity to River View Park and River View Golf Course will be converted to cottonwood/willow habitat. This site, located in Reach 1, north of SR 202, should require minimal disturbance activities. Construction activities for this area should not cause impacts above and beyond those associated with the rest of the project construction. The impacts on recreation under this alternative would be less than significant.

Mitigation Measure: No mitigation required.

Impact: Long-Term Beneficial Effect on Recreational Experience

Long-term beneficial effects of Alternative O, along with any of the recreation options would be substantially similar to Alternative F. Recreational and interpretive benefits would be realized with the development of the trail in association with the addition of cottonwood/ willow habitat in the old recharge site on the south side of the river in Reach 1. The multi-use trail in Reach 6, included in recreation options A and C, would allow trail users in other parts of the City of Mesa to access the restored habitat in the central portion of the project area.

Mitigation Measure: No mitigation required.

Impact: Compatibility with Land Use and Planning Policies of Local and Tribal Government Jurisdictions

Alternative O is compatible with the land use goals and policies of local government jurisdictions. The inclusion of cottonwood/willow habitat in the southern area of Reach 1 enhances recreation opportunities in the City of Mesa-owned parcel at the western end of the project area.

Mitigation Measure: No mitigation required.

5.11.2.5 Alternative E

Impact: Temporary Adverse Effects on Recreation during Project Construction

Under Alternative E, temporary impacts from construction of restoration features and recreation facilties will be substantially similar to those in Alternative F. The old recharge site identified in Alternative N will be converted to cottonwood/willow habitat in this alternative as well, but should require minimal disturbance activities. Impacts on recreation from this alternative not be above and beyond those associated with the rest of the project construction and would be less than significant.

Mitigation Measure: No mitigation required.

Impact: Long-Term Beneficial Effect on Recreational Experience

Long-term beneficial effects of Alternative E, with any of the recreation options, will be substantially similar to those of Alternative F. Additional recreation benefits could be realized with the development of the cottonwood/ willow habitat in the old recharge site on the south side of the river in Reach 1, especially when connected to the SRPMIC cultural center as in recreation option C. Alternative E includes higher amounts of Sonoran Desert vegetation and less cottonwood/willow than Alternative F, and could result in less wildlife diversity for recreation viewing.

Mitigation Measure: No mitigation required.

Impact: Compatibility with Land Use and Planning Policies of Local and Tribal Government Jurisdictions

Alternative E is compatible with the land use goals and policies of local government jurisdictions. The inclusion of cottonwood/willow habitat in the southern area of Reach 1 enhances recreation opportunities in the City of Mesa-owned parcel at the western end of the project area especially if recreation Option C is selected and the habitat is connected to the SRPMIC cultural center.

Mitigation Measure: No mitigation required.

5.11.2.6 Alternative A

Impact: Temporary Adverse Effects on Recreation during Project Construction

Temporary adverse impacts from construction of restoration features and recreation facilties would be reduced in Alternative A. There is no construction activity planned in the western area of the project area where two existing recreation facilities are located. Thus, there should be no impacts to recreation from this alternative.

Mitigation Measure: No mitigation required.

Impact: Long-Term Beneficial Effect on Recreational Experience

Long-term recreation benefits associated with Alternative A would be reduced in comparison to those of Alternative F. New habitat development is limited to Sonoran Desert vegetation types, which could lead to lower wildlife diversity and may attract fewer recreationists who would use the trail system in any of the recreation options.

Mitigation Measure: No mitigation required.

Impact: Compatibility with Land Use and Planning Policies of Local and Tribal Government Jurisdictions

While not in direct conflict with local land use plans and policies, the recreation aspects of Alternative A will not advance the recreation goals of the local government jurisdictions. With any of the recreation options, recreation development opportunities will be more limited because of the lack of restored river habitat to attract a wide variety of recreationists. The Cultural Center would be the primary recreation feature and with limited opportunities there could be less collaboration between local jurisdictions to coordinate recreation along the Salt River. Though Alternative A will not serve to promote compatibility in land use plans, this is not considered a significant adverse impact.

Mitigation Measure: No mitigation required.

5.12 PUBLIC HEALTH AND SAFETY

5.12.1 APPROACH AND METHODOLOGY

Public health and safety issues were identified by estimating the potential effects of each alternative against existing environmental conditions. Potential public health and safety issues in the project study area were also identified. For this analysis, impacts were considered significant if the public's health or safety would be adversely affected as a result of the proposed project. The Phase I Environmental Site Assessment, which is found in Appendix I, provides a detailed analysis of the proposed project area.

5.12.2 ENVIRONMENTAL IMPACTS

5.12.2.1 No Action

Under the No-Action Alternative, the potential health and safety benefits associated with the other alternatives would not be realized. Safety threats associated with flood hazards would continue to exist for properties within the floodplain. Benefits to soil and water quality would not occur. Mosquitoes are currently a potential problem in the area. Implementation of the No-Action Alternative would not provide vector control beyond existing levels and, thus, existing vector problems would persist.

5.12.2.2 Alternative F

Alternative F involves excavation and grading in the river corridor, construction of wetlands, development of cottonwood/willow, mesquite, and Sonoran desert habitat, and installation of various irrigation systems to support the new vegetation.

Impact: Potential for Breach and/or Damage to Landfill Closure Caps

The *Final Closure Report and Postclosure Maintenance Plan for the Tri-Cites Landfill and North Center Street Landfill* (CH2M HILL 1994) states that additional cover fill materials may be placed over the Tri-City Landfill and North Center Street Landfill caps to accommodate post-closure uses, but that the 18-inch barrier layer underlying the existing 12-inch vegetative soil layer must not be disturbed. Additionally, if fill materials are added it should be assumed that the extra weight of imported soil will hasten settlement of the waste buried beneath, which may necessitate more frequent maintenance to regrade the cover to prevent ponding of water on the surface and consequent infiltration. Under Alternative F, mesquite and xeric Sonoran Desert species would be planted on the terrace formed by the Tri-City Landfill. This vegetation would be irrigated using surface and storm water routed via the constructed Surface Braided Irrigation Network (SBIN). CH2M HILL's *Final Closure Report and Postclosure Maintenance Plan* states that trees or shrubs may be incorporated into future uses of the land, but that soil mounds and barrier layers should be created to prevent root systems from penetrating the closure cap barrier layer and releasing methane trapped within. Methane released by penetration of the barrier layer will kill the overlying vegetation. Finally, CH2M HILL specifies that any irrigation of new vegetation must be carefully regulated so as not to promote deep percolation and subsequent generation of leachate migrating to groundwater. Under Alternative F, none of the three remaining closed landfill sites are expected to receive or be impacted by newly planted vegetation. Implementation of the following mitigation measure would reduce the potential for breach or damage to the landfill closure caps to a less-than-significant level.

Mitigation Measure PHS-1: Redesign Vegetation Pallet for Landfill Closure Caps

The Corps should redesign the vegetation pallet for landfill cover to be limited to annual native grasses and herbaceous plants with shallow root systems. This plan should not include any species of trees or shrubs or columnar cactus, but may include cactus with shallow root systems. These plants should be hydroseeded and rely on minimal overhead irrigation for establishment. Implementation of this mitigation measure would obviate the potential for penetration of the landfill closure caps.

Impact: Addition of Cover Material on Tri-City Landfill May Cause Exceedance of Minimum Ground Clearance for Overhead Power Transmission Lines

Three sets of electrical transmission towers belonging to APS and SRP run generally northeast-southwest through the northern portion of the Tri-City Landfill. These towers must have a minimum ground clearance of 25 feet for the SRP lines and 23 feet for the APS lines. No overhead utility lines are present on the Cypress or North Center Street Landfills. Implementation of mitigation measure PHS-2 should eliminate any adverse effects to the power transmission towers, thus reducing this impact to a less-than-significant level.

Mitigation Measure PHS-2: Raise Power Transmission Poles to Maintain Minimum Ground Clearance

If additional cover materials to support new vegetation are placed around the APS or SRP power transmission poles that cross the Tri-City Landfill, the concrete encasements at the bases of the towers or poles would need to be raised to maintain the required minimum ground clearance.

Impact: Temporary Construction-Related Water Quality Impacts

Project-related construction activities in the river channel could cause temporary water quality impacts because disturbed and eroded soil, petroleum products, and miscellaneous construction wastes or unearthed waste debris may be discharged to receiving surface waters and groundwater. Soil and associated contaminants that enter stream channels can increase turbidity, stimulate the growth of algae, increase sedimentation of aquatic habitat, and introduce compounds that are toxic to aquatic organisms. Construction materials such as fuels, oils, paints, and concrete are potentially harmful to fish and other aquatic life if released into the environment. The extent of potential environmental effects depends on the erodibility of soil types encountered, the type of construction practice, the extent of the disturbed area and the duration of the disturbance, the timing of precipitation, and the proximity to drainage channels. Implementation of the following mitigation would reduce construction impacts to water quality to a less-than-significant level.

Mitigation Measure PHS-3: Implement Construction Site Management Practices

To minimize exposure of disturbed construction sites to rainfall and stormwater runoff, construction activities should be conducted in the dry weather season to the extent possible. The general contractor for the project will prepare and implement standard grading and erosion control measures (e.g., management, structural, and vegetative controls) to minimize exposure of soil that may contribute to contaminated runoff. Additionally, the contractor will complete the necessary paperwork to obtain an NPDES permit for construction-related projects. Best management practices (BMPs) must be implemented before predicted rain events. In addition, the construction contractor will implement standard hazardous materials management practices to reduce the possibility of chemical spills or releases of contaminants in runoff.

Impact: Potential for Temporary Increases in Mosquito Breeding following Irrigation Activities

If areas are not maintained and properly monitored, standing water may be present for a short time following heavy rainfall or irrigation in various portions of the project area. Such standing water may have the potential to cause temporary increases in mosquito breeding in the project area, although any potential increase is expected to be offset by the comprehensive removal throughout the project area of discarded tires and other waste that holds standing water and allows mosquitoes to breed. Implementation of the following mitigation measure would ensure this impact remains less than significant.

Mitigation Measure PHS-4: Coordinate O&M Vector Control Measures with SRPMIC, Other Local Governments and Agencies

The project design will consider mosquito control to the extent feasible to limit issues associated with mosquitoes. In concept, the new habitat and channels constructed as principal elements of this restoration project will cycle water through the habitat areas, rather than allow water to pool. Thus, the proposed project is likely to help inhibit mosquito breeding. The Corps will work with the SRPMIC and other local government jurisdictions and agencies to coordinate vector control measures for this project. Potential control measures may include adjusting water levels, biological controls, spraying, or other measures. These measures are proposed as part of post-construction O&M activities.

Impact: Beneficial Decrease in Illegal/Unauthorized Activities in the Project Area

Currently, a number of illegal or unauthorized activities occur in the project study area, primarily dumping of refuse, unauthorized firearm discharges, and short-term habitation of certain portions of the project study area by transient persons. After this project is completed, increased use of the area by recreationists and maintenance staff would tend to decrease illegal activities in the area because of increased patrolling of the area by the city and use by the public. Project lands will be acquired by local and tribal jurisdictions, who will become responsible for policing these areas and protecting recreationists from illegal activities. This is a beneficial impact.

Mitigation Measure: No mitigation required.

5.12.2.3 Alternative N

Under Alternative N, the terrace formed by the Tri-City Landfill (in Reach 4) would not be revegetated, although a narrow strip of cottonwood/willow would be established along the north bank of the Salt River channel near this landfill. The ground clearance of existing APS and SRP power transmission lines would be unaffected. Further downstream, in Reach 2, it is proposed that cottonwood/willow and mesquite be established along the north bank of river channel southwest of the Cypress Golf Course. This newly planted vegetation would be maintained over time by water via an SBIN, with additional water possibly (if it is determined to be of sufficient quality) being supplied by the golf course.

Impact: Temporary Construction-Related Water Quality Impacts

Project-related construction activities in the river channel could cause temporary water quality impacts because disturbed and eroded soil, petroleum products, and miscellaneous construction wastes or unearthed waste debris may be discharged to receiving surface waters and groundwater. Soil and associated contaminants that enter stream channels can increase turbidity, stimulate the growth of algae, increase sedimentation of aquatic habitat, and introduce compounds that are toxic to aquatic organisms. Construction materials such as fuels, oils, paints, and concrete are potentially harmful to fish and other aquatic life if released into the environment. The extent of potential environmental effects depends on the erodibility of soil types encountered, the type of construction practice, the extent of the disturbed area and the duration of the disturbance, the timing of precipitation, and the proximity to drainage channels. Implementation of the following mitigation would reduce construction impacts to water quality to a less-than-significant level.

Mitigation Measure PHS-3: Implement Construction Site Management Practices

See Alternative F for a description of this mitigation measure.

Impact: Potential for Temporary Increases in Mosquito Breeding following Irrigation Activities

If areas are not maintained and properly monitored, standing water may be present for a short time following heavy rainfall or irrigation in various portions of the project area. Such standing water may have the potential to cause temporary increases in mosquito breeding in the project area, although any potential increase is expected to be offset by the comprehensive removal throughout the project area of discarded tires and other waste that holds standing water and allows mosquitoes to breed. Implementation of the following mitigation measure would ensure this impact remains less than significant.

Mitigation Measure PHS-4: Coordinate O&M Vector Control Measures with SRPMIC, Other Local Governments and Agencies

See Alternative F for a description of this mitigation measure.

Impact: Beneficial Decrease in Illegal/Unauthorized Activities in the Project Area

Currently, a number of illegal or unauthorized activities occur in the project study area, primarily dumping of refuse, unauthorized firearm discharges, and short-term habitation of certain portions of the project study area by transient persons. After this project is completed, increased use of the area by recreationists and maintenance staff would tend to decrease illegal activities in the area because of increased patrolling of the area by the city and use by the public. Project lands will be acquired by local and tribal jurisdictions, who will become responsible for policing these areas and protecting recreationists from illegal activities. This is a beneficial impact.

Mitigation Measure: No mitigation required.

5.12.2.4 Alternative O (Preferred Alternative)

Under Alternative O, the terrace formed by the Tri-City Landfill (in Reach 4) would not be revegetated, although a narrow strip of cottonwood/willow would be established along the north bank, at the edge of the main channel. The ground clearance of existing APS and SRP power transmission lines would be unaffected. Further downstream, in Reach 2, it is proposed that cottonwood/willow be established along the north bank of river channel southwest of the Cypress Golf Course. This newly planted vegetation would be maintained over time by water via an SBIN, with additional water possibly (if it is determined to be of sufficient quality) being supplied by the golf course.

Impact: Temporary Construction-Related Water Quality Impacts

Project-related construction activities in the river channel could cause temporary water quality impacts because disturbed and eroded soil, petroleum products, and miscellaneous construction wastes or unearthed waste debris may be discharged to receiving surface waters and groundwater. Soil and associated contaminants that enter stream channels can increase turbidity, stimulate the growth of algae, increase sedimentation of aquatic habitat, and introduce compounds that are toxic to aquatic organisms. Construction materials such as fuels, oils, paints, and concrete are potentially harmful to fish and other aquatic life if released into the environment. The extent of potential environmental effects depends on the erodibility of soil types encountered, the type of construction practice, the extent of the disturbed area and the duration of the disturbance, the timing of precipitation, and the proximity to drainage channels. Implementation of the following mitigation would reduce construction impacts to water quality to a less-than-significant level.

Mitigation Measure PHS-3: Implement Construction Site Management Practices

See Alternative F for a description of this mitigation measure.

Impact: Potential for Temporary Increases in Mosquito Breeding following Irrigation Activities

If areas are not maintained and properly monitored, standing water may be present for a short time following heavy rainfall or irrigation in various portions of the project area. Such standing water may have the potential to cause temporary increases in mosquito breeding in the project area, although any potential increase is expected to be offset by the comprehensive removal throughout the project area of discarded tires and other waste that holds standing water and allows mosquitoes to breed. Implementation of the following mitigation measure would ensure this impact remains less than significant.

Mitigation Measure PHS-4: Coordinate O&M Vector Control Measures with SRPMIC, Other Local Governments and Agencies

See Alternative F for a description of this mitigation measure.

Impact: Beneficial Decrease in Illegal/Unauthorized Activities in the Project Area

Currently, a number of illegal or unauthorized activities occur in the project study area, primarily dumping of refuse, unauthorized firearm discharges, and short-term habitation of certain portions of the project study area by transient persons. After this project is completed, increased use of the area by recreationists and maintenance staff would tend to decrease illegal activities in the area because of increased patrolling of the area by the city and use by the public. Project lands will be acquired by local and tribal jurisdictions, who will become responsible for policing these areas and protecting recreationists from illegal activities. This is a beneficial impact.

Mitigation Measure: No mitigation required.

5.12.2.5 Alternative E

Under Alternative E, mesquite would be established in Reach 4 on the terrace formed by the closed Tri-City Landfill, which would be irrigated using surface water or stormwater redirected from the Evergreen Drain via an SBIN. In other respects, Alternative E is substantially similar to Alternatives F, N, and O in terms of public health and safety.

Impact: Potential for Breach and/or Damage to Landfill Closure Caps

The existing 12-inch vegetative soil layer on the Tri-City Landfill is insufficient to sustain mesquite; planting of mesquite at this location would quickly lead to penetration of the landfill closure cap. In addition, the saturated soil conditions 1–3 feet below the surface that mesquite require could not be provided, even with the addition of soil, without increasing the potential for irrigation water percolating down through the buried waste and possibly contaminating groundwater. Implementation of mitigation measure PHS-1 would obviate the potential for penetration of the landfill closure caps, thus reducing this impact to a less-than-significant level.

Mitigation Measure PHS-1: Redesign Vegetation Pallet for Landfill Closure Caps

See Alternative F for a description of this mitigation measure.

Impact: Addition of Cover Material on Tri-City Landfill May Cause Exceedance of Minimum Ground Clearance for Overhead Power Transmission Lines

Three sets of electrical transmission towers belonging to APS and SRP run generally northeast-southwest through the northern portion of the Tri-City Landfill. These towers must have a minimum ground clearance of 25 feet for the SRP lines and 23 feet for the APS lines. No overhead utility lines are present on the Cypress or North Center Street Landfills. Implementation of mitigation measure PHS-2 should eliminate any adverse effects to the power transmission towers, thus reducing this impact to a less-than-significant level.

Mitigation Measure PHS-2: Raise Power Transmission Poles to Maintain Minimum Ground Clearance

See Alternative F for a description of this mitigation measure.

Impact: Temporary Construction-Related Water Quality Impacts

Project-related construction activities in the river channel could cause temporary water quality impacts because disturbed and eroded soil, petroleum products, and miscellaneous construction wastes or unearthed waste debris may be discharged to receiving surface waters and groundwater. Soil and associated contaminants that enter stream channels can increase turbidity, stimulate the growth of algae, increase sedimentation of aquatic habitat, and introduce compounds that are toxic to aquatic organisms. Construction materials such as fuels, oils, paints, and concrete are potentially harmful to fish and other aquatic life if released into the environment. The extent of potential environmental effects depends on the erodibility of soil types encountered, the type of construction practice, the extent of the disturbed area and the duration of the disturbance, the timing of precipitation, and the proximity to drainage channels. Implementation of the following mitigation would reduce construction impacts to water quality to a less-than-significant level.

Mitigation Measure PHS-3: Implement Construction Site Management Practices

See Alternative F for a description of this mitigation measure.

Impact: Potential for Temporary Increases in Mosquito Breeding following Irrigation Activities

If areas are not maintained and properly monitored, standing water may be present for a short time following heavy rainfall or irrigation in various portions of the project area. Such standing water may have the potential to cause temporary increases in mosquito breeding in the project area, although any potential increase is expected to be offset by the comprehensive removal throughout the project area of discarded tires and other waste that holds standing water and allows mosquitoes to breed. Implementation of the following mitigation measure would ensure this impact remains less than significant.

Mitigation Measure PHS-4: Coordinate O&M Vector Control Measures with SRPMIC, Other Local Governments and Agencies

See Alternative F for a description of this mitigation measure.

Impact: Beneficial Decrease in Illegal/Unauthorized Activities in the Project Area

Currently, a number of illegal or unauthorized activities occur in the project study area, primarily dumping of refuse, unauthorized firearm discharges, and short-term habitation of certain portions of the project study area by transient persons. After this project is completed, increased use of the area by recreationists and maintenance staff would tend to decrease illegal activities in the area because of increased patrolling of the area by the city and use by the public. Project lands will be acquired by local and tribal jurisdictions, who will become responsible for policing these areas and protecting recreationists from illegal activities. This is a beneficial impact.

Mitigation Measure: No mitigation required.

5.12.2.6 Alternative A

Under this alternative, no new vegetation would be planted at the locations of known landfills. Thus, no threat would be posed to public health and safety by the potential for breach of the closure caps. The ground clearance of existing APS and SRP power transmission lines would be unaffected. In all other respects, such as vector control and potential for short-term water quality impacts, the impacts and mitigation measures for Alternative A are identical to those described above for Alternatives F, N, O, and E. No residual adverse impacts are anticipated.

Impact: Temporary Construction-Related Water Quality Impacts

Project-related construction activities in the river channel could cause temporary water quality impacts because disturbed and eroded soil, petroleum products, and miscellaneous construction wastes or unearthed waste debris may be discharged to receiving surface waters and groundwater. Soil and associated contaminants that enter stream channels can increase turbidity, stimulate the growth of algae, increase sedimentation of aquatic habitat, and introduce compounds that are toxic to aquatic organisms. Construction materials such as fuels, oils, paints, and concrete are potentially harmful to fish and other aquatic life if released into the environment. The extent of potential environmental effects depends on the erodibility of soil types encountered, the type of construction practice, the extent of the disturbed area and the duration of the disturbance, the timing of precipitation, and the proximity to drainage channels. Implementation of the following mitigation would reduce construction impacts to water quality to a less-than-significant level.

Mitigation Measure PHS-3: Implement Construction Site Management Practices

See Alternative F for a description of this mitigation measure.

Impact: Potential for Temporary Increases in Mosquito Breeding following Irrigation Activities

If areas are not maintained and properly monitored, standing water may be present for a short time following heavy rainfall or irrigation in various portions of the project area. Such standing water may have the potential to cause temporary increases in mosquito breeding in the project area, although any potential increase is expected to be offset by the comprehensive removal throughout the project area of discarded tires and other waste that holds standing water and allows mosquitoes to breed. Implementation of the following mitigation measure would ensure this impact remains less than significant.

Mitigation Measure PHS-4: Coordinate O&M Vector Control Measures with SRPMIC, Other Local Governments and Agencies

See Alternative F for a description of this mitigation measure.

Impact: Beneficial Decrease in Illegal/Unauthorized Activities in the Project Area

Currently, a number of illegal or unauthorized activities occur in the project study area, primarily dumping of refuse, unauthorized firearm discharges, and short-term habitation of certain portions of the project study area by transient persons. After this project is completed, increased use of the area by recreationists and maintenance staff would tend to decrease illegal activities in the area because of increased patrolling of the area by the city and use by the public. Project lands will be acquired by local and tribal jurisdictions, who will become responsible for policing these areas and protecting recreationists from illegal activities. This is a beneficial impact.

Mitigation Measure: No mitigation required.

CHAPTER 6. UNAVOIDABLE SIGNIFICANT IMPACTS

Unavoidable significant impacts are impacts that remain following the implementation of mitigation measures, or impacts for which there are no mitigation measures. The following section details significant impacts that could occur as a result of implementing any of the analyzed construction alternatives [F, N, O (Preferred Alternative), E, and A]. The analysis is based on the evaluation of impacts attributable to Alternative F, which would require the greatest amount of vegetative and structural work. The remaining construction alternatives, including Alternative O (Preferred Alternative), would have an equal or smaller impact as described below.

Cultural Resources

Each of the construction alternatives could adversely affect a number of known cultural sites. The maximum number of prehistoric and historic cultural resources that may be affected is 40, which could occur under Alternatives F, N, and O. Alternative E could affect 38 known sites and Alternative A could affect 20 known sites. In addition to construction-related activities that could possibly affect NRHP sites, the root systems of newly planted vegetation, once developed, could disturb archaeological sites by increasing the moisture level in the soil. Such changes in the soil chemistry could increase the rate of degradation of important perishable ecofactual remains.

In accordance with the NHPA, further evaluations of cultural resources in the project area would need to be conducted. If resources were determined to be NRHP eligible and avoidance is not feasible, further mitigation measures would be detailed in a Memorandum of Agreement between the Corps, the SRPMIC, the City of Mesa, and the SHPO. These would include field surveys, testing, and data recovery. Mitigation measures would also contain provisions that if cultural or paleontological resources are encountered during construction or other activities, work in the area will stop until a qualified archaeologist can evaluate the finds and determine whether further investigation is necessary. The Corps, SRPMIC, City of Mesa, and the SHPO will be notified if buried cultural resources are encountered.

While data recovery actions may lessen the degree of impact, additional undiscovered sites, which are likely due to the significant number of known sites, may still be damaged during construction activities or as a result of planting vegetation in the project area.

CHAPTER 7. CUMULATIVE IMPACT ANALYSIS

Cumulative impacts are defined as negative or beneficial impacts on the environment that would result from incremental impacts of the project when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7). This cumulative impact analysis is an evaluation of impacts possible to Alternative F, which would require the greatest amount of vegetative and structural work. The remaining construction alternatives, including Alternative O (Preferred Alternative), would have similar cumulative impacts and are covered in the description below.

7.1 POTENTIAL CUMULATIVE IMPACT ZONE

For the purpose of this analysis, the Va Shly'ay Akimel project impact zone is identified as the Salt River corridor, stretching from the Granite Reef Dam to the confluence of the Agua Fria and Salt Rivers. This geographic boundary is set significantly larger than the project boundary to address cumulative impacts that may result from this project and additional projects and activities surrounding the project area. Currently, four ecosystem restoration projects (Tres Rios, Rio Salado Oeste, Rio Salado, and Va Shly'ay Akimel) have been proposed along the Salt River downstream from Granite Reef Dam. Although funding has not been secured for all of the projects, they are considered the past, present, and reasonably foreseeable projects that will be considered for this analysis. The analysis of cumulative impacts examined potential impacts from these surrounding projects over a period of approximately 10 years (1998–2008).

7.2 SUMMARY OF CUMULATIVE IMPACTS BY RESOURCE AREA

Thresholds and criteria used to determine the significance of effects vary depending on the type of resource being analyzed. For the project to contribute cumulatively to impacts of any particular resource, the project would first need to directly impact that resource in some way. An analysis of cumulative impacts to each of the resource areas is presented below.

Geology and Topography

Cumulative impacts to geology and topography would be beneficial in nature. The geomorphologic character of the existing landscape would be permanently altered due to reshaping procedures, however, these activities would help to enhance and restore the area. Bank stabilization would prevent further erosion and potential damage to roads and bridges in the vicinity.

Hydrology and Water Resources

Cumulative impacts to hydrology and water resources would be adverse only in the short term. Temporary soil disturbances during construction could discharge soil and sediment into the river channel. The discharge would be temporary and localized, as other projects within the project impact zone would not be simultaneously under construction. The project is designed to prevent long-term erosion, resulting in an overall long-term cumulatively beneficial impact. Furthermore, other existing and proposed ecosystem restoration projects along the Salt River within the project impact zone are not likely to cause cumulatively adverse impacts as a result of an accidental spill of fuels or other toxic materials due to the development and implementation of the Stormwater Pollution Prevention Plan (SWPPP), which will be required to obtain a construction permit.

Changes in the 100-year floodplain could cause a cumulative affect, however additional hydraulic analyses would continue and the proposed construction alternative would be redesigned if a cumulatively adverse impact was likely to occur. Additionally, cumulative impacts to groundwater hydrology could occur with the installation of a new well. The installation of new wells are permitted and implementation would require the development of institutional arrangements between the Corps and SRPMIC, City of Mesa or SRP, and ADWR, therefore reducing the likelihood for a cumulatively adverse impact to groundwater hydrology.

Effects on water quality associated with irrigation water would not cause a cumulatively adverse impact. If water sources are found to contain contaminants that could adversely effect water quality and aquatic organisms, the Corps would identify other irrigation sources or implement water quality improvement measures, therefore alleviating the adverse impact.

Despite minor short-term cumulatively adverse impacts, the proposed project in combination with other existing and proposed ecosystem restoration projects along the Salt River within the project impact zone are cumulatively beneficial in nature. The proposed construction activities would benefit hydrology and water resources by reducing the overall potential for flooding in the project area.

Biological Resources

Increasing and enhancing biological resources in the project study area is the major purpose of the project. Although short-term construction impacts may negatively impact some biological communities, long-term cumulative impacts to biological resources would be beneficial for all construction alternatives. Combined, the other existing and proposed ecosystem restoration projects along the Salt River within the project impact zone could greatly enhance native wildlife populations and habitat along several miles of the Salt River. Of all the proposed alternatives, cumulative adverse impacts would likely result only from the No-Action Alternative, which would result in further degradation of the Salt River corridor. While the amount of native wildlife and habitat would be expected to decrease under the no action alternative, populations of invasive species such as saltcedar, would continue to increase, and could move back into restoration areas downstream from the project.

Cultural Resources

The implementation of any construction alternative (Alternatives F, N, O (Preferred Alternative), E, or A) may contribute to cumulative losses of cultural resources. However, while historic and/or prehistoric sites may be destroyed by construction activities, the informational value of those could be preserved through data collection and contribute to the understanding of past societies.

Aesthetic Resources

As a result of the existing and proposed project construction activities in the area, each of the construction alternatives could contribute to temporary adverse cumulative impacts on the aesthetic environment. However, the duration of these adverse impacts would be short since each construction alternative would implement measures intended to improve overall aesthetic conditions. Furthermore, the restoration projects along the Salt River will not be occurring within the same timeframe, therefore removing the likelihood for adverse cumulative impacts. The long-term cumulative effects of this project to the aesthetic resources would be beneficial since it would improve the aesthetic quality of the Salt River corridor.

Air Quality

Although construction activities would generate emissions of ozone precursors, carbon monoxide (CO), oxides of nitrogen (NOx), and fugitive dust (PM10), the annual emission levels would be below federal conformity *de minimus* levels during each year of project construction and operation. Furthermore, there is no indication that the other ecosystem restoration projects would be conducted simultaneous with the Va Shly'ay Akimel project. Therefore, it is unlikely the emissions from those projects would combine with the emissions from the Va Shly'ay Akimel project to cause the ambient concentrations to exceed the thresholds for General Conformity. The Va Shly'ay Akimel project would, therefore, not exacerbate the existing cumulative impact on air quality.

Noise

The project impact zone has relatively low levels of ambient noise compared to other, more urbanized areas in the region. Although the proposed action will generate both short-term construction noise and long-term traffic noise from visitors to the site, this increase in noise, in conjunction with the surrounding ecosystem restoration projects, would not substantially contribute to adverse cumulative noise conditions in the study area.

Social and Economic Resources

Cumulative impacts associated with social and economic resources are not likely to occur. As discussed previously, no proposed project features or activities would contribute to substantial changes in socioeconomic characteristics. The surrounding population will receive aesthetic and recreational benefits associated with restoration and enhancement of the river corridor/channel. Overall, growth in the area is not likely to be induced by the project. Therefore, there would be no cumulative effect on changes in social and economic resources in the area.

Transportation

The proposed project is not expected to contribute to adverse cumulative impacts on transportation. The project would generate short-term impacts associated with construction activities; however, most of these impacts are less than significant and others are potentially significant impact but avoidable with mitigation. Furthermore, the construction activities along the Salt River would not be occurring simultaneously, removing the possibility for adverse cumulative impacts caused by construction activities. Long-term cumulative impacts are expected to be beneficial because the area would be enhanced and restored. The project would be consistent with long-term planning policies and would not add to traffic congestion.

Land Use

The project area and surroundings fall within the boundaries of several local government jurisdictions, including Maricopa County, the City of Mesa, the City of Tempe, the City of Phoenix, the City of Avondale, the Gila River Indian Community, and the SRPMIC. The alternatives do not require the relocation of any businesses or residents, and therefore do not present potential for cumulative impacts to existing land use and/or ownership. However, projected growth and development surrounding the project area may occur at a faster rate with project implementation than without corridor improvements due to improvements of aesthetic quality. The enhanced and restored project area would not contribute to additional long-term traffic, noise, or limited vistas, allowing the planned development in the surrounding areas to proceed without conflict.

Recreation

Despite short-term impacts associated with construction activities, cumulative impacts to recreation should be beneficial due to an increased amount of attractive open space, enhancing the overall experience of recreational users. Combined, the existing and proposed habitat restoration projects in this area could increase recreational opportunities and value, therefore increasing the number of recreational users drawn to the area.

Public Health and Safety

Cumulative impacts associated with public health and safety would be beneficial. The project, in combination with the four previously mentioned ecosystem restoration projects, would improve the ecological health of the river and the human health associated with river resources. Flooding threats would be reduced, soil and water quality would be improved, and vector agents would be controlled. No adverse cumulative impacts are anticipated.

7.3 CONCLUSIONS REGARDING CUMULATIVE IMPACTS OF THE VA SHLY'AY AKIMEL PROJECT

In addition to the cumulative impacts discussed above, past, past, present, and future urban development surrounding the project area may also result in cumulative impacts. Increased urban development, whether residential or commercial, will lead to habitat degradation in a variety of ways. The most prominent degrading factors are: overall loss in habitat acreage, changes in the local hydrologic regime, and increases in human disturbance. Losses in habitat acreage would occur through development of land that might otherwise support various habitat types. Urbanization requires land surface, therefore any habitat that once occupied a site will be lost through land clearing, construction related activities, and replacement of the habitat by residences, commercial buildings, streets, and parking lots. What open space remaining is generally of highly degraded quality, diversity, and extent. Urbanization also creates an increase in impervious land surface (pavement, asphalt, and concrete replacing pervious open space), which in turn affects local hydrologic regimes. Increasing the amount of impervious surfaces prevents precipitation from penetrating into the ground, thereby increasing overland flow. Overland flow carries pollutants from road surfaces, roofs, and parking lots, into drainage ditches. The debris and sediment it carries as it moves over the land, eventually empties into existing or restored habitat areas or the river channel itself, where it can be carried downstream into other areas. These pollutants and sediments can contaminate existing vegetation directly, or alter conditions enough to prevent new vegetation from establishing. The loss of infiltration also prevents that water from being available on-site to support vegetation, eliminates shallow soil moisture recharge, and decreases the volume of deeper aquifer groundwater recharge. Trees and other vegetation that depends on these water sources are thereby eliminated. Finally, with an increase in development, one can assume an increase in human disturbance, whether through increased noise and activity on the channel banks or through more direct disturbance caused by individuals entering into the channel or riparian zone itself for recreational activities.

Negative cumulative effects of the Va Shly'ay Akimel project are generally temporary and associated only with project implementation. For many resource areas, implementation of any construction alternative would result in long-term beneficial effects. The anticipated negative effects of any construction alternative would be compensated by overall improvements in watershed condition, improved aesthetic quality of the area, improved public health and safety conditions, and an increase in the health and diversity of wildlife habitats and populations.

CHAPTER 8. MITIGATION MEASURES/ ENVIRONMENTAL COMMITMENTS

The following explanation details required mitigation measures for Alternative O, the preferred alternative. For a complete comparison of mitigation measures for each alternative, please refer to Table ES-1 "Environmental Impact Summary Matrix."

8.1 GEOLOGY AND TOPOGRAPHY

No mitigation required.

8.2 HYDROLOGY AND WATER RESOURCES

Mitigation Measure HWR-1: Implement Erosion Control Measures

The Corps and their contractors shall implement erosion control measures throughout the construction period and during implementation of O&M activities to minimize erosion and sediment input into the river. The Corps will oversee implementation of erosion control measures. The contractor selected for the project shall:

- conduct construction and O&M activities during the dry season;
- conduct all construction work in accordance with site-specific construction plans that minimize the potential for increased sediment inputs to the river;
- divert concentrated runoff away from channel banks;
- minimize vegetation removal;
- identify with construction fencing all areas that require clearing, grading, revegetation, or reshaping and minimize areas to be cleared, graded, reshaped or otherwise disturbed;
- grade and stabilize spoils and stockpile sites to minimize erosion and sediment input to the river;
- implement erosion control measures as appropriate to prevent sediment from entering the river channel or other watercourses to the extent feasible, including the use of silt fencing or fiber rolls to trap sediments and erosion control blankets to protect channel banks;
- mulch disturbed areas as appropriate and plant with appropriate species as soon as practicable after disturbance; and
- avoid operating equipment in flowing water by using temporary cofferdams or other suitable structures to divert flow around the channel and bank construction areas.

Mitigation Measure HWR-2: Implement Spill Prevention Measures

The Corps and their contractors shall prepare a spill prevention and response plan that regulates the use of hazardous and toxic materials, such as petroleum-based fuels and lubricants for construction equipment. The Corps will oversee development and implementation of a stormwater pollution prevention plan. Elements of the plan will ensure that:

- workers are trained to avoid and manage spills;
- construction and maintenance materials are prevented from entering the river channel;
- all spills are cleaned up immediately and appropriate agencies are notified of any spills and of the cleanup procedures employed;
- staging and storage areas for equipment, materials, fuels, lubricants, solvents, and other possible contaminants are located at least 100 feet away from the river's normal high-water area;
- vehicles are removed from the river's normal high-water area before refueling or lubricating;
- vehicles are immediately removed from the work area if they are leaking; and
- equipment is not operated in flowing water (if necessary, suitable temporary structures can be installed to divert water around in-channel work areas).

Mitigation Measure HWR-4: Develop Institutional Agreements for Groundwater Use

The Corps will work with the appropriate agencies to develop the institutional agreements necessary to install/construct a new groundwater well and allow groundwater pumping for irrigation purposes.

Mitigation Measure HWR-5: Conduct Additional Stormwater Quality Sampling and Analysis

The Corps will develop a stormwater quality sampling plan and conduct sampling and analyses to identify potential contaminants and adverse effects on water quality associated with using stormwater as an irrigation source for restoration plantings. If the analyses show that constituents exceed applicable water quality standards, the Corps will identify other irrigation sources or implement water quality improvement measures (e.g., detention basins, treatment swales).

8.3 BIOLOGICAL RESOURCES

Mitigation Measure BR-1: Minimize Disturbance of Vegetation during Construction

During the final design of the project, disturbances to areas of existing vegetation that are not within the project footprint can be minimized through careful phasing of the project construction. In addition, areas of desirable vegetation can be delineated on construction plans as areas that are not to be disturbed.

Mitigation Measure BR-2: Conduct Long-Term Maintenance Activities on a Rotating Basis and Only During Non-Nesting Periods

Sediment removal activities and other activities would only be conducted during non-nesting periods of the southwestern willow flycatcher, the yellow-billed cuckoo, and the Yuma clapper rail. In the case of sediment removal, these activities would be conducted on a rotating basis so that no more that 25% of the marsh area would be affected in any one year.

Mitigation Measure BR-3: Minimize Disturbance to Waters of the United States

During O&M activities, care would be taken to minimize any necessary disturbance to waters of the United States and to ensure that such activities comply with the provisions of Section 404 of the Clean Water Act and its associated regulations.

8.4 CULTURAL RESOURCES

Mitigation Measure CR-1: Conclude Memorandum of Agreement to Complete Field Surveys and Conduct Testing and Data Recovery Activities as Appropriate

In accordance with the NHPA, additional evaluations need to be conducted to determine if any of the identified cultural sites not yet evaluated are eligible for the NRHP. If any resources are determined to be NRHP eligible, and avoidance is not feasible, mitigation measures would be detailed in a Memorandum of Agreement between the Corps, the Salt River Pima-Maricopa Indian Community, the City of Mesa, and the SHPO.

8.5 AESTHETIC RESOURCES

No mitigation required.

8.6 AIR QUALITY

Mitigation Measure AQ-1: Implement PM10-Reducing Measures During Channel Excavation and Bank Stabilization

The Corps would implement the following PM10-reducing construction practices throughout the construction period and during O&M activities:

- Apply water to unpaved haul roads at a frequency adequate to maintain visible surface moisture. Alternatively, apply nontoxic binders (e.g., latex acrylic copolymer) to supplement road watering.
- Water active storage piles at least twice daily.
- Cover inactive storage piles.
- Cover haul trucks securely or maintain at least 2 feet of freeboard on all haul trucks when transporting materials.
- Water all active construction sites at least twice daily. Frequency should be increased if wind speeds exceed 15 mph.
- Prohibit all grading activities during periods of high wind (i.e., winds greater than 30 mph).
- Apply nontoxic chemical soil stabilizers to inactive construction areas (i.e., disturbed lands within construction areas that are unused for at least 4 consecutive days), or water at least twice daily.
- Apply nontoxic binders (e.g., latex acrylic copolymer) to exposed areas after cut-and-fill operations and hydroseed the areas if appropriate for the project location.
- Install wheel washers for all exiting trucks.
- Sweep streets if visible soil material is carried onto adjacent public roads.

These practices would be made a condition of the construction contract and would be enforced through weekly inspection by the Corps.

8.7 NOISE

Mitigation Measure N-1: Employ Noise-Reducing Construction Measures

The Corps and their contractors shall incorporate the following measures into construction contract specifications:

- Construction within 1,000 feet of residences or other noise-sensitive uses shall be restricted to daytime hours. No construction shall be performed within 1,000 feet of an occupied dwelling on Sundays, on legal holidays, or between the hours of 7 p.m. and 7 a.m. on other days.
- All construction equipment shall have sound-control devices that are at least as effective as those devices provided on the original equipment. No equipment shall have an unmuffled exhaust.

As directed by the Corps, the contractor shall implement appropriate additional noise mitigation, including, but not limited to, changing the location of stationary construction equipment, shutting off idling equipment, notifying adjacent residents in advance of construction work, and installing acoustic barriers around stationary construction noise sources.

8.8 SOCIAL AND ECONOMIC RESOURCES

No mitigation required.

8.9 TRANSPORTATION

Mitigation Measure T-1: Repair Damaged Roadways

The Corps or its contractors shall repair any damage to existing roadways caused as a result of construction activities for this project. Repair work shall be coordinated with the agencies having jurisdiction of each roadway, and with the intent to return the roadways to the conditions existing immediately prior to the commencement of the project.

8.10 LAND USE

No mitigation required.

8.11 RECREATION

No mitigation required.

8.12 PUBLIC HEALTH AND SAFETY

Mitigation Measure PHS-3: Implement Construction Site Management Practices

To minimize exposure of disturbed construction sites to rainfall and stormwater runoff, construction activities should be conducted in the dry weather season to the extent possible. The general contractor for the project will prepare and implement standard grading and erosion control measures (e.g., management, structural, and vegetative controls) to minimize exposure of soil that may contribute to contaminated runoff. Additionally, the contractor will complete the necessary paperwork to obtain an NPDES permit for construction-related projects. Best management practices (BMPs) must be implemented before predicted rain events. In addition, the construction contractor will implement standard hazardous materials management practices to reduce the possibility of chemical spills or releases of contaminants in runoff.

Mitigation Measure PHS-4: Coordinate O&M Vector Control Measures with SRPMIC, Other Local Governments and Agencies

The project design will consider mosquito control to the extent feasible to limit issues associated with mosquitoes. In concept, the new habitat and channels constructed as principal elements of this restoration project will cycle water through the habitat areas, rather than allow water to pool. Thus, the proposed project is likely to help inhibit mosquito breeding. The Corps will work with the SRPMIC and other local government jurisdictions and agencies to coordinate vector control measures for this project. Potential control measures may include adjusting water levels, biological controls, spraying, or other measures. These measures are proposed as part of post-construction O&M activities.

CHAPTER 9. RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Short-term impacts caused by the proposed project (including the preferred alternative) would be similar for any of the construction alternatives. These impacts would occur during and immediately after construction and would generally result in adverse effects. However, the long-term impacts that would occur over the life of the project would result in overall beneficial effects.

Short-term impacts during project implementation would result in construction effects on traffic, water resources, air quality, noise, public health and safety, recreation, and aesthetic and biological resources. However, these effects would be temporary, lasting only for the duration of the construction activities.

Generally over time, the implementation of any construction alternative would result in beneficial long-term impacts. The proposed action would restore and enhance environmental resources in the Salt River, thereby enhancing its long-term biological productivity. A substantial increase in suitable habitat for several common and sensitive species occurring or potentially occurring in the study area is expected. Species that could benefit from the habitat restoration include the southwestern willow flycatcher, yellow-billed cuckoo, and Yuma clapper rail. Additionally, foraging habitat for sensitive raptor species would increase. Habitat values would also substantially improve as a result of native vegetation restoration and invasive species (e.g., saltcedar) removal. Cottonwood-willow, new river bottom, and open water communities would all receive long-term benefits. Together, these improvements would enhance the natural environment and increase biodiversity throughout the project study area.

CHAPTER 10. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The preferred alternatives described in the feasibility report and evaluated in this EIS would involve the construction of several components that would use specific resources. The use of these resources is described below.

10.1 WATER RESOURCES

There are six water sources for the project:

21. Salt River Project water leaking from Granite Reef Dam
22. groundwater from existing and new wells
23. stormwater
24. City of Mesa Wastewater Treatment Facility water (used within existing recharge basins)
25. irrigation tailwater, and
26. surface water available for use by the SRPMIC via existing water source locations.

The construction of a well may require additional diversion structures. Although groundwater is an irretrievable resource, this project will rely primarily on excess surface water from the SRPMIC and effluent from the City of Mesa Wastewater Treatment Facility. Groundwater is considered a secondary source of water.

10.2 IRRIGATION TECHNIQUES

Irrigation techniques would require the construction of a network of lined irrigation channels and buried pipes. Materials used to build the channels include irrigation lining and concrete. Other required irrigation materials include the piping, water pumps, and wells. All of the above-mentioned materials are both readily available and easily generated.

10.3 VEGETATION

The water resources that will support the vegetation represent expenditure of a nonrenewable resource; however, the proposed vegetation would not have a significant impact on the groundwater table. The vegetation will be primarily dependent on surface water for irrigation, with groundwater considered a secondary source.

The wetland areas will be excavated and then lined by layering a silt/clay substrate overlain by a mixed gravel and a cobble layer. Furthermore, erosion control measures consisting of a series of drainage ditches will be constructed. River bottom will require only surface reshaping, including partially filling large depressions and excavating large mounds.

All materials that will be used for vegetation, including plants and seeds, are readily available and easily generated. Additionally, materials being used during reshaping will be removed and reused elsewhere in the project area, meaning there will be no permanent commitment of resources beyond what is available and easily generated.

10.4 RESHAPING

Reshaping through channelization, as well as surface reshaping for vegetation installation and irrigation, would require moving materials during the construction process. Because materials that are being used during reshaping are being removed and reused elsewhere in the project area, there is no permanent commitment of resources beyond what is available and easily generated.

10.5 RIVER CHANNELIZATION

Channelization will require the river bottom to be excavated. The excavated materials can be used to created benches along the channel, to fill quarry pits, and to vary the local topography to encourage vegetation growth and reduce flood damage on proposed vegetation areas. Because these materials are being removed and reused elsewhere in the project area, there is no permanent commitment of resources beyond what currently takes place in the natural system.

10.6 GRADE CONTROL STRUCTURE

A grade control structure would use a combination of construction materials and earth and rock materials to create the structure. All of the resources used for the grade control structure are considered to be readily available and plentiful and would not affect the availability of these materials for other uses.

10.7 BANK STABILIZATION

Methods used for bank stabilization could include berms, riprap, buried groins, or bendway weirs (wingdams, groins). The preferred material is soil cement, though reinforced concrete may also be required.

In addition to soil cement, quarry pits will be filled with materials from the reshaping and excavating, therefore utilizing materials being removed from elsewhere in the project area.

Structures being developed would use materials that are considered readily available and plentiful and would not affect the availability of these materials for other uses.

CHAPTER 11. PUBLIC INVOLVEMENT AND INTERAGENCY COORDINATION

11.1 SCOPING

The SRPMIC and the City of Mesa formally requested assistance from the Corps to explore possible remedies for several problems recognized along the Salt River. Many of these problems have long-standing and regionally widespread roots, but are evident in the immediate region of the study area. In brief, they can be attributed to land use changes in the past 150 years. The Salt River no longer runs as a perennial stream and the average depth to groundwater is far greater than was true in 1850. Without previously available groundwater, most of the native vegetation and wildlife cannot survive, and the Salt River is biologically quite impoverished.

The initiatives the sponsors wish to address through the study include:

- increasing native riparian quality for both plants and animals;
- attracting migratory birds into these better habitats;
- gradually creating a continuous biological corridor;
- fostering the reestablishment of species native to the riparian communities and augmenting overall species diversity;
- creating physical settings in the river bottom itself which promote reestablishment of cottonwood willow gallery forests and mesquite bosques;
- eliminating invasive and non-native plant species;
- restoring vegetative communities within the river corridor to a more natural state; and
- increasing acreage of functional seasonal wetland habitat.

The non-federal views and preferences regarding ecosystem restoration, with some recreation, were in general obtained through coordination with the study sponsors and with various local and regional agencies and organizations, neighborhood associations, and the general public. These coordination efforts consisted of a series of public meetings held during the reconnaissance and feasibility study phases, through the maintenance of a "point-of-contact" with whom any interested party could discuss matters, through various citizens groups, and through mailing lists by means of which invitations to public meetings were distributed.

Announcements for public meetings were made in local newspapers, including date, time, place, and subject matter.

Formal public scoping meetings were held with the sponsors (SRPMIC and the City of Mesa) between January 24, 2002 and April 1, 2003. The purpose of these meetings was to introduce the project to the public, give individuals and agencies an opportunity to identify issues for consideration in this EIS, and to solicit input on the project. The Corps received no written public comments during the scoping period.

The Corps, in conjunction with the local sponsors, held or made presentations at the following locations:

- Public meeting with the SRPMIC – January 24, 2002
- Public meeting with City of Mesa – March 20, 2002
- City of Mesa Council – October 31, 2002; March 20, 2003
- SRPMIC Tribal Council meeting – January 15, 2003
- SRPMIC public participation forum – February 13, 2003
- SRPMIC Tribal Council and City of Mesa Council meeting – April 1, 2003.

In addition, news articles relating to the project were published on the following dates:

- City of Mesa news release – July 18, 2002
- *East Valley Tribune* newspaper article – November 1, 2002
- *Arizona Republic* newspaper article – March 21, 2003

Public concerns expressed at the public meetings included the following (those items in bold were expressed repeatedly):

27. **Where will the water come from and how will future droughts be addressed?**
28. Who will maintain the aquifer in the future and what are the risks of aquifer contamination?
29. Concern was expressed about the City of Mesa's involvement.
30. **Concern was expressed about future rights to the land surrounding the river and future possession by federal government.**
31. Concern was expressed about future property loss of project site.
32. Where does project fit in with Sand and Gravel mining?
33. Concern was expressed about the protection of burial grounds.
34. Concern was expressed that preservation of this land would encourage the FAA to cement their flight plans over Community land due to lack of human establishment.

35. Concern was expressed about future restrictions of Community land use due to project.

11.2 HGM MODEL PREPARATION

The hydrogeomorphic modeling (HGM) approach to assessing wetland functions has been developed by scientists and the Engineering Research and Development Center (ERDC) Environmental Laboratory (EL) under its wetlands research program. Under this assessment procedure, the focus is narrowed to 1) the functions a particular type of wetland will perform and 2) the characteristics of the ecosystem and landscape controls of those functions. Wetlands are classified by their geomorphic setting, water source, and hydrodynamics.

From March 26–28, 2002, the Corps sponsored a workshop in Tucson, Arizona, to modify the HGM models that would be used for this project. In addition to the Corps and its consultants, participants included representatives of federal, state and local agencies; technical experts in hydrology, soils, wildlife, and riparian vegetation; and local sponsors. A subset of workshop participants gathered the base field data for the HGM model during the week of April 22, 2002. In June 2002 representatives of federal, state, and local agencies with an interest in the Va Shly'ay Akimel project met to discuss baseline project area conditions and without-project results. In August 2002 a similar group met to project future without-project conditions for the HGM models. This same team has continued to meet as alternatives were formulated and evaluated.

11.3 AGENCY COORDINATION

This EIS has been prepared in compliance with NEPA to meet the needs of federal, state, and local permitting agencies in considering the proposed restoration of this reach of the Salt River. The lead agency responsible for preparing this EIS for the proposed action is the U.S. Army Corps of Engineers, Los Angeles District. The SRPMIC and the City of Mesa are the non-federal sponsors for the project. The lead agency is responsible for ensuring that this EIS has been prepared in compliance with the provisions of NEPA. The Corps will determine the adequacy and completeness of the final EIS prior to rendering any decisions on the proposed action. The Corps will issue a decision for the proposed action in the form of a Record of Decision. The Corps will rely upon this EIS when considering whether to move forward with any of the restoration projects described in the proposed action. This EIS will also be utilized by other federal and state agencies to evaluate the project for permitting decisions.

The Corps has coordinated with the following agencies during the completion of this EIS:

U.S. Fish & Wildlife Service
Flood Control District of Maricopa County
Arizona Game and Fish
Arizona Department of Water Quality

11.4 DRAFT EIS REVIEW

This draft EIS has been provided to the following individuals, agencies, and organizations for review and comment:

ELECTED OFFICIALS

Honorable Janet Napolitano, Governor, State of Arizona
Honorable Jon Kyl, U.S. Senator
Honorable John McCain, Senator
Honorable J.D. Hayworth, U.S. Congressman
Honorable Toni Hellon, Arizona State Senator
Honorable Steve Huffman, Arizona State Representative
Honorable Pete Hershberger, Arizona State Representative
Honorable Fulton Brock, Supervisor, Maricopa County
Honorable Don Stapley, Supervisor, Maricopa County
Honorable Andrew Kunasek, Supervisor, Maricopa County
Honorable Max Wilson, Supervisor, Maricopa County
Honorable Mary Rose Wilcox, Supervisor, Maricopa County
Honorable Keno Hawker, Mayor, City of Mesa
President Joni Ramos, Salt River Pima Maricopa Indian Community

FEDERAL AGENCIES

Advisory Council on Historic Preservation
Animal and Plant Health Inspection Service, Wildlife Services
Bureau of Indian Affairs
Federal Aviation Administration
Federal Emergency Management Agency
Federal Highway Administration
National Resources Conservation Service
U.S. Army Corps of Engineers, Regulatory Branch
U.S. Bureau of Reclamation
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Geological Survey

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Arizona Department of Water Resources
Arizona Game and Fish Department
Arizona Native Plant Society
Arizona State Parks

Arizona State Parks-Historic Preservation
State Historic Preservation Officer

REGIONAL AGENCIES

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Regional Planning Manager, Planning and Project Management Division
Maricopa County Environmental Services
Maricopa County Historical Society
Maricopa County Parks and Recreation Department

SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY

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CITY OF MESA

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Mesa Public Library
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CHAPTER 13. REFERENCES

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Zarbin, E. 1997. *Two sides of the river: Salt River Valley canals, 1867–1902.* Salt River Project, Phoenix.

PERSONAL COMMUNICATIONS

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CHAPTER 14. GLOSSARY OF TERMS AND ACRONYMS

14.1 ACRONYMS AND ABBREVIATIONS

ac-ft	acre-foot
ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
ADT	Average Daily Traffic
ADWR	Arizona Department of Water Resources
AGFD	Arizona Game and Fish Department
AMA	Active Management Area (Arizona Department of Water Resources designation for particular groundwater basins throughout the state)
BOD	biochemical oxygen demand
CAA	Clean Air Act
CAFO	Concentrated Animal-Feeding Operation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (commonly referred to as the "Superfund" Act)
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System (EPA database of current and potential Superfund sites)
cfs	cubic feet per second
CNEL	community noise equivalent level
CO	carbon monoxide
Corps	U.S. Army Corps of Engineers
dB	decibel
dBA	A-weighted decibel
DES	Arizona Department of Economic Security

EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FCDMC	Flood Control District of Maricopa County
FCI	Functional Capacity Index
FCU	Functional Capacity Unit
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
GRIC	Gila River Indian Community
HGM	Hydrogeomorphic modeling method
LAU	Lower Alluvial Unit
L_{dn}	day-night average sound level
L_{eq}	equivalent sound level
LOS	Level of Service (quantifies capability of a given roadway segment to handle traffic flow)
LUST	leaking underground storage tank
$\mu g/m^3$	micrograms per cubic meter
MAG	Maricopa Association of Governments
MAU	Middle Alluvial Unit
mg/l	milligrams per liter
MM	Modified Mercalli Intensity Scale (used in quantifying intensity of seismic events)
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NER Plan	National Ecosystem Restoration Plan
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NO_2	nitrogen dioxide
NOx	oxides of nitrogen

NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List (EPA list of Superfund sites)
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
O_3	ozone
O&M	operation and maintenance
OSHA	Occupational Safety and Health Administration
PM10	particulate matter 10 microns or less in diameter
ppm	parts per million
RCRA	Resource Conservation and Recovery Act (federal law regulating the generation, transportation, treatment, storage, and disposal of hazardous wastes)
RID	Roosevelt Irrigation District
SARA	Superfund Amendment and Reauthorization Act
SIP	State Implementation Plan (EPA approved, state-level measures for meeting clean air standards)
SO_2	sulfur dioxide
SRP	Salt River Project
SRPMIC	Salt River Pima-Maricopa Indian Community
SWPPP	Stormwater Pollution Prevention Plan
TAC	toxic air contaminant
TDS	total dissolved solids
thalweg	centerline of drainage flow within a watercourse
TMDL	Total Maximum Daily Load
tpy	tons per year
TSD	RCRA-approved treatment, storage, and disposal facilities
UAU	Upper Alluvial Unit
USBR	U.S. Bureau of Reclamation
USFWS	U.S. Fish and Wildlife Service

USGS	U.S. Geological Survey
VOC	volatile organic compound
WQARF	Arizona Water Quality Assurance Revolving Fund
WWTP	wastewater treatment plant

14.2 GLOSSARY

100-year flood. A major destructive flood event that would occur on average once every 100 years.

A-weighting. Process in which noise measurements are weighted more heavily within those frequencies of maximum human sensitivity.

acre-foot. Volume of water that could cover 1 acre to a depth of 1 foot.

alluvium. Clay, silt, sand, gravel, or similar material deposited by running water.

National Ambient Air Quality Standards. The specified average concentration of an air pollutant in ambient air during a specified time period at or above which undesirable effects may be produced.

area of potential effects. Geographical area that may be affected by a project.

average daily traffic. Volume of traffic occurring on a roadway averaged over 1 day.

attenuation. To decrease in severity.

bedrock. Solid rock underlying unconsolidated surface soils.

biochemical oxygen demand. The oxygen used in meeting the metabolic needs of aerobic microorganisms in water rich in organic matter.

biological assessment. A document prepared under Section 7 process of the Endangered Species Act to determine whether a proposed action is likely to adversely affect listed species, proposed species, or designated critical habitat.

bosques. Groves or stands of vegetation.

braided channel. A stream with a complex tangle of converging and diverging channels separated by sand bars or islands.

census tract. A standard area in certain large American cities used by the U.S. Bureau of the Census for purposes of population enumeration.

Council on Environmental Quality. The agency responsible for the oversight and development of national environmental policy. Created by NEPA, CEQ shares this responsibility with the EPA.

criteria pollutants. Air pollutants for which the federal or state government have established ambient air quality standards, or criteria, for outdoor concentration in order to protect public health.

de minimis. Refers to a project with criteria air pollutant emissions that do not exceed federal conformity thresholds.

decibel. A unit for expressing the relative intensity of sounds.

diurnal variations. Daily changes.

ecorestoration. Renewal, revival, or reestablishment of an ecological community.

effluent. Waste material (such as wastewater) discharged into the environment.

endangered. The classification provided to an animal or plant in danger of extinction within the foreseeable future throughout all or a significant portion of its range.

environmental impact statement. The detailed report required by NEPA that describes the environmental impacts of a major federal action that may significantly affect the quality of the environment.

ephemeral. Present only during certain seasons.

Federal Register. An index of all the public notices of all the departments in the federal government.

federal Endangered Species Act. Federal legislation intended to provide a means whereby the ecosystems on which endangered and threatened species depend may be conserved and programs provided for the conservation of those species, thus preventing extinction of native plants and animals.

fugitive dust. Dust particles that have become suspended in the air.

General Industrial Stormwater Permit. Permits for the discharge of stormwater runoff to waters of the United States from specified industrial activities.

General Construction Stormwater Permit. Permits for the discharge of stormwater runoff to waters of the United States from disturbances of more than 5 acres.

General Conformity Rule. Applies to all nontransportation federal projects to ensure that the project conforms to applicable SIPs so that the project does not interfere with strategies to attain NAAQS in nonattainment areas.

geomorphic. Relating to the form of the earth.

geomorphology. A science that deals with the land and submarine relief features of the earth's surface.

Hohokam. Of, belonging to, or characteristic of an American Indian culture of the central and southern deserts of Arizona, about A.D. 450–1450.

hydrogeology. The science dealing with the occurrence, distribution, and movement of water below the surface of the earth, with a greater emphasis on geology.

hydrologic. Dealing with the properties, distribution, and circulation of water on and below the earth's surface and in the atmosphere.

igneous rock. Rocks formed from solidification of magma.

Level of Service. Operating ratio (volume/capacity) of an intersection of roadway segment that is presented in terms of traffic conditions on a scale from A to F.

listed species. A species, subspecies, or distinct vertebrate population segment that has been added to the federal lists of endangered and threatened wildlife and plants as they appear in sections 17.11 and 17.12 of Title 50 of the Code of Federal Regulations (50 CFR 17.11 and 17.12).

National Register of Historic Places. A database containing a list of historic resources that meet specific eligibility requirements.

National Emission Standards for Hazardous Air Pollutants. Designated to control emissions of toxic air pollutants to prevent adverse health effects.

National Pollutant Discharge Elimination Systems. Provides regulations for discharging pollutants into surface water bodies, including providing mechanisms to eliminate nonstormwater discharge, pollution prevention plans, inspection, and monitoring.

National Environmental Policy Act. The federal law established in 1970 to protect the environment by ensuring that federal agency decision makers take environmental factors relating to federal actions into account.

New Source Review. Preconstruction review requirements for new and modified major and minor stationary sources.

nonattainment area. A regional area that exceeds air quality standards for certain pollutants as designated by the EPA.

ozone precursors. Chemicals, such as reactive organic compounds and nitrogen oxides, that occur either naturally or as a result of human activities and that contribute to the formation of ozone.

particulate matter (PM10 and PM 2.5). Criteria pollutant consisting of solid material that is small enough in size to be inhaled.

peak mean daily flow. Highest average flow of a river or watercourse that occurs over the course of a 1-day period.

perennial. Present at all seasons of the year.

phreatophyte. Deep rooted plant that obtains its waters from the water table or the layer of soil just above it.

prevention of significant deterioration. An air pollution permitting program for new or modified major stationary sources in attainment areas.

raptors. Birds of prey.

ruderal. Connotes weeds or other non-native vegetation growing where previous vegetation has been disturbed by human activity.

saltcedar. A non-native, invasive shrub or small tree with bluish foliage and white or pinkish flowers.

scour-and-fill. Generally a condition where flood events degrade a channel and deposit sediments.

Section 7. The section of the Endangered Species Act that requires all federal agencies, in consultation with USFWS, to ensure that their actions are not likely to jeopardize the continued existence of listed species or result in destruction or adverse modification of critical habitat.

sedimentation. The action or process of forming or depositing sediment.

shorebirds. Any of a suborder of birds that frequent the seashore or other surface water bodies.

sinuosity. The degree to which a watercourse varies back and forth across its flow centerline.

State Implementation Plan. A state's plan to attain the federal air quality standards for all non-attainment areas with the state.

tailwater. Excess surface water draining from a field under cultivation.

thalweg. A figurative line connecting the lowest points along the main drainage of a waterway.

threatened. The classification provided to an animal or plant likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

total dissolved solids. The amount of material (inorganic salts and small amounts of organic material) dissolved in water and commonly expressed as a concentration in terms of milligrams per liter.

toxic air contaminants. Air pollutants that are carcinogens or produce acute effects. Toxic air pollutant thresholds are based on quantitative risk assessment rather than ambient air standards as with criteria pollutants.

toxicological benchmark. Contaminant threshold level that results in a toxic effect on a given subject.

turbidity. Water that is not clear or transparent because of stirred-up sediment.

volatile organic compounds. Secondary petrochemicals, including light alcohols, acetone, trichloroethylene, percholoroethylene, dichloroethylene, benzene, vinyl chloride, toluene, and methylene chloride. These potentially toxic chemicals are used as solvents, degreasers, paints, thinners, and fuels. Because of their volatile nature, they readily evaporate into the air, increasing the potential exposure to humans. Due to their low water solubility, environmental persistence, and widespread industrial use, they are commonly found in soil and groundwater.

water table. The upper surface of a zone of saturation by groundwater.

waterfowl. Swimming game birds as distinguished from upland game birds and shorebirds.

waters of the United States. Broadest category of regulated water bodies under the Clean Water Act. Includes wetlands along with nonwetland habitat, including streams, rivers, lakes, ponds, bays, and oceans.

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Appendices

Appendix A

Section 404(b)(1) Evaluation and ADEQ Support Letter

APPENDIX A. CLEAN WATER ACT, SECTION 404(b)(1) COMPLIANCE EVALUATION

I. INTRODUCTION

This appendix evaluates compliance of the recommended plan (preferred alternative), Alternative O, with the Guidelines established under the Federal Pollution Control Act (Clean Water Act) Amendments of 1972 (Public Law 92-500), as amended by the Clean Water Act of 1977 (Public Law 95-217), legislation collectively referred to as the Clean Water Act.

The Clean Water Act sets national goals and policies to eliminate the discharge of water pollutants into navigable waters. Any discharge of dredged or fill material into waters of the U.S. by the Corps requires a written evaluation that demonstrates that a proposed action complies with the guidelines published at 40 CFR Part 230. These guidelines, referred to as the Section 404(b)(1) Guidelines or "Guidelines," are the substantive criteria used in evaluating discharges of dredged or fill material under Section 404 of the Clean Water Act.

Fundamental to the Guidelines is the precept that "dredged or fill material should not be discharged into the aquatic ecosystem, unless it can be demonstrated such a discharge will not have an unacceptable adverse impact either individually or in combination with known and/or probable impacts of other activities affecting the ecosystems of concern."

The procedures for documenting compliance with the Guidelines include the following:

- Examining practicable alternatives to the proposed discharge that might have fewer adverse environmental impacts, including not discharging into a water of the U.S. or discharging into an alternative aquatic site
- Evaluating the potential short- and long-term effects, including cumulative effects, of a proposed discharge of dredged or fill material on the physical, chemical, and biological components of the aquatic environment.
- Identifying appropriate and practicable measures to mitigate the unavoidable adverse environmental impacts of the proposed discharge
- Making and documenting the Findings of Compliance required by §230.12 of the Guidelines.

This Clean Water Act, Section 404(b)(1) evaluation of compliance with the Guidelines is not intended to be a "stand alone" document; it relies heavily on information provided in the environmental impact statement (EIS) to which it is attached.

II. PROJECT DESCRIPTION

A. Authority: This study has been conducted under two separate authorities provided by Congress. The first and most recent authority is provided by House Resolution 2425 (HR 2425), dated May 17, 1994. HR 2425 states:

> The Secretary of the Army is requested to review reports of the Chief of Engineers on the State of Arizona…in the interest of flood damage reduction, environmental protection and restoration and related purposes.

The second authority is given in Public Law 761, 75th Congress, known as Section 6 of the Flood Control Act of 1938. This authority, dated June 28, 1938, states:

> The Secretary of War (now Secretary of the Army) is hereby authorized and directed to cause preliminary examinations and surveys . . . at the following localities: . . . Gila River and tributaries, Arizona.

B. Project Purpose and Need. The purpose of the project is to restore ecosystem functions and processes to improve overall ecological health and return the project area to a less degraded, more natural condition. Implementation of the proposed action would increase the diversity of native plants and animals, enhance the ability of the area to sustain larger populations of key indicator species or more biologically desirable species, and produce a viable, self-sustaining ecosystem that would require only minimal ongoing human intervention.

The Salt River was once a perennial watercourse in the project area, characterized by meandering flows throughout the river system. Scour-and-fill events have degraded the river bed in some areas and caused elevations to increase in other areas. The scour-and-fill transportation of sediment has produced numerous thick deposits within the fluvial system: cobble lag surfaces, sand sheets (macro-forms), channel sidebars, mid-channel bars, point bars, and overbank deposits. Channel shifts have distributed alluvial material across the entire width of the floodplain. Many of these deposits, however, have been disturbed by intensive sand and gravel mining. Flood control, in-river mining, and water supply projects within the Gila River watershed have resulted in substantial alteration of the hydrological and sediment transport regimes. This alteration, as well as increased agricultural development and urbanization of the metropolitan Phoenix area, have eliminated almost most of the native cottonwood-willow, mesquite bosque, freshwater marsh, and willow woodland habitat types. Within the study area, the river is now a highly disturbed riverbed with minimal native vegetation.

Without restoration, habitat values in the study area are expected to further decline within the next 50 years. This will decrease the overall habitat value for wildlife and reduce potential habitat for the endangered Yuma clapper rail, southwestern willow flycatcher, and other sensitive species.

This project is needed to provide an ecological connection between other riparian restoration projects that are currently underway along the Salt River. Additionally, there is a substantial need for additional recreation areas within the Phoenix metropolitan area. Restoration of the area may provide new passive and active recreational opportunities by increasing the area of open space that is available to recreationists.

C. Location: The Salt River, a tributary of the Gila River, flows west into the Phoenix basin from the Superstition and Goldfield mountain ranges. The study area is located in Maricopa County, Arizona, and includes portions of the Salt River Pima-Maricopa Indian Community (SRPMIC) and the City of Mesa. The approximately 17,435 acre-study area is approximately 2 miles wide and 14 miles long, extending east and west along the Salt River from the Pima Freeway (Loop 101) upstream to Granite Reef Dam

D. General Description: An initial array of 16 alternatives (including the No-Action Alternative) was developed by the Corps and the local sponsors (Salt River Pima-Maricopa Indian Community [SRPMIC] and the City of Mesa) during the alternatives formulation process. The alternatives represented varying combinations of restoration treatments (e.g., vegetation types, channel modification, water source, infrastructure). Alternatives were initially developed based on the Corps' federal planning objectives for water resource projects, specific planning objectives developed for the Va Shly'ay Akimel Ecosystem Restoration Project, and project-specific opportunities and constraints for implementing restoration activities. These alternatives were later refined based on input received through public meetings and coordination with local and regional agencies.

After formulation and refinement of the project alternatives, alternatives were ranked and screened based on associated habitat benefits and implementation costs. The Hydrogeomorphic (HGM) wetland assessment method was used by the Corps' planning team to identify and quantify the anticipated habitat benefits associated with the proposed restoration alternatives. The HGM method assesses and quantifies the functional values of existing wetland habitat types (e.g., water storage, plant community characteristics) and evaluates and quantifies future changes in these characteristics and associated habitat benefits resulting from implementation of the restoration alternatives.

Results of the HGM assessment were incorporated into the Corps' standard cost evaluation analysis (ICA) to identify the alternatives that provided the highest habitat benefits per unit cost.

The construction alternatives are Alternative F, Alternative N, Alternative O, Alternative E and Alternative A. The following ecorestoration and flood control features are common to all construction alternatives:

- construction of vegetated habitat
- eradication of saltcedar (*Tamarix* spp.)
- ground reshaping to alter significant features (e.g., reshaping the old Gilbert quarry to create new river bottom), install irrigation systems, or create topographic conditions needed to establish plantings
- Use of supplemental water sources, such as irrigation, groundwater, and/or effluent from the City of Mesa Wastewater Treatment Facility

- Water distribution systems (canals, diversion structures, etc.)

Project alternatives differ primarily in the types and amounts of vegetation types that would be created, the amount of flood protection provided, the extent of structural components, and the amount of site alteration that would occur. Project features would be constructed both in and adjacent to the river channel.

Operation and maintenance (O&M) activities will be needed for all alternatives after the project is constructed in order to keep project features functioning as designed. These activities may include:

- maintenance and replacement of pumps, pipelines, and other water delivery and irrigation infrastructure features;
- vector control;
- environmental monitoring; and
- periodic dredging to remove sediment deposited by floods; surface reshaping, or replanting of project features damaged by flood events.

III. PROJECT ALTERNATIVES

Section 230.10 of the Guidelines dictates that, except as provided under §404(b)(2), "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have significant adverse environmental considerations."]. While the NEPA process, through the EIS, extensively examines alternatives and discloses all of their environmental impacts, the 404(b)(1) Evaluation focuses on the impacts of alternatives to the aquatic ecosystem. The Guidelines require choosing for implementation the practicable alternative that has the least damage to the aquatic ecosystem, assuming that this alternative has no significant adverse environmental impacts to other components of the environment, such as endangered species that occupy upland habitat. A "practicable alternative" is defined as "available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes."

The Guidelines also require that "where the activity associated with a discharge which is proposed for a special aquatic site does not require access or proximity to or siting within the special aquatic site in question to fulfill its basic purpose (i.e., is not "water dependent"), practicable alternatives that do not involve special aquatic sites are presumed to be available, unless clearly demonstrated otherwise." The basic purpose of this project—to produce a viable, more natural riparian ecosystem in this portion of the Salt River—is water dependent, since the project purpose cannot be fulfilled outside the river.

The Guidelines further specify that where a discharge is proposed for a special aquatic site, all practicable alternatives to the proposed discharge that do not involve a discharge into a special aquatic site are presumed to have less adverse impact on the aquatic ecosystem, unless clearly demonstrated otherwise. Fresh water emergent wetlands are the only special aquatic site type in the project area. Although the project would not reduce the acreage of wetlands in the Salt River, these wetlands may be temporarily disturbed by construction activity. Since the project would increase the long-term functional value of the wetlands as well as the riparian areas of this ecosystem and these elements are physically adjacent as well as functionally interrelated, alternatives that do not temporarily impact wetlands would provide fewer long-term improvements in wetland and riparian habitat function.

For the purpose of a 404(b)(1) alternatives analysis, practicable alternatives[1] include:

- Offsite alternatives—i.e., discharges of dredged or fill material at other locations in waters of the United States.
- On-site alternatives—these include project designs that do not involve a discharge of dredged or fill material into waters of the United States as well as project designs that have different impacts to waters of the U.S.

OFF-SITE ALTERNATIVES

The location of this project was chosen based upon the availability of a large contiguous segment of the river corridor, the support of local sponsors, the proximity and contiguity of other restoration projects on the Salt River in the Phoenix metropolitan area and the technical feasibility of constructing a project at this location. The Va Shly'ay Akimel project is one of four ecosystem restoration projects that are at various stages of development by the Corps and local sponsors along the Salt River downstream from Granite Reef Dam. The Rio Salado project, just downstream from Va Shly'ay Akimel is currently under construction. The Rio Salado Oeste project is immediately downstream of the Rio Salado project and is currently on a parallel feasibility study schedule with Va Shly'ay Akimel. The Tres Rios project, just downstream from Rio Salado Oeste, is currently in the design stage. The proposed project location will provide an almost continuous series of habitat restoration projects from the most downstream dam on the Salt River (Granite Reef Dam) to the confluence of the Salt River with the Gila River (EIS, Figure 2.4-1). The nearest other potential location for a Salt River restoration project would be upstream of Granite Reef Dam. Such a location would not be near or contiguous with the other restoration projects, does not currently have local sponsorship support and, because of the series of upstream dams and associated legal constraints to project design, would be much more difficult, if not impossible, to design as a functioning habitat restoration project. Off-site alternatives therefore are not practicable at this time.

ON-SITE ALTERNATIVES

The five construction alternatives analyzed in detail through the NEPA process would each accomplish the identified project purpose. However, they would accomplish the project purpose

[1] The no-action alternative in the meaning of "no project" alternative would not accomplish the project purpose. Therefore, although the no action alternative must be analyzed in the EIS, it is not considered a practicable alternative as defined in the Guidelines. It is not, therefore, included in the comparison of practicable alternatives.

to varying extents, with varying levels of benefits and varying adverse impacts to the aquatic ecosystem.

The types of O&M activities necessary would generally be the same for each alternative, although the level of effort for O&M activity would be proportional to the amount of new habitat created (i.e., Alternative A would require the least amount of O&M and Alternative F would require the greatest amount of O&M effort and associated cost).

The following is a summary of project elements for each alternative. In general, Alternative F entails the greatest amount of vegetative and structural work. Alternative N includes most of Alternative F's vegetation features but lacks most of its structural features. Alternative O differs from Alternative N in the amount of acres of each vegetation type being created. It has the same structural features of N. Alternative E provides more vegetation and structural features than Alternative A but fewer than Alternatives N, F, and O. Alternative A entails the least amount of work in waters of the U.S., but creates only Sonoran Desert vegetation and river bottom habitat types. These alternatives are described in greater detail in Chapter 3 of the EIS.

Alternative F includes:

- Channelization of portions of 16,500 linear feet of the Salt River.
- Bank stabilization (armoring or hardening) in portions of several reaches (not Reach 1).
- Grade control structure across Salt River channel at old Gilbert quarry.
- Reshaping old quarry (including Gilbert Quarry) and river channels.
- Construction of new drainage channels, irrigation diversions, and/or spillways.
- Creation of 701.1 acres of CW; 602.9 acres of river bottom, including wetlands; 808 acres of mesquite; and 266.4 acres of Sonoran desert scrub-shrub. Revegetation efforts include plantings on site of former Tri-City Landfill.
- Replacing invasive plant species with native species.

Alternative N includes:

- No channelization.
- No bank stabilization.
- Grade control structure across Salt River channel at old Gilbert quarry.
- Reshaping old quarry (including Gilbert Quarry) and river channels.
- Construction of new drainage channels, irrigation diversions, and/or spillways.
- Creation of 853.1 acres of CW; 331.8 acres of river bottom, including wetlands; 379.7 acres of mesquite; and 23.6 acres of Sonoran desert scrub-shrub. Plantings at Tri-City Landfill site limited to a narrow strip of CW along the north bank of the river, at the edge of the main channel.
- Replacing invasive plant species with native species.

Alternative O includes:

- No channelization.
- Grade control structure across Salt River channel at old Gilbert quarry.
- Reshaping old quarry (including Gilbert Quarry) and river channels.
- Construction of new drainage channels, irrigation diversions, and/or spillways.
- Creation of 883.41 acres of CW; 425.1 acres of river bottom, including wetlands; 379.7 acres of mesquite; and 23.6 acres of Sonoran desert scrub-shrub. Plantings at Tri-City Landfill site limited to a narrow strip of CW along the north bank of the river, at the edge of the main channel. Replacing invasive plant species with native species.

Alternative E includes:

- No channelization.
- Bank stabilization (armoring or hardening) in portions of several reaches (not Reach 1).
- No grade control structure across Salt River channel at old Gilbert quarry.
- Reshaping old quarry (including Gilbert Quarry) and river channels.
- Construction of new drainage channels, irrigation diversions, and/or spillways.
- Creation of 286.4 acres of CW; 340.8 acres of river bottom, including wetlands; 296 acres of mesquite; and 808 acres of Sonoran desert scrub. Revegetation efforts include mesquite plantings on site of former Tri-City Landfill.
- Replacing invasive plant species with native species.

Alternative A includes:

- No channelization.
- No bank stabilization.
- No grade control structure across Salt River channel at old Gilbert quarry.
- Reshaping Gilbert Quarry to create new river bottom.
- Construction of new drainage channels, irrigation diversions, and/or spillways.
- Creation of 152.3 acres of river bottom, including wetlands and 495.8 acres of Sonoran desert scrub-shrub. No plantings at old Tri-City Landfill site.
- Replacing invasive plant species with native species.

Table A-1 summarizes the acreages of different habitat types that would be created under each alternative in areas considered to be waters of the United States.

Table A-1. New Riparian Areas Associated With Each Construction Alternative

Increase in Habitat Acreage over No-Action Alternative Over 50-Year Life of Project	Alternatives				
	F	N	O	E	A
New Cottonwood-willow	701.1	853.1	883.4	286.40	0.0
New river bottom (includes wetlands)	602.9	331.8	425.1	340.80	152.3
New Buffer	0.0	0.0	0.00	0.0	0.0
Mesquite	558	379.7	379.7	296	0.0
New Open Water	0.0	0.0	0.0	0.0	0.0
New Sonoran Scrub-Shrub	266.4	23.6	23.6	808	495.8
Total acreage created	2189.7	1588.2	1711.8	1822.0	748.6

COMPARISON OF ALTERNATIVES

Alternatives F, N, and O would provide the greatest amount of the particularly desirable cottonwood-willow, river bottom, and mesquite vegetation categories: 1,923.3 acres, 1,564.6, and 1,688.2 acres, respectively. Alternative F, however, entails much more structural work in waters of the U.S. than Alternatives N and O and therefore has greater adverse impacts to waters of the U.S. The primary differences between N and O are in the number of acres of each type of habitat being created 1588.2 versus 1711.8 respectively. N and O are similar in the amount of work entailed in waters of the U.S and thus are similar in the level of adverse impacts; however, Alternative O creates more of the desirable vegetation and habitat. Thus, Alternative O is considered the least environmentally damaging practicable alternative that meets the objective of the purpose and need for this project. This alternative provides the best combination of habitat restoration and cost and creates ecosystem benefits that far exceed the short-term effects to jurisdictional waters, and will have insignificant adverse environmental impacts to the surrounding ecosystem.

IV. FACTUAL DETERMINATIONS

A. Physical Substrate Determinations

1. Substrate Elevation and Slope: The study area includes river channel and overbank areas. Topographic relief is generally very low to flat (0-2% slopes), ranging from an elevation of 1,300 feet in the Salt River bed at Granite Reef Dam at the upstream (east) end of the area,

gently sloping down to about 1,175 feet at the downstream (west) end. In the eastern portion of the project, low hills of the Usury Mountains form the banks and uplands south of the Salt River, and rise to 50 to 150 feet above the riverbed. The highest of these, Schlechts Butte on the southeast side of Granite Reef Dam, rises to 1,798 feet. The lower flanks of Mount McDowell extend into the northeast corner of the project area, where they rise about 100 feet above the riverbed at Granite Reef Dam.

Reshaping the river bottom and regrading to create areas suitable for supporting the desired vegetation will require changing the elevation and slope of the river channel and banks at many locations. The substrate of the river bottom will be permanently altered as a result. Materials will be discharged into waters of the U.S. in order to install some of the water distribution and irrigation systems, fill and reshape the abandoned Gilbert quarry, build a grade control structure, complete bank hardening and reshape the channel area to create wetlands or otherwise prepare the surface for planting. Construction will consist of native alluvial soils from the project area. No dredged or fill materials will be imported into the project site as part of this project. Any excess excavated materials will be transported from the project site. Offsite disposal of excavated materials would consist of either recycling, providing overburden to nearby gravel operators or, if required, transporting materials to an appropriate landfill.

Channel reshaping and vegetation planting activities have the potential to increase 100-year water surface elevations and increase the potential for flooding in the project area. As part of the project planning process, the Corps conducted modeling (HEC-RAS) to analyze changes in hydraulic conditions associated with implementation of the project alternatives. Initial hydraulic modeling conducted for Alternative O demonstrated that an increase in the water elevation was likely to occur due to placement of vegetation within the active area of conveyance. Based on the modeling results, modifications were made to the alternative to increase the low flow channel in the lower and middle project reaches and offset increases in water surface elevation associated with the plantings.

2. Sediment Type: The soils in the vicinity of the river channel in the study area belong to the Hyperthermic Torrifluvents association, a group of well-drained to excessively well-drained soils that are found on nearly level or gently sloping surfaces. The texture of the surface layer ranges from gravelly sand or very gravelly sand to fine sandy loam. The material beneath the surface layer is very gravelly sand to very fine sandy loam or loam. Terraces above the river channel consist of thick, well cemented to non-cemented sand and gravel the terraces form gently sloping (0-2%), undulatory surfaces of low relief. Exposed bedrock is present near Granite Reef Dam, at the upstream end of the project area.

Reshaping will include moving soil to fill depressions or remove unwanted mounds as well as creating new river bottom from the old Gilbert quarry. Where existing sediments are used, sediment types will not be changed by the project. However, soils different from existing sediment types will be used in various areas to provide the necessary environment for new vegetation. Clay, mixed gravel, and cobble layers will be placed in areas of proposed wetland habitats.

3. Dredged/Fill Material Movement: Due to the limited flows of the Salt River system, substantial movement of the fill material from the locations in which it is placed for this project is expected to occur only under conditions of high flows. Operation and Maintenance (O&M) activities have been incorporated into the project to allow the removal or replacement of sediments to restore project features damaged by the transport of sediment. O&M activities will include repair work after major flooding events; dredging and reconstruction may be required in the restoration areas. This will temporarily change substrate elevations and compaction, as the substrate is restored to design configurations. Implementation of mitigation measure HWR-1 should minimize unintended movement of fill material (see paragraph 6).

The Surface Braided Irrigation Network (SBIN) will change the existing water runoff pattern, with consequent effects upon erosion and deposition within the channel. However, it is unlikely to cause functional changes in the river channel's current erosion and deposition patterns.

Continued quarrying at the Higley Plant has the potential to increase the rate of downstream sediment deposition in Reach 7, thereby decreasing the bedload material downstream in Reach 6. The lack of bedload material may affect the stability of the river channel in Reach 6. However, these potential changes are considered less than significant.

4. Physical Effects on Benthos: This project would affect portions of the river bottom to be excavated and/or filled during project construction. Site preparation for vegetation planting, channel excavation and reshaping, and the installation of grade control features as well as O&M activities such as sediment removal will result in soil disturbance and may cause temporary discharges of soil and sediment into the river channel. Soil discharged into the river channel may increase turbidity, stimulate algal growth, increase sediment deposition, and adversely affect aquatic organisms. This would be a potentially significant impact but can be mitigated through the implementation of Mitigation Measure HWR-1. In addition, benthic organisms (organisms that live at the bottom of a waterbody) are likely to occur in the project area only where there is permanent standing water, presently Reach 1 and Reach 9, which are the upstream and downstream limits of the project). The only measures that are proposed in waters of the U.S. at these locations are removal of invasive plants and possibly some new plantings. Any physical effects on benthos from these activities would be minor and temporary. If the project increases the amount of surface water in the project area, it may create new habitat for benthic organisms.

5. Other Effects: Project construction and restoration activities could result in accidental spills of fuel or other toxic materials associated with the operation of construction equipment (e.g., gasoline, oils, lubricants, solvents). Hazardous substances that enter the river channel could have temporary adverse effects on water quality and aquatic organisms. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-2 (see paragraph 6).

6. Actions Taken to Minimize Impacts: Mitigation measures have been included in the EIS to reduce the magnitude of potential water quality effects described above. These include Mitigation Measures HWR-1, HWR-2, , and BR-3:

Mitigation Measure HWR-1: Implement Erosion Control Measures

The Corps and their contractors shall implement erosion control measures throughout the construction period and during implementation of O&M activities to minimize erosion and sediment input into the river. The Corps will oversee implementation of erosion control measures. The contractor selected for the project shall:

- conduct construction and O&M activities during the dry season;
- conduct all construction work in accordance with site-specific construction plans that minimize the potential for increased sediment inputs to the river;
- divert concentrated runoff away from channel banks;
- minimize vegetation removal;
- identify with construction fencing all areas that require clearing, grading, revegetation, or reshaping and minimize areas to be cleared, graded, reshaped or otherwise disturbed;
- grade and stabilize spoils and stockpile sites to minimize erosion and sediment input to the river;
- implement erosion control measures as appropriate to prevent sediment from entering the river channel or other watercourses to the extent feasible, including the use of silt fencing or fiber rolls to trap sediments and erosion control blankets to protect channel banks;
- mulch disturbed areas as appropriate and plant with appropriate species as soon as practicable after disturbance; and
- avoid operating equipment in flowing water by using temporary cofferdams or other suitable structures to divert flow around the channel and bank construction areas.

Mitigation Measure HWR-2: Implement Spill Prevention Measures

The Corps and their contractors shall prepare a spill prevention and response plan that regulates the use of hazardous and toxic materials, such as petroleum-based fuels and lubricants for construction equipment. The Corps will oversee development and implementation of a stormwater pollution prevention plan. Elements of the plan will ensure that:

- workers are trained to avoid and manage spills;
- construction and maintenance materials are prevented from entering the river channel;
- all spills are cleaned up immediately and appropriate agencies are notified of any spills and of the cleanup procedures employed;
- staging and storage areas for equipment, materials, fuels, lubricants, solvents, and other possible contaminants are located at least 100 feet away from the river's normal high-water area;
- vehicles are removed from the river's normal high-water area before refueling or lubricating;

- vehicles are immediately removed from the work area if they are leaking; and
- equipment is not operated in flowing water (if necessary, suitable temporary structures can be installed to divert water around in-channel work areas).

Mitigation Measure BR-3: Minimize Disturbance to Waters of the United States

During O&M activities, care would be taken to minimize any necessary disturbance to waters of the United States and to ensure that such activities comply with the provisions of Section 404 of the Clean Water Act and its associated regulations.

B. Water Circulation, Fluctuation, and Salinity Determinations

1. Effect on Water: Irrigation water sources include the construction of one new groundwater well. Approximately 3,600 acre-feet/year will be pumped from this new well and diverted to planting areas through distribution channels or pipelines. Although groundwater in sufficient quantity is available to supply water wells within the project area, it is uncertain if the installation of a new well and the pumping of sufficient groundwater for irrigation purposes will affect flows in nearby wells. Additionally, the installation of new wells and the pumping of groundwater are restricted and require permits. This alternative will require development of institutional arrangements between the Corps and SRPMIC, City of Mesa or SRP and ADWQ. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-4.

Agricultural return flows, surplus agricultural water and stormwater runoff from the Hennessey and Evergreen Drains, groundwater from a new well, and discharge from local storm drains will be diverted into newly constructed distribution channels and pipelines for irrigation purposes. These water sources may contain contaminants (e.g., VOCs, metals, ions, nutrients, herbicides) that could have adverse effects on water quality and aquatic organisms. In general, because of their sources, irrigation return flows and surplus agricultural water are of relatively high quality and are suitable for use as irrigation for restoration plantings. However, because stormwater discharges represent runoff from urban, rural, and agricultural areas, water quality varies greatly based on land use and the magnitude, duration, and timing of storm events. Sediment and pollutants tend to accumulate between storm events and the highest concentrations of pollutants are often washed into rivers, creeks, and streams during "first flush" events. It is difficult to assess potential adverse effects on water quality associated with the use of stormwater for irrigation because only limited water quality data are available for the project area. A review of existing water quality data showed that storm water runoff exceeded applicable standards for five trace metals including total recoverable lead, and dissolved copper, cadmium, silver, and zinc (Knight Piésold 2003). Because of the lack of existing data related to stormwater quality, this impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-5.

Effects on Current Drainage Patterns and Circulation: The Surface Braided Irrigation Network (SBIN) will change the existing water runoff patterns and lateral migration of the channel will occur for events greater than 5-year events, but also allows for the most flexibility when irrigating large areas of new vegetation and the ability to modify irrigation patterns to respond to changes in the project area. Additionally, it mimics the natural conditions and helps in the recruitment of other native species.

Effects on Normal Water Level Fluctuations: Channel reshaping and vegetation planting activities proposed under Alternative F have the potential to increase 100-year water surface elevations and increase the potential for flooding in the project area. As part of the project planning process, the Corps conducted modeling (HEC-RAS) to analyze changes in hydraulic conditions associated with implementation of the project alternatives. Initial hydraulic modeling conducted for Alternative O demonstrated increases in water surface elevations in the lower and middle project reaches (Reaches 3, 4, 5, and 6) associated with the establishment of cottonwood/willow and wetland vegetation in the main channel. Based on the modeling results, modifications were made to the alternative to increase the low flow channel in the lower and middle project reaches and offset increases in water surface elevation associated with the plantings.

4. Action Taken to Minimize Impacts: Unavoidable impacts will be minimized through implementation of Mitigation Measure HWR-5.

Mitigation Measure HWR-5: Conduct Additional Storm Water Quality Sampling and Analysis. The Corps will develop a storm water quality sampling plan and conduct sampling and analyses to identify potential contaminants and adverse effects on water quality associated with using storm water as an irrigation source for restoration plantings. If the analyses show that constituents exceed applicable water quality standards, the Corps will identify other irrigation sources or implement water quality improvement measures (e.g., detention basins, treatment swales).

C. Suspended Particulate/Turbidity Determinations at the Disposal Site

1. Expected Change in Suspended Particulate and Turbidity Levels in the Vicinity of Disposal Site: Short-term increases in suspended particulate and turbidity levels may occur during construction. However, no long-term effects are anticipated.

2. Effects on Chemical and Physical Properties of the Water Column: Project construction and restoration activities could result in accidental spills of fuel or other toxic materials associated with the operation of construction equipment (e.g., gasoline, oils, lubricants, solvents). Hazardous substances that enter the river channel could have temporary adverse effects on water quality and aquatic organisms. This impact is considered potentially significant but can be mitigated through the implementation of Mitigation Measure HWR-2.

3. Effects of Turbidity on Biota. Soil discharged into the river channel may increase turbidity and adversely affect aquatic organisms. This would be a potentially significant impact but can be mitigated through the implementation of Mitigation Measure HWR-1.

4. Actions Taken to Minimize Impacts: Unavoidable adverse impacts will be minimized through implementation of Mitigation Measures HWR -1 and HWR-2.

D. Contamination Determination: The project study area was evaluated to determine the potential for encountering hazardous materials and wastes in areas that would be disturbed during construction (see Sections 4.12 and 5.12 of the EIS). Buried materials found during construction will be evaluated and disposed of in accordance with local, state and federal regulations.

E. Effect on Aquatic Ecosystem and Organism Determination: Alternative O would result in a substantial increase in the cottonwood/willow, new river bottom (including freshwater marsh), and open water communities compared to future conditions without the project. It would result in the creation of 883.41 acres of cottonwood; 425.1 acres of river bottom, including wetlands; 379.7 acres of mesquite; and 23.6 acres of Sonoran desert scrub-shrublands. It would also entail the physical removal of non-native saltcedar habitat in areas where the new habitat cells would be created. With implementation of erosion control measures and other measures identified in the EIS, no significant adverse effects on the aquatic ecosystem or aquatic organisms are anticipated. The only existing special aquatic sites in the project area are wetland areas in Reach 1 and Reach 9, the upstream and downstream ends of the project. The only work proposed for these areas entails removal of invasive plant species and possible planting of desirable species. These activities would have a beneficial effect on the habitat value of the aquatic ecosystem.

On a long-term basis, habitat value in the region would increase substantially for common and sensitive wildlife species. The primary benefit would be to riparian-obligate bird species due to increases in cottonwood/willow and mesquite communities. There would also be a substantial increase in habitat for shorebirds and waterfowl associated with the constructed wetlands. In addition, it is anticipated that amphibian species would benefit from implementation of Alternative O, and that this alternative would increase foraging habitat for raptors and mammalian carnivores. A substantial increase in nesting and foraging habitat for the southwestern willow flycatcher, the western yellow-billed cuckoo, and the Yuma clapper rail is also anticipated. Finally, implementation of Alternative O is expected to increase potential habitat for the cactus ferruginous pygmy-owl and increase foraging habitat for sensitive raptor species such as the peregrine falcon and the bald eagle.

Implementation of Alternative O would also result in substantial short-term impacts on vegetation. The major disruption would be to saltcedar habitat, which would be removed in some areas. There is also the potential for other communities to be indirectly disturbed during grading and restoration. This potentially significant impact will be mitigated through implementation of Mitigation Measure BR -1.

Mitigation Measure BR-1: Minimize Disturbance of Vegetation during Construction

During the final design of the project, disturbances to areas of existing vegetation that are not within the project footprint can be minimized through careful phasing of the project construction. Areas of desirable vegetation can be delineated on construction plans as areas that are not to be disturbed. Additionally, vegetation removal would occur outside of the spring breeding season (usually late January to early April) to ensure adequate time for a majority of the avian offspring to disperse prior to construction activities.

Long-term maintenance activities would be needed to maintain flood protection capacity and retain the habitat values of the restored vegetation. However, the O&M activities have the potential to adversely affect the restored habitat and sensitive species through noise, increased human activity, and physical disturbance of habitat for channel and drainage maintenance, vector control, sediment removal from restoration features, and removal of saltcedar regrowth. The greatest potential impact would be the necessary removal of sediment from the open water and marsh habitat. Although this activity is necessary to maintain the habitat, there would be short-term loss of marsh vegetation and potential loss of Yuma clapper rail habitat. This activity may also disturb nesting southwestern willow flycatchers in cottonwood/willow habitat by creating substantial noise. Other activities may also create short-term disturbances to this habitat. However, implementation of Mitigation Measure BR-2 would reduce these impacts to a less-than-significant level.

Mitigation Measure BR-2: Conduct Long-Term Maintenance Activities on a Rotating Basis and Only During Non-Nesting Periods

Sediment removal activities and other activities would only be conducted during non-nesting periods of the southwestern willow flycatcher, the yellow-billed cuckoo, and the Yuma clapper rail. In the case of sediment removal, these activities would be conducted on a rotating basis so that no more that 25% of the marsh area would be affected in any one year.

Construction and restoration activities also have a potentially significant short-term impact on common wildlife species. Of particular concern is the disruption of nesting and nesting habitat for riparian-obligate species. Even saltcedar, the exotic weed species proposed for removal, provides some nesting habitat for these species. Noise and other construction activities may also tend to cause wildlife to avoid the area. Although the short-term effects would be considerable, with the exception of species protected under the Endangered Species Act the species that would be affected are locally abundant and would be displaced on temporarily. In addition, Mitigation Measure BR-1 for listed wildlife species would also have benefits for common wildlife in the project study area. Therefore, this is not considered a significant impact.

Construction activities would have a potentially significant impact on nesting or foraging habitat of the Yuma clapper rail. Suitable habitat is present adjacent to the Loop 101/Loop 202 interchange. However, surveys conducted in 2003 of the wetland habitat in this location did not detect the presence of clapper rails. Prior to construction, the Corps will reevaluate the suitability of vegetation communities located within the project area to support Yuma clapper rail and other threatened and endangered species. If suitable habitat has developed that was not part of the original Section 7 consultation, the Corps will coordinate with USFWS to determine the necessity of surveys.

F. Proposed Disposal Site Determinations: The area to be affected during construction of this project will be confined to the minimum area necessary to construct the project features. The project is expected to be in compliance with applicable water quality standards. Implementation of the proposed mitigation measures should ensure that adverse impacts to waters of the U.S. are minimized.

G. Determination of Cumulative Effects of Disposal of Fill on the Aquatic Ecosystem: With implementation of mitigation measures, this project will not significantly contribute to adverse cumulative effects on the aquatic ecosystem of the Salt River. It will, however, directly contribute to the cumulative beneficial effects on the aquatic ecosystem anticipated to result from implementation of this and other ecosystem improvement projects on the Salt River, including Tres Rios, Rio Salado Oeste and Rio Salado. Together with these other restoration efforts on the Salt River, this project may also have the indirect beneficial effect of encouraging the implementation of additional efforts to improve this aquatic ecosystem.

H. Determination of Indirect Effects of Disposal of Fill on the Aquatic Ecosystem: Indirect effects are effects that are associated with a discharge of dredged or fill material, but do not result from the actual placement of these materials. Such effects would potentially in include increases in flood potential or changes in wildlife communities in responses to changes in vegetation growing in filled areas. The indirect effects of this project are generally overwhelming environmentally beneficial. Adequate mitigation is provided for the adverse impacts that may occur.

IV. FINDING OF COMPLIANCE

A review of the proposed project indicates the following findings:

1. The discharge represents the least environmentally damaging practicable alternative and, if in a special aquatic site, the activity associated with the discharge must have direct access or proximity to or be located in the aquatic ecosystem to fulfill its basic purpose.

X Yes __ No

2. The activity does not appear to: (1) violate applicable state water quality standards or effluent standards prohibited under Section 307 of the Clean Water Act; (2) jeopardize the existence of federally listed endangered or threatened species or designated marine sanctuary.

X Yes __ No

3. The activity would not cause or contribute to significant degradation of waters of the United States, including adverse effects on human health; life stages of organisms dependent on the aquatic ecosystem; ecosystem diversity, productivity, and stability; and recreational, aesthetic, and economic values.

X Yes __ No

4. Appropriate and practical steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem.

X Yes __ No

Note: A negative response indicates that the proposed project does not comply with the guidelines.

On the basis of the guidelines, the proposed disposal site for the discharge of fill material is:

___ (1) Specified as complying with the requirements of these guidelines; or

X (2) Specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem; or

___ (3) Specified as failing to comply with the requirements of these guidelines.

Prepared by: ____________________________

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Date: September 2004

Appendix B

Monitoring and Adaptive Management Plan

APPENDIX B. MONITORING AND ADAPTIVE MANAGEMENT PLAN

1.0 INTRODUCTION

The Monitoring and Adaptive Management Plan (MAMP) is an essential element in the overall implementation of the proposed restoration plan. It provides a mechanism to evaluate the effectiveness of the restoration measures implemented in this project and to implement adaptive changes, if required, to realize project objectives. As outlined in EC 1105-2-210 (21.b.), the MAMP is intended to ascertain whether the project is functioning per project objectives; determine whether adjustments for unforeseen circumstances are needed; and/or evaluate whether changes to structures or their operation or management techniques are required.

This MAMP document describes:

- The restoration goals and objectives as described by plan formulation and HGM;
- The success criteria evaluation procedure;
- Data collection methods for success criteria evaluation;
- Reporting requirements of success evaluation; and
- Methods to promote future flexibility and contingency plans for adaptive management.

The MAMP covers Corps related monitoring and adaptive management actions during the first five years after initial project construction is complete. After the first five years, monitoring and/or adaptive management becomes the responsibility of the local sponsors (i.e., the Salt River Pima-Maricopa Indian Community [SRPMIC] and the City of Mesa). However, the local sponsors can use this plan to help guide monitoring efforts and refine the project features such that project goals and objectives are achieved.

The data collection methods described in this MAMP was taken from the HGM Appendix for this project and "A Guide to Hydrogeomorphic Models for Arizona's Arid Riverine Waters and Wetlands, Draft Model Report" prepared by the U.S. Army Corps of Engineers, Engineer Research and Development Center.

2.0 GOALS AND OBJECTIVES

The driving force of a Feasibility Study is the identification of the project's primary goals and objectives. These are determined in coordination with the local sponsor(s), and guide the eventual project feature design. The Va Shly'ay Akimel Ecosystem Restoration project covers a large land area, and is locally sponsored by both the SRPMIC and the City of Mesa, therefore, the stated goals and objectives cover more than one area of interest.

The biological goals and objectives of the ecosystem restoration project as stated in the EIS are:

- Restore the riparian ecosystem to the degree that it supports native vegetation and wildlife through the Salt River from immediately downstream of the Granite Reef Dam to the Pima Freeway (SR 101).
- Establish a functional floodplain in unconstrained river reaches of the study area that is ongoing and mimics the natural processes found in other naturalized riparian corridors in Arizona.

Other goals and objectives as stated in the EIS are:

- Provide passive recreation opportunities for visitors of all ages, abilities, and backgrounds that are in harmony with the SRPMIC's management of its culture and native ecology.
- Create awareness through ongoing educational opportunities of the significance of the cultural resources relating to the Salt River.
- Create awareness through ongoing educational opportunities of the significance of the Salt River ecosystem.
- Create awareness through ongoing educational opportunities of the ecological connection between other ongoing riparian restoration projects along the Salt River.

Once the biological goals and objectives were identified, habitat value goals were determined using HydroGeoMorphic Assessment of Wetlands (HGM). Performance targets were established for both the acreages of desired cover types, or partial wetland assessment areas (PWAAs), and the functional capacity index (FCI) of those habitats. A detailed discussion of the development of the HGM models and how they were applied in this project can be found in the HGM Appendix.

Table 1 details the quantitative performance targets for each PWAA while Table 2 details the qualitative performance targets listed by FCI function for each pre-selected Target Year (TY).

Table 1. Partial wetland assessment areas (PWAAs) used in Va Shly'ay Akimel Restoration project and their performance target acres.

PWAA Description	PWAA Code	Target Acreages	Notes
Existing Cottonwood-Willow Forests in Active Channel	CTWWFOR	63.0	Accept 10% loss of Existing CTWWFOR Acreage
Existing Mesquite Woodlands-on the Terraces and in Active Channel	MESQUITE	4.0	Preserve/Protect Existing Mesquite
Newly Developed Cottonwood-Willow Forests	NEWCWWFOR	150.0	Convert from SANDGRAVEL
Newly Developed Mesquite Woodlands on Terraces and in Active Channel	NEWMESQUIT	300.0	Convert from SANDGRAVEL, DESERT
Newly Developed River Bottom Areas within the Active Channel-Largely Unvegetated (Includes Emergents)	NEWRVRBOTM	75.0	Convert from SANDGRAVEL
Newly Developed Scrub-Shrublands in the Active Channel	NEWSCRUB	1000.0	Convert from SANDGRAVEL
Existing River Bottom Areas within the Active Channel-Largely Unvegetated (Includes Emergents)	RIVERBOTTOM	334.0	Accept no net loss of RIVERBOTTOM
Existing Scrub-Shrublands in the Active Channel	SCRUBSHRUB	2056.0	Preserve existing SCRUBSHRUB

Table 2. FCI function models and performance targets for Alternative O2.

Function	Alternative O2 Target Year FCIs			
	1	**6**	**26**	**51**
Function 1: Maintenance of Channel Dynamics	0.374	0.374	0.374	0.374
Function 2: dynamic Surface Water Storage/Energy Dissipation	0.551	0.563	0.588	0.589
Function 3: Long Term Surface Water Storage	0.292	0.292	0.292	0.292
Function 4: Dynamic Subsurface Water Storage	0.225	0.225	0.225	0.225
Function 5: Nutrient Cycling	0.237	0.384	0.495	0.568
Function 6: Detention of Imported Elements and Compounds	0.305	0.352	0.385	0.391
Function 7: Detention of Particles	0.453	0.462	0.484	0.485
Function 8: Maintain Characteristic Plant Communities	0.643	0.624	0.767	0.763
Function 9: Maintain Spatial Structure of Habitat	0.494	0.567	0.624	0.641
Function 10: Maintain Interspersion and Connectivity	0.527	0.644	0.669	0.681

The quantitative and qualitative performance targets established during plan formulation will be used as the measure of success; these values and habitat improvement predictions were the basis for determining which project alternative was most economically justified. These habitat values were also derived from measurable variables that were selected to be used in the HGM model and can therefore be measured again in the future.

3.0 SUCCESS CRITERA EVALUATION

A key to properly determining the success or failure of a project is the ability to measure a parameter repeatedly and consistently, over time and then compare these results to a quantitative target. The project FCI values and performance target acreages will be the primary parameters measured to determine whether the goals of this restoration effort are being achieved. The quantitative values, acres, can be easily assessed at target year 0 (immediately after construction) and target year 1 (one year post construction). If all habitat features are planted during the same construction phase, the acreage criteria can be met immediately post-construction. The habitat acreage, once planted, is not expected to increase significantly given the limiting factors outside of the project feature areas (lack of supplemental irrigation, poorly graded surface, etc.). Further, the habitat acreage would not be allowed to decrease significantly without adaptive management. However, the expected success criteria for habitat acreage could change during the preliminary engineering design (PED) phase for a variety of reasons. They include, but are not limited to: 1) If construction takes place in distinct phases, it would eliminate the opportunity for all acres of any particular habitat to be planted during the same year, 2) project site conditions may change in such a way that a particular area is no longer conducive to a previously planned vegetation type, and 3) the vegetation acreages were planned using GIS maps and shape files, therefore, may not reflect the exact acreages found on the ground. Because of these limitations, acreage success will be determined by meeting 90% of the projected acreage in any given project reach and by achieving a vegetation survival rate of 80% or more. Eighty percent survival rate is within the range of other previously documented riparian restoration efforts with ample irrigation (Goldner, 1984; Jack et al., 2002; http://weather.nmsu.edu/nmcrops/riparian-vegetation/bosque/bosquie-%20revegetation.htm)

Functional Capacity Indices are derived from field measurements taken from several different variables. While the methods of this data collection will be clearly outlined, see "Methods" below, it is inevitable that some human induced variation in measurement technique will occur within each year's data collection. Therefore, it is unreasonable to expect the FCI values to match exactly for any given target year. To account for this variation, success will be determined by meeting 80% of the projected FCI value in any given target year for any given function.

4.0 METHODS

The following discussion is taken primarily from the HGM Appendix for this project. While the intent here is to capture enough detail to conduct the field and non-field sampling, the HGM Appendix should be used as a reference for further detail or clarification, if necessary.

4.1 Variables to be Sampled

The HGM model is derived from multiple FCI models that use a number of variables depending upon the particular HGM model used. In the Va Shly'ay Akimel instance, the Arizona Riverine HGM model used twenty-seven (27) different variables. Table 3 provides a brief description of each variable used in this HGM model.

Table 3. Variable names and descriptions used in the Va Shly'ay Akimel HGM Assessment.

Variable Code	Variable Description
AGSA	Algal Growth Surface Area as an indicator of past inundation.
BUFFCOV	Percent of native vegetation cover in the buffer.
BUFFLENGTH	Percent of area with sufficient buffer.
BUFFWIDTH	With of buffer (m).
CONTIG	Contiguous vegetation cover between waters/wetlands and uplands (%).
CWD	Abundance of dead and down woody debris ≥ 2.5" in diameter (coarse)
DECAY	The presence of coarse woody debris in various stages of decomposition.
DEPSATSED	Depth of saturated sediments (m).
FPA	Floodprone area as defined by the projection of a horizontal plane at a level twice the bankfull thalweg depth.
FREQ	Frequency of inundation.
FWD	Abundance of dead and down woody debris < 2.5" in diameter (fine).
HERB	Abundance as measured through vegetation volume of herbaceous species.
INVASIVES	Abundance of invasive species.
LANDUSE	Type of adjacent landuse.
LITTER	Abundance of leaf litter and other detrital matter in the FPA.
PORE	Soil pore spaces available for storing subsurface water. Performance is related to soil texture and permeability.
Q	Alterations of hydro-regime that affect the assessment area.
SED	Extent of sediment delivery to the water/wetland from culturally accelerated sources.
SHRUB	Abundance as measured through vegetation volume of shrubs (multiple stems, woody species).
SPECRICH	Species richness.
SUBIN	Subsurface flow into the water/wetland via interflow and return flow.
SURFIN	Surface inflow to the wetland via sheetflow.
TOPO	Macro (large scale) and microtopographic (small scale) relief. Macrotopography generally refers to large-scale features such as secondary channels and in-channel ponds. Microtopography generally refers to small-scale features such as pit-and-mound and hummock-and-hollow patterns.
TREE	Abundance as measured through vegetation volume of trees.
TRIB	Presence of connected tributaries.
VEGSTRATA	Number of vegetation layers present.
WIS	Wetland indicator score.

Not all variables are used in all FCI models, and some variables are used in more than one FCI model.

4.2 Sampling Protocol

The variables to be collected can be divided into two groups; data that can be collected with field sampling, and data that can be collected without field sampling. Data that required field sampling included those variables related to water quality, geochemistry, hydrology, fluvial geomorphology, substrate, flora, and fauna. Data that does not require field sampling includes information on historical conditions, landscape scale habitat conditions, land use characteristics, ownership, pattern of ownership and jurisdictional boundaries.

4.2.1 Variables Measured in the Field

Certain variables in the HGM require field sampling to quantify. A variety of methods are used to obtain such data; a brief description of the field sampling protocol follows.

The sampling team consisted of 4 individuals. Each team had one member experienced with HGM data collection. Other team members had expertise in a field related to the sampling effort. Each team had a designated recorder for the sampling day to record data reported by team members. Prior to sampling, observers standardized their estimates of cover with each other, discussed the kinds of species present, and discussed their impressions of the site. To minimize observer error, the same observers estimated the same components on all transects.

Table 4 provides a brief description of the protocols used in obtaining the field collected data:

Table 4. Protocols for field data collection for the Va Shly'ay Akimel Ecosystem Restoration Project.

Variable Code	Protocol Description
AGSA	Measure the percent of a 1m quadrat with algae, algal remnants, or water present.
BUFFCOV	Measure percent cover of native vegetation vs. bare ground and/or non-native vegetation within a 1m quadrat.
CWD	Dead and down woody debris larger than or equal to 2.5 " in diameter measured as class data: 0= No data 1= CWD 9-15% 2= CWD 6-8% 3= CWD >15% 4= CWD 1-2% 5= CWD 0-<1%, recoverable 6= CWD 0-<1%, unrecoverable
FWD	Dead and down woody debris smaller than 2.5" in diameter measured as class data: 0= No data 1= FWD 38-68% 2= FWD 25-37% 3= FWD >73% 4 =FWD 13-24% 5= FWD 3-12% 6= FWD 0-2%, recoverable 7= FWD 0-2%, unrecoverable
HERB	Record the number of decimeter hits within each meter interval. A hit is defined as any vegetation within a 10cm radius of the rod, per vertical decimeter. Estimate volume above 10m as either three or seven hits per interval. These estimations can be based on comparison with lower intervals where hits can be directly measured.
LITTER	Litter is measured by the percent of leaf litter or other detrital material in data classes: 0= No data 1= 28-46% litter cover 2= 18-27% litter cover 3= <46% litter cover 4= 9-17% litter cover 5= 2-8% litter cover 6= 0-1% litter cover, recoverable 7= 0-1% litter cover, unrecoverable
SHRUB	Record the number of decimeter hits within each meter interval. A hit is defined as any vegetation within a 10cm radius of the rod, per vertical decimeter. Estimate volume above 10m as

	either three or seven hits per interval. These estimations can be based on comparisons with lower intervals where hits can be directly measured. 0= No data 1= 2547-4245 stems/acre 2= 1698-2546 stems/acre 3= >4245 stems/acre 4= 849-1697 stems/acre 5= 170-848 stems/acre 6= 0-169 stems/acre, recoverable 7= 0-169 stems/acre, unrecoverable
SPECRICH	Count (and if possible identify) the number of plant species present within the 10m wide belt transect. Herbaceous sampling should be done twice per year, once in the summer dry season (May-June) and once in the summer rainy season (Aug-Sep).
TOPO	Meassure the macro and microtopographic relief using the following class data: 0=No data 1=Macro and mircrotopo relief 2=Homogenous surfaces with macro and microtopo relief 3=Homogenous surface & lacks macro and microtopo relief 4=Steep bank, recoverable 5=Steep bank, not recoverable
TREE	Record the number of decimeter hits within each meter interval. A hit is defined as any vegetation within a 10cm radius of the rod, per vertical decimeter. Estimate volume above 10m as either three or seven hits per interval. These estimations can be based on comparisons with lower intervals where hits can be directly measured.
VEGSTRATA	Record the number of vegetation layers present. Layers include: Tall (>10m) broad-leaved tree Short broad-leaved tree Tall microphyllous tree Short Microphyllous tree Tall (>1m) broad-leaved shrub Short broad-leaved shrub Tall (>1m) microphyllous shrub Short microphyllous shrub Vine Epiphyte Bunch grass Non-bunch grass Forb Lichens or biotic soil crusts

To collect these data, at each PWAA, a 100m long transect will be established generally parallel to the river channel. In some PWAAs, the transect may have to curve or be broken into two 50m transects. Along the 100m transect, establish a series of 10m X 10m quadrats, creating a belt transect. Each 100m transect should have 10, 10m X 10m quadrats. At the center of the quadrat, the recorder should note the presence of rills on adjacent slopes. Within the 10m X 10m quadrat the following should be recorded as reported by team members and based on the methods stated above:

1. Number of vegetation layers
2. Species composition
3. Microtopographic features (small scale pits and hummocks)
4. Logs and stage of decay

Within the 10m quadrat, a 1m X 1m quadrat should be randomly located. Within this quadrat the following data should be recorded based on the methods stated above:

1. Percent coarse woody debris (% CWD)
2. Percent fine woody debris (% FWD)
3. Percent litter cover
4. Percent algal mat
5. Percent tree canopy
6. Percent shrub cover
7. Percent herbaceous cover

The percent cover of all components should be estimated occularly. Percent cover of coarse woody debris, fine woody debris, litter cover, algal mat, shrub and herbaceous components should be estimated by vertically projecting the cover of each onto the ground surface. Due to the multi-layered nature of vegetation, total vegetative cover can exceed 100 percent. An example of this is the occurrence of herbaceous species under shrub canopies. Tree canopy cover should be estimated by viewing the tree canopy upwards through a sighting tube. The sighting tube should be divided into quarters by a cross-hair. The percent of the sky obscured by tree canopy as viewed through the sighting tube should be determined and recorded. At the center of each 1m X 1m quadrat, a 9.5m pole graduated in meters and decimeters should be placed vertically within the foliage. The number of decimeter hits within each meter interval should be recorded. A hit is defined as any vegetation within a 10cm radius of the rod per vertical decimeter. Estimates of volume above 10m in height should be recorded as either three (3) or seven (7) hits per interval. Such estimates can be based on comparison with lower intervals where hits can be directly measured.

4.2.2 Variables Not Collected in the Field

Some variables can be obtained through various historical records, aerial photographs, or mathematical calculations rather than through active field sampling. Table 5 provides a brief description of those protocols used in obtaining the non-field collected data:

Table 5. Protocols for non-field data collection for the Va Shly'ay Akimel Ecosystem Restoration Project.

Variable Code	Protocol Description
BUFFLENGTH	Measure the percent of area with sufficient buffer length using data classes: 0= No data 1= 100% of the reach has right and left bank buffers 2= Only onside of the reach has 100% buffering 3= 75% of the reach has right and left bank buffers 4= Only one side has 75% buffering 5= 50% of the reach has right and left bank buffers 6= Only one side has 50% buffering 7= 25% of the reach has right and left bank buffering 8= Only one side has 25% buffering 9= 0% of the reach has right and left bank buffers
BUFFWIDTH	Measure the width of the buffer in meters using data classes: 0= No data 1= Reach has a 15m right bank buffer and a 15m left bank buffer 2= Only 1 bank has a 30m buffer 3= Reach has a 10m right bank buffer and a 10m left bank buffer 4= Only 1 bank has a 20m buffer 5= Reach has a 5m right bank buffer and a 5m left bank buffer 6= Only 1 bank has a 10m buffer 7= Only 1 bank has a 5m buffer 8= No buffer exists
CONTIG	Measure the percent of contiguous vegetation.
DEPSATSED	Measure the depth of saturated sediments using class data: For CTWWFOR: 0= No data 1= 0m 2= 1-3m 3= >3m For MESQUITE: 0= No data 1= 0m 2= 1-7m 3= >7m For RIVERBOTTOM (emergents): 0= No data 1= 0m 2= 0.01 – 0.25m 3= >0.25m

FPA	Measure the flood prone area as defined by the projection of a horizontal plane at a level twice the bankfull thalweg depth using class data: 0= No data 1= FPA not clearly defined 2= FPA confined on one side 3= FPA confined is <15x bankfull width 4= FPA confined is <15x bankfull width recoverable 5= FPA confined is <2x bankfull width not recoverable 6= FPA confined to concrete channel.
FREQ	Measure the frequency of inundation of a site using class data: 0= No data 1= Perennial flow 2= Intermittent flow 3= Saturated 4= Temporally flooded by seasonal high flow (Q1-Q2) 5= Temporally flooded at bankfull flow (Q2-Q10) 6= Temporally flooded at large flood (Q10-Q25) 7= Temporally flooded at major flood (Q25-Q100) 8= Temporally flooded at super flood (>Q100)
LANDUSE	Measure the type of adjacent land use using class data: 0= No data 1= Active sand and gravel operations 2= Commercial/Industrial 3= Paved roads 4= Multi-family residential (apartments and duplexes) 5= Single-family residential (individual houses) 6= Gravel roads, dirt roads, bike paths, and infrequently visited structures 7= Inactive sand and gravel operations 8= Agricultural cropland 9= Open space (parks, golf course, etc) 10= Pristine, uninhabited areas
PORE	Measure soil pore space available for storing subsurface water using class data: 0= No data 1= Soil texture is sand-sandy loam; no restrictive layer 2= Soil finer than sand-has restrictive layer 3= Soil texture is finer than a restrictive layer 4= Modal soil profile highly compacted in the upper 24" 5= Concrete channel
Q	Measure the alteration of the hydrologic regime in the assessment area using class data: 0= No data 1= No additions, diversions, or damming of flow affecting the assessment area (e.g., water harvesting, farming practices,

	stormwater management, etc.) 2= Evidence of additions, diversions, or damming of flow, but no evidence of significant impacts to channel pattern, dimension, and profile 3= Evidence of additions, diversions, or damming of low, and there is evidence of changes I vegetation abundance. No evidence of increase sediment or scour. 4= Evidence of additions, diversions, or damming of flow, and there is evidence of increase sediment or scour. 5= Evidence of additions, diversions, or damming of flow, and there is evidence of significant impacts to channel pattern, dimension, and profile. Variable is recoverable. 6= Permanent alterations to hydroregime are evident. Variable is not recoverable.
SED	Measure the extent of sediment delivery to the water/wetland from culturally accelerated sources using class data: 0= No data 1= No sediment disturbance 2= Disturbance evident 3= Disturbance and delivery evident 4= Disturbance extreme and vegetation mortality 5= Area filled
SUBIN	Measure surface flow into the water/wetland via interflow and return flow using class data: 0= No data 1= Undistributed, subsurface flow evident 2= Undisturbed and subsurface flow is observed 3= Disturbed soils and plant communities 4= Utilized for agricultural activities 5= Fill 6= Impervious 7= Concrete channel
SURFIN	Measure surface inflow to wetland using class data: 0= No data 1= Any of the following indicators are present and similar to the reference standard: rills on adjacent upland slopes; lateral tributaries entering floodplain and not connected to the channel 2= Both indicators are resent but less than the reference standard 3= Both indictors are absent 4= Both indicators are absent and channelization prevents sedimentation on wetland surface
TRIB	Measure the presence of connected tributaries using class data: 0= No data 1= All tributaries (channel and riparian corridor) are unmodified and connect to the mainstem

	2= Some tributaries are modified (consolidated, redirected, or channelized) but still connected to the mainstem 3= Tributaries are highly modified/channelized, or not connected to the mainstem
WIS	Measure the wetland indicator score for each species in SPECRICH using class data: 1= Obligate 2= Facultative wet 3= Facultative 4= Facultative upland 5= Upland

Once all field and non-field data are collected, the values can be entered into the Arizona Riverine HGM model, resulting in output that can then be directly compared to the projected output values. For the restoration project to be deemed successful, the actual Target Year results must meet or exceed 80% of the project Target Year results for each of the 4 Target Years.

4.3 Additional Monitoring Requirements

4.3.1 Insects

Monitoring insects should be done annually during the Operations and Maintenance period to address concerns regarding disease vector control. Mosquito monitoring should include establishing a baseline prior to construction of the project features. Such a baseline would consider routine sampling of both adult and juvenile forms of mosquitoes during the months of April through October at a minimum. Such information provides insight into the existing mosquito population dynamics and may be used to guide monitoring and management activities during and after construction.

4.3.2 Federally Threatened and Endangered Species

Habitat development for federally listed threatened and endangered (T&E) species is not listed as a goal and objective of this restoration project. However, because of the shortage of native riparian habitat in the southwest, there are a number of T&E species that are likely to migrate into the created habitat. In preparation for this, both the SRPMIC and the City of Mesa have expressed an interest in developing a Safe Harbor Agreement with the U.S. Fish and Wildlife Service (USFWS). This agreement allows the local sponsor to develop habitat that may be suitable and/or attractive to federally listed T&E species, without the future risk of activity limits as dictated by the Endangered Species Act. A Safe Harbor Agreement allows the local sponsor to conduct activities, such as maintenance related activities, without the need to apply for a take permit. However, part of the Safe Harbor Agreement is to conduct a thorough baseline condition survey for all T&E species that might be in the area. This effort is expected to provide the first monitoring requirement, target year (TY) 1.

The T&E species listed as part of the Endangered Species Act, Section 7 consultation determination of "may affect, not likely to adversely affect" are: bald eagle, southwestern willow flycatcher, Yuma clapper rail, cactus ferruginous pygmy-owl, and California brown pelican. These species will be of particular importance to monitor for as long as the project is authorized.

Monitoring of T&E species must follow USFWS approved protocol and should be conducted initially as part of the Safe Harbor Agreement procedure and subsequently during the Operations and Maintenance period. It will be important to coordinate with the USFWS regarding survey timing and frequency; coordination is essential if T&E species are found within the project area.

4.3.3 Wildlife Hazard Monitoring

The U.S. Department of Agriculture-Animal and Plant Health Inspection Service-Wildlife Services (WS) program is authorized and directed to protect resources from damage associated with wildlife. WS provides assistance to the aviation community to assess and manage wildlife hazards at airports. They recommend a distance of 10,000 feet between any wildlife attractant and an airport's aircraft movement areas to avoid bird strikes. While the City of Mesa's Falcon Field Airport is more than 10,000 feet from the nearest project feature, recognizing the risks of wildlife related damage is important. During any regular operation and/or maintenance or monitoring activities, if there is evidence that wildlife, associated with the project features, may be infringing upon the 10,000 foot safety zone, the WS should be notified immediately. The WS, Corps, and local sponsors can then work together to resolve the issue.

4.4 Frequency of HGM Model Runs

The HGM performance target FCU values were computed for four Target Years: TY1, TY6, TY26 and TY51. Therefore, as part of the success criteria evaluation, the HGM model data collection and subsequent model runs should be conducted at those same years, at a minimum. These milestones will again allow for a direct comparison of the predicted FCIs and acreages versus the achieved habitat values and to quantify the extent of the failure(s).

Should a particular project feature, vegetation type, or area within the project footprint show signs of failure of any kind, the HGM model and associated data collection should be performed, regardless of time post-construction, to help identify the likely cause of the degradation.

5.0 DOCUMENTATION

Proper documentation of the monitoring efforts serves two primary purposes. First, the documentation should provide a clear picture of the project results so current conditions can be easily identified and the appropriate adaptive management measures can be applied, if necessary. Second, documentation should be easily assessable so that future projects can reference the procedures used and learn from the planning or adaptive management measures taken.

The Corps, in cooperation with the local sponsors, will write an annual report at the end of each of the first five years post construction. This report should include a written description of current conditions as well as the results of any HGM runs, flora and fauna surveys conducted, geo-references and maps for the area covered in the report, topographic survey results identifying all significant features (planting sites, on-going mining operations, etc.) and a well documented photographic record including oblique photos from before, during and after construction. The exact photo point locations should be fixed using GPS coordinates so that an exact photograph can be repeated for all submissions. This report should be made available to the USFWS and all other interested resource agencies.

The photographic record should be explicitly documented using photo point data sheets, courtesy of the Arizona Water Protection Fund, as shown at the end of this MAMP. The exact photo point locations should be repeated for all submissions. Because of the expected vegetation growth, each photo point should be taken in the channel, or from some vantage point that will not be obscured by vegetation in the future.

After the first five years, the local sponsors will be responsible for preparing the monitoring reports and for funding and implementing any modifications necessary to ensure the success of the project.

A Technical Committee consisting, at a minimum, of representatives of the USFWS, U.S. Bureau of Reclamation, and Arizona Game and Fish Department will assist in collection of monitoring data, review monitoring data results and reports, and recommend possible adaptive management measures.

6.0 ADAPTIVE MANAGEMENT

The Technical Committee will recommend adaptive management measures to the existing project's design if either the acreage or quality of PWAAs does not achieve the identified goal and objectives. If the designated vegetation species composition is not achieved, replanting, additional irrigation, and/or removal of vegetation (especially exotics) may be necessary.

Flexibility is essential to adaptive management success. This should be in the form of design contingency plans and flexible funding availability. During PED, contingency plans should be developed for situations that, while not predicted to occur, may occur given varying environmental, social, or structural conditions. These may include accounting for a variety of site-specific soil conditions, changes in land use immediately outside of the project area, or changes in mining operations and quarry pits.

The allotted funding for monitoring is up to 1% of the total project cost. These funds are cost shared 65% to 35% between the Corps and the local sponsors, respectively.

Adaptive Management funds are authorized up to 3% of the total project costs, again, cost shared between the Corps and local sponsors. Should the local sponsors choose to, they might begin contributing to an escrow account early in the project construction phase to maximize the funding, which helps ensure maximum flexibility. If the entire 3% of the project cost authorized for Adaptive Management needs is not utilized in the first five years after construction, it too can be put into an escrow account to be used by the local sponsor for future adaptive management needs.

7.0 CONCLUSION

The Monitoring and Adaptive Management Plan is designed to provide guidance that will provide a means for cost effective, reliable, and effective monitoring of success of the ecosystem restoration project. The purpose of this monitoring is to ensure that the project is functioning as it was intended to. The HGM model will be used at the designated target years to evaluate the quantitative and qualitative condition of the project site with the expectation that the project features will meet or exceed 80% of the predicted FCI and acreage values.

Should the project fall below the 80% threshold of predicted acreages and/or FCI values, adaptive management strategies will be implemented. Adaptive Management is designed to alter any design feature necessary to help promote the meeting of design objectives, should monitoring indicate they are falling short.

8.0 REFERENCES

J.D. Jack, A. C. Parola, and W.C. Vesley. Assessment of channel and riparian restoration in an urban stream in Louisville, KY (USA). Presented at the North American Benthological Society Annual Meeting. Pittsburgh, PA. 2002.

Goldner, B.H. 1984. Riparian restoration efforts associated with structurally modified flood control channels. Pages 445-451 *in* R.E. Warner and K.M. Hendrix [eds]. California riparian systems: ecology, conservation, and productive management. California Water Resources Report No. 55. University of California Press, Berkeley.

http://weather.nmsu.edu/nmcrops/Riparian-vegetation/Bosque/bosque%20revegetation.htm

APPENDIX B: Photo Point Data Sheet (courtesy of Arizona Water Protection Fund)

INITIAL TAKE
PERMANENT PHOTO POINT RECORD

Photo Point No. ____________________
Project Name ____
Landowner/Management Unit ________________________________ County_______________
____

Subject and Purpose of Photo ____
____
____
____

Retake Frequency______________________________ Retake Due Dates ________________
____

Initial Photo Info: ______________________________
Photographer __________________________________ Date _______________ Time ________
______a.m. p.m.
Camera _________________________ Film _____________________ ASA ________

Weather Conditions

Photo Point Description (Describe access to point, point vicinity, and specific location; include sketch map below):

Legal Description ____
USGS Quad Map ____
Est. Position Coordinates (UTM's, Lat/Long) ____________________________________
____

View 1	View 2	View 3
Camera Height________	Camera Height________	Camera Height________
Compass Bearing_______	Compass Bearing_______	Compass Bearing_______
Lens_________Filter_________	Lens_________Filter_________	Lens_________Filter_________
F-stop________Speed_________	F-stop________Speed_________	F-stop________Speed_________
Focus Distance________	Focus Distance________	Focus Distance________

SKETCH MAP: Include background reference points to help with relocation.

Reference Point 1
Description___________
____
Bearing and
distance_____________
____

Reference Point 2
Description___________
____
Bearing and
distance_____________
____

Reference Point 3
Description___________

Bearing and
distance______________

RETAKE
PERMANENT PHOTO POINT RECORD

Photo Point No. ______________ Date______Time___________________a.m. / p.m.
Project Name ____
Landowner/Management Unit ______________________________County ____________________
Photographer ____________________________
Camera __________________________Film _______________ASA _____________________

View 1	View 2	View 3
Camera Height________	Camera Height________	Camera Height________
Compass Bearing_______	Compass Bearing_______	Compass Bearing_______
Lens_________Filter_________	Lens_________Filter_________	Lens_________Filter_________
F-stop________Speed________	F-stop________Speed________	F-stop________Speed________
Focus Distance________	Focus Distance________	Focus Distance________

Condition of Point Monument and references: ____
____

Weather conditions or recent events that may have influenced conditions at the site:

Appendix C

List of Plant and Animal Species Mentioned in the Text

Appendix C. List of Plant and Animal Species Mentioned in the Text

Common Name	Scientific Name
Plants	
Acacia	*Acacia greggii*
Agave and yucca	*Agave* spp.
Arrow weed	*Sagittaria* spp.
Barrel cactus	*Ferocactus* spp.
Bermuda grass	*Cynodon dactylon*
Blue paloverde	*Cercidium floridum* var. *floridum*
Brittlebush	*Encelia farinosa*
Bulrush	*Scipus* spp.
Burro brush	*Hymenoclea salsola*
Cholla	*Opuntia* spp.
Cattail	*Typha* spp.
Cottonwood	*Populus* spp.
Creosote bush	*Larrea tridentata*
Desert broom	*Baccharis sarothroides*
Desert thorn	*Lycium macrodon*
Desert willow	*Chilopsis linearis*
Dock	*Rumex* spp.
Elderberry	*Sambucus glauca*
Filaree	*Erodium cicutarium*
Fremont cottonwood	*Populus fremontii* ssp. *fremontii*
Goodding's willow	*Salix gooddingii*
Ironwood	*Olneya tesota*
Knotweed	*Polygonum* spp.
London rocket	*Sisymbrium irio*
Marsh fleabane	*Pluchea purpurascens* var. *purpurascens*
Mesquite	*Prosopis velutina*
Organ pipe cactus	*Cereus thurberi*
Quailbush	*Atriplex lentiformis* ssp. *lentiformis*
Rabbit brush	*Chrysothamnus* spp.
Russian thistle	*Salsola tragus*
Saguaro	*Carnegiea gigantea*

Appendix C. Continued

Common Name	Scientific Name
Salt heliotrope	*Heliotropium curassavicum*
Saltbush	*Atriplex* spp.
Saltcedar	*Tamarix* spp.
Sedge	*Carex* spp.
Tree tobacco	*Nicotiana glauca*
Triangle bursage	*Ambrosia deltoidea*
Tule	*Scirpus acutus*
Velvet mesquite	*Prosopis velutina*
Western honey mesquite	*Prosopis glandulosa*
White bursage	*Ambrosia dumosa*
Willow	*Salix* spp.
Yellow paloverde	*Cercidium microphyllum*
Reptiles and Amphibians	
Banded gecko	*Coleonyx variegatus*
Banded sand snake	*Chilomeniscus cinctus*
Common kingsnake	*Lampropeltis getulus*
Desert black-headed snake	*Tantilla nigriceps*
Desert spiny lizard	*Sceloporus magister*
Desert tortoise	*Gopherus agassizii*
Earless lizard	*Holbrookia texana*
Gopher snake	*Pituophis melanoleucus*
Lowland leopard frog	*Rana yavapaiensis*
Mexican garter snake	*Thamnophis eques*
Side-blotched lizard	*Uta stansburiana*
Tree lizard	*Urosaurus ornatus*
Western diamondback rattlesnake	*Crotalus atrox*
Western whiptail	*Cnemidophorous tigris*
Insects	
Mosquito	Family Culicidae

Appendix C. Continued

Common Name	Scientific Name
Birds	
Abert's Towhee	*Pipilo aberti*
American Coot	*Gallinula chloropus*
American Kestrel	*Falco sparverius*
Anna's Hummingbird	*Calypte anna*
Ash-throated Flycatcher	*Myiarchus cinerascens*
Bald Eagle	*Haliaeetus leucocephalus*
Barn Owl	*Tyto alba*
Bell's Vireo	*Vireo belli*
Belted Kingfisher	*Ceryle alcyon*
Bewick's Wren	*Thryomanes bewickii*
Black Phoebe	*Sayornis nigricans*
Black-bellied Whistling Duck	*Dendrocygna autumnalis*
Black-crowned Night-Heron	*Nycticorax nycticorax*
Black-throated Sparrow	*Amphispiza bilineata*
Brown-headed Cowbird	*Molothrus ater*
Cactus Ferruginous Pygmy-Owl	*Glaucidium brasilianum cactorum*
Canyon Towhee	*Pipilo fuscus*
Cinnamon Teal	*Anas cyanoptera*
Common Merganser	*Mergus merganser*
Curve-billed Thrasher	*Toxostoma curvirostre*
Dusky Flycatcher	*Empidonax oberholseri*
Elf Owl	*Micrathene whitneyi*
European Starling	*Sturnus vulgarus*
Gambel's Quail	*Callipepla gambelii*
Gila Woodpecker	*Melanerpes uropygialis*
Great Blue Heron	*Ardea herodias*
Great Egret	*Ardea alba*
Great Horned Owl	*Bubo virginianus*
Greater Roadrunner	*Geococcyx californianus*
Horned Lark	*Eremophila alpestris*
House Finch	*Carpodacus mexicanus*
House Sparrow (I)	*Passer domesticus*
House Wren	*Troglodytes aedon*

Appendix C. Continued

Common Name	Scientific Name
Killdeer	*Charadrius vociferus*
Loggerhead Shrike	*Lanius ludovicianus*
Lucy's Warbler	*Vermivora luciae*
Mallard	*Anas platyrhynchos*
Marsh Wren	*Cistothorus palustris*
Mountain Plover	*Charadrius montanus*
Mourning Dove	*Zenaida macroura*
Northern Flicker	*Colaptes auratus*
Northern Harrier	*Circus cyaneus*
Northern Mockingbird	*Mimus polyglottos*
Northern Pintail	*Anas acuta*
Osprey	*Pandion haliaetus*
Peregrine Falcon	*Falco peregrinus*
Phainopepla	*Phainopepla nitens*
Red-tailed Hawk	*Buteo jamaicensis*
Red-winged Blackbird	*Agelaius phoeniceus*
Rock Dove (I)	*Columba livia*
Southwestern Willow Flycatcher	*Empidonax traillii extimus*
Spotted Sandpiper	*Actitis macularia*
Summer Tanager	*Piranga rubra*
Tree Swallow	*Tachycineta bicolor*
Verdin	*Auriparus flaviceps*
Western Burrowing Owl	*Athene cunicularia*
Western Kingbird	*Tyrannus verticalis*
Western Sandpiper	*Calidris mauri*
Western Screech Owl	*Otus kennicottii*
Western Wood-Pewee	*Contopus sordidulus*
Western Yellow-billed Cuckoo	*Coccyzus americanus*
White-tailed Kite	*Elanus leucurus*
White-winged Dove	*Zenaida asiatica*
Yellow Warbler	*Dendroica petechia*
Yellow-rumped Warbler	*Dendroica coronata*
Yuma Clapper Rail	*Rallus longirostris yumanensis*

Appendix C. Continued

Common Name	Scientific Name
Mammals	
Blacktail jack rabbit	*Lepus californicus*
Bobcat	*Lynx rufus*
Cactus mouse	*Peromyscus eremicus*
Coyote	*Canis latrans*
Deer mouse	*Peromyscus maniculatus*
Desert cottontail	*Sylvilagus auduboni*
Gray fox	*Urocyon cinereoargenteus*
Ground squirrel	*Citellus* spp.
Hispid cotton rat	*Sigmodon hispidus*
Lesser long-nosed bat	*Leptonycteris curasoae yerbabuenae*
Muskrat	*Ondatra zibethica*
Opossum	*Didelphis virginianus*
Pocket gopher	*Pappogeomys castanops*
Raccoon	*Procyon lotor*
Striped skunk	*Mephitis mephitis*
Western harvest mouse	*Reithrodontomys magalotis*
Whitethroat wood rat	*Neotoma albigula*
Vole	*Microtus* spp.

Appendix D

Fish and Wildlife Coordination Act Documentation

United States Department of the Interior

U.S. Fish and Wildlife Service
2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
Telephone: (602) 242-0210 FAX: (602) 242-2513

In Reply Refer to:

AESO/FA

August 2, 2004

Ms. Ruth Villalobos
Chief, Planning Division
Attn: Sarah Laughlin
U.S. Army Corps of Engineers, Los Angeles District
P.O. Box 532711
Los Angeles, California 90053-2352

Dear Ms. Villalobos:

The Fish and Wildlife Service (FWS) has reviewed the U.S. Army Corps of Engineers (Corps) proposed Va Shly' ay Akimel Feasibility Study. This report represents our evaluation of the Va Shly' ay Akimel Salt River ecosystem restoration project and is provided pursuant to Section 2(B) of the Fish and Wildlife Coordination Act (48 stat. 401, as amended; 16 U.S.C. 661 et seq.) (FWCA). This report is based on coordination with the Arizona Game and Fish Department (AGFD), local sponsors, literature research, file reviews, and information provided by the Corps including the Section 905(B) Analysis, the Draft Environmental Impact Statement (DEIS) (Corps, 2004), the Independent Technical Report Draft Alternative Formulation Briefing Feasibility Report (ITR) (Corps, 2003b), and comments on the draft FWCA report.

PROJECT DESCRIPTION

The Corps is investigating environmental restoration along the Salt River under authority of House Resolution 2425 of May 17, 1994, and Section 6 of the Flood Control Act of 1938. Together with the Salt River Pima-Maricopa Indian Community (SRPMIC) and the City of Mesa, the local sponsors, the Corps is evaluating ecosystem restoration opportunities within an approximately 14 mile stretch of the Salt River from the Granite Reef Diversion Dam to the Pima/Price Freeway, Maricopa County, Arizona (Figure 1-1).

The Salt River originates in eastern Arizona and flows westward to its confluence with the Gila River west of downtown Phoenix. Prior to agricultural development and urbanization of the Phoenix metropolitan area in the 20th century, the Salt River was a perennial stream. Impoundments, diversions, and groundwater pumping eventually eliminated perennial flow below Granite Reef, causing significant changes in the riparian and wetland ecosystems along the Salt River.

The proposed action would restore ecosystem functions and processes, return the project area to a less degraded natural condition, increase the diversity of native plants and animals, enhance the ability of the area to sustain larger populations of desirable species, and produce a viable, self-sustaining ecosystem requiring minimal maintenance. The proposed action would also provide a number of incidental benefits including an increase in recreation opportunities and improvement in water quality and supply. Without restoration, habitat values in the study area are expected to further decline within the next 50 years.

The feasibility study has planning objectives similar to and compatible with objectives established for other proposed restoration projects along the Salt River. Specific planning objectives developed for the Va Shly' ay Akimel project include the following:

- Restore and create conditions for sustainable riparian habitat in and around the study area by incorporating a channel configuration that would provide a functional floodplain to mimic natural processes found in other self-sustaining riparian corridors in Arizona.

- Identify water sources that can be used to sustain riparian restoration areas.

- Create a complete and diverse riparian system similar to the natural riparian habitat typical of this area by incorporating a diverse mix of riparian habitat types including mesquite, cottonwood-willow, wetland marsh, and open water.

- Increase environmental education and passive recreation opportunities incidental to the restoration effort.

EXISTING ENVIRONMENT

Dams along the Verde River and upper Salt River have significantly altered the hydrologic regime of the lower Salt River, changing the magnitude and timing of flows. Salt River Project (SRP) intermittently releases water from reservoirs prior to winter rains or when they are unexpectedly full. The system of dams along the Salt River has eliminated perennial flow and steady, high winter flows. Since Bartlett Dam began operating on the Verde River in 1938, the lower Salt River has contained water only as a result of controlled or uncontrolled releases from Granite Reef Diversion Dam. Granite Reef diverts reservoir releases into the Arizona Canal and the South Canal for water delivery to agricultural, municipal, and industrial uses. There are no releases during drier years and the riverbed is dry during those times except for stormwater runoff, groundwater emergence, and effluent discharges.

A biological community classification system was developed for this study and is described in detail in the DEIS. The classification system categorizes cover types in the project study area, by dominant vegetation cover. Agricultural lands are common in the project study area occupying 3262 acres. Generally, agricultural uses include irrigation for cattle grazing, citrus orchards, and crops such as cotton, small grains, and assorted vegetables. Parks and recreational areas occupy

279 acres and include turf-covered lands such as golf courses. These areas generally contain non-native ornamental trees and shrubs. Urban areas are common in the project study area, occupying 3000 acres in residential, commercial, and industrial uses. Sand and gravel operations occupy 1962 acres and have contributed to habitat alteration within the river channel.

Cottonwood/willow forest is uncommon in the study area, occupying only 40.2 acres in primarily early seral-stage stands. It is found in narrow, linear strands oriented in the main channel, particularly where effluent enters the river from the City of Mesa Wastewater Treatment Plant (WWTP). Fremont's cottonwood (*Populus fremontii*) and Goodding's willow (*Salix goodingii*) are the dominant canopy species. Understory vegetation includes salt cedar (*Tamarix* sp.), desert broom (*Baccharis sarothroides)*, desert willow (*Chilopsis linearis*), and marsh fleabane (*Pluchea purpurescens*). Additionally, another 31.2 acres has been classified as mixed salt cedar and CW forest. These areas are dominated by salt cedar but contain scattered cottonwood and willow trees throughout.

The most common cover type in the study area is described as Desert Areas in the DEIS and occupies 6008 acres. Desert areas are separated into two subtypes: creosote bush/white bursage, and Sonoran desert scrub. The creosote bush/white bursage subtype is 5226.4 acres characterized by mostly creosote bush (*Larrea tridentata*) with scattered white bursage (*Ambrosia dumosa*). This community type is variable, from monotypic stands of creosote bush to a more diverse canopy in the transition zone between it and Sonoran desert scrub. There are 782.1 acres of Sonoran desert scrub located in the uplands near Granite Reef. Characteristic species are typically more diverse and include creosote bush, saguaro (*Carnegiea gigantea*), paloverde (*Parkinsonia* sp.), cholla (*Opuntia* sp.) , and barrel cactus (*Ferocactus* sp.).

Emergent wetlands are scattered over 73 acres in the floodplain of the study area near the Mesa WWTP, Granite Reef Dam, and areas around abandoned gravel mining ponds that are not routinely cleared of vegetation. Emergent wetlands in the project study area are dominated by obligate wetland species such as cattails (*Typha* sp.), bulrush (*Scirpus* sp.), and dock (*Rumex* sp.).

The DEIS further describes another 1419 acres as scrub/shrublands. This cover type is present within the active channel of the river and dominated by combinations of burrobush (*Hymenoclea salsola*), rabbitbush (*Chrysothamnus* sp.), saltbush (*Atriplex* sp.), and creosote. Many of these areas have been highly disturbed from off-highway vehicle traffic and mining. Unvegetated river bottom occupies 251.8 acres of the project area.

These vegetation communities provide habitat for a variety of native wildlife species. Common mammals found in the study area include black-tailed jackrabbit (*Lepus californicus*), coyote (*Canis latrans*), desert cottontail (*Sylvilagus auduboni*), cotton rat (*Sigmodon* sp.), muskrat (*Ondatra zibethica*), wood rat (*Neotoma* sp.), and deer mice (*Peromyscus* sp.). Common avifauna include American coot (*Gallinula chloropus*), barn owl (*Tyto alba*), Bell's vireo (*Vireo belli*), black-crowned night-heron (*Nycticorax nycticorax*), black throated sparrow (*Amphispiza bilineta*), brown-headed cowbird (*Molothrus ater*), curve-billed thrasher (*Toxostoma *curvirostre*), Gambel's quail (*Callipepla gambelii*), mourning dove (*Zenaida asiatica*), red-tailed hawk (*Buteo jamaicensis*), turkey vulture (*Cathartes aura*), great blue heron (*Ardea herodias*), greater roadrunner (*Geococcyx californianus*), house finch (*Carpodacus mexicanus*), killdeer (*Charadrius vociferus*), and mallard (*Anas platyrhynchos*), to name a few.

Common herpetofauna include common kingsnake (*Lampropeltis getulus*), desert spiny lizard (*Sceloporus magister*), desert tortoise (*Gopherus agassizii*), gopher snake *(Pituophis melanoleucus*), tree lizard (*Urosaurus ornatus*), western whiptail (*Cnemidopherus tigris*), and western diamond rattlesnake (*Crotalus atrox*). Open water in the study area is limited to sand/gravel operation ponds and the groundwater recharge basins located north of the Mesa WWTP. Very little information exists regarding fish species in the study area, though non-natives such as mosquitofish (*Gambusia affinis*), tilapia (*Tilapia* sp.), and sunfish (*Lepomis* sp.) are present downstream.

Species listed as threatened or endangered under the Endangered Species Act are known to use the Salt River downstream and the Verde and Salt rivers upstream of the project area. Suitable habitat for the endangered Yuma clapper rail (*Rallus longirostris yumanensis*) exists in the downstream portion of the project area where marshy areas characterized by cattails and other wetland vegetation are established. However, these areas were surveyed in accordance with FWS protocol in May, 2003, and no rails were detected (Corps, 2003c). Suitable foraging habitat for the threatened bald eagle (*Haliaeetus leucocephalus*) exists in the downstream portion of the project area and eagles have been observed foraging along the Salt River near the project area (Corps 2003c). Riparian woodland characterized by cottonwood, willow, and salt cedar within the project area are generally sparse, patchy, and unsuitable for the endangered southwestern willow flycatcher (*Empidonax traillii extimus*) (Corps, 2003c). No habitat suitable for other threatened or endangered species exists within the project area.

ALTERNATIVES

An initial array of 14 alternatives was developed by the Corps and local sponsors during the alternatives formulation process. Alternatives were further refined based on coordination with the public and resource agencies. The Hydrogeomorphic (HGM) wetland assessment method was used by the planning team to identify and quantify anticipated benefits associated with alternatives. Benefits were quantified as Average Annual Functional Capacity Units (AAFCUs) which represent expected changes in ecological functions based on the model developed by the planning team. The five highest-ranking alternatives were selected for further evaluation and are presented here. For comparison purposes, the study area was divided into nine reaches (Figure 3-1). The following general descriptions are based on information presented in the DEIS.

No Action Alternative

Under the No-Action Alternative, the Corps would take no action to restore the ecosystem within the study area. Incidental benefits to provide recreation and improve water quality and supply would not be provided. Although it is possible that local agencies would implement limited improvements, restoration efforts would be unlikely to occur on the scale of the proposed project. The No-Action Alternative would create no short-term adverse impacts associated with construction and restoration such as habitat fragmentation, sedimentation, and air quality degradation. There also would be no increase in flood protection downstream nor any improvement in water quality.

Features Common to all Action Alternatives

Water Sources: There are several water sources for the project including groundwater from existing and new wells, stormwater runoff, City of Mesa Wastewater Treatment Facility (WWTP) effluent water, irrigation tailwater, and SRP water available for use by the SRPMIC via existing water source locations. Alternatives rely primarily on surface water and groundwater from the SRPMIC and effluent from the WWTP. According to SRPMIC, 30,000 acre-feet/year of water can be allocated to the project.

Water Distribution System: The water distribution system includes infrastructure needed to deliver water from the source to vegetated areas, excluding the irrigation system. Surface water from the SRPMIC would be the primary source of water. Surface water would enter the project by way of irrigation canals controlled by the SRPMIC. A diversion structure would store and divert surface water from the irrigation channels to the water distribution drain, a 12-inch buried pipe. Diversion structures would divert water from SRPMIC system and the wastewater treatment sources to the distribution pipe. Stormwater and irrigation tailwater would be used when available. Diversion structures would be designed to divert both project water and excess water to the project area.

Irrigation Techniques: Surface water from stormwater sources, irrigation canals, and ditches would be diverted to various vegetated areas by a network of lined irrigation channels and buried pipes. Pumps may be used to distribute water. Vegetated areas would be irrigated by either surface braided irrigation network, flood irrigation, or drip irrigation. Surface braided irrigation network (SBIN) would distribute water through a network of shallow ditches, 6 inches deep and 2 to 3 feet wide. Flood irrigation would consist of inundating an area by overland flow. Water distribution would be manually controlled for the life of the project.

Reshaping: Many features would require channelization, surface reshaping, vegetation reshaping, and/or irrigation reshaping. Channelization refers to material that would be moved in the process of constructing the 200- foot-wide, low-flow channel. Surface reshaping refers to material moved to alter significant features such as large mounds, quarry pits, and side slopes. Vegetation construction of irrigation ditches needed in flood or surface braided irrigation methods and construction of drainage ditches.

ALTERNATIVE F

Alternative F has the greatest number of project features. It is the only alternative that would involve channelization of portions of the Salt River and one of two that would include bank stabilization features in certain reaches. A total of 16,500 linear feet would be channelized unde this alternative. The excavated material would be used to create benches along the channel, to fill quarry pits, and to vary the local topography to encourage vegetation growth and reduce flooc damage on proposed vegetation areas.

Reaches 9 and 8: Invasive plant species, primarily saltcedar (*Tamarix* sp.), would be removed if no threatened or endangered wildlife species are associated with them, and native vegetation would be planted. No other changes to the current conditions are proposed.

Reach 7: No changes proposed due to the presence of the active Higley Quarry. To reduce effects from mining, quarry operators should be encouraged to preserve a narrow corridor within the existing main channel or create a channel at grade to convey flow and bed load material to Reach 6. By reducing the deposition, bed load material would continue to flow downstream, maintaining the stability of the channel within Reach 6.

Reach 6: Large areas of cottonwood-willow (CW) and mesquite (MS) would be established along the north side of the river. The CW would be located south of the GRUSP site and irrigatec using surface water from the Hennessey Drain. The MS would be north of the GRUSP site, immediately outside of the active channel and outside the 10-year floodplain, and irrigated using groundwater. Water would be distributed by flood irrigation or SBIN.

On the south bank, CW would be planted in an abandoned quarry directly east of Gilbert Road. The area would be irrigated using surface water and stormwater through flood irrigation. A large abandoned quarry further upstream along the south bank would be reconnected to the Salt River with two spillways and partially filled. To ensure the quarry does not affect the current channel layout, the south bank of the river would be reestablished north of the quarry and hard-banked approximately 6,000 linear feet.

A wetland (WT) would be constructed in the riverbed near the existing Hennessey Drain outlet near the east end of Reach 6. A berm of coarse rock would be constructed on the upstream side of the WT to provide protection from scour during flooding to force flows away from the south

The WT would also serve as the upstream starting point of the low-flow channel. The larger wetland feature would fit within the channel. Channelization would continue downstream to approximately Gilbert Road (the western limit of Reach 6), with a total of two WT features within the channel. Sonoran desertscrub (SD) would be established on the benches.

Reach 5: The north bank of the Salt River in the vicinity of the Gilbert Quarry pit would be armored to prevent high flows from entering the Gilbert Quarry. Soil cement is recommended for bank stabilization.

The Gilbert Quarry pit would be reshaped and converted to river bottom. Two spillways would be constructed as part of the bank stabilization to allow water flow in and out of the pit from the river. CW, MS, and SD would be planted on the overbank area. The SD and MS would be irrigated using groundwater from a new well. The CW would be irrigated using surface water diverted from the drainage distribution channel via the SBIN.

The river channel in the western portion of this reach would also be reshaped and converted to river bottom. WT and MS would be established at Evergreen Drain, on the north side of the channel. The MS would be irrigated using groundwater from the new well, and the WT would be supported by runoff from Evergreen Drain.

The south bank would be vegetated with CW and MS. Surface water and stormwater would be used to irrigate these areas. The south bank CW and MS would continue eastward, ending at Gilbert Road. Irrigation of the CW and MS would be SBIN.

A grade control structure is proposed to protect the Gilbert Road Bridge due to the extensive mining that has occurred downstream of the bridge. The grade control structure would help reduce the upstream migration and stabilize the river system, improving the likelihood of success of vegetation established upstream and downstream. The grade control structure would be placed in the main channel at the center point of the former Gilbert Quarry.

Reach 4: A large portion of this reach is located on a terrace north of the channel that is the site of the closed Tri-City Landfill. MS, SD, and a small stand of CW could be established in this area if water quality is good and the soil layer over the landfill cap is sufficiently deep. The area would be irrigated using surface water and stormwater by way of the SBIN.

The area along the south bank would support CW, MS, and WT. Two surface water outlets on the south bank would supply water to the SBIN to irrigate the vegetation. The western outlet would support the WT as well as surrounding CW and MS. Since this southern area is relatively protected from the main channel, damage to the channel and the irrigation system has the potential to occur less frequently.

The western wetland feature would be the upstream starting point for the second section of channelized river bottom. In Reach 4, this channelized area would support two WT features within the channel and SD on the benches. Channelization would extend from this point in Reach 4 downstream through all of Reach 3 and Reach 2.
Reach 3: As indicated in the previous paragraph, the river would be channelized for the entire length of Reach 3, thus reshaping and creating new river bottom along this entire reach. A channel would be constructed to drain the southern portion of Reach 4 to supply water to a portion of the WT and CW vegetation to be established within the river channel in Reach 3. Water would be conveyed to the CW using the SBIN.

Reach 2: The river would be channelized for the entire length of Reach 2. It would support an in-channel WT that terminates in a larger wetland immediately downstream of Alma School Road. Bank stabilization with soil cement is recommended for the south bank between Country ClubRoad and Alma School Road.

The northern portion would support a WT feature surrounded by CW to the west, south, and east, and MS to the north. These features would be supported by surface water outlets and maintained using SBIN. Additional water may be supplied by a golf course located north of the Salt River, if the water is of sufficient quality.

The south bank would include a small WT and small areas of CW and MS. One stand of CW would surround the wetland; the second stand would be downstream of the first, with the stand c MS located between the two CW areas. The WT would be constructed near the Country Club Storm Drain on the existing river bottom and will need to withstand stormwater runoff. The W1 would be surrounded by CW and irrigated using SBIN.

Reach 1: No work is proposed for Reach 1.

ALTERNATIVE N

Alternative N would include most of Alternative F's vegetation features but lacks most of its structural features. Most notably, it does not include channelization or bank stabilization.

Reaches 9 and 8: Invasive plant species, primarily saltcedar (*Tamarix* sp.), would be removed if no threatened or endangered wildlife species are associated with them, and native vegetation would be planted. No other changes to the current conditions are proposed.

Reach 6: Relatively large areas of CW and MS would be established along the north side of the river. The CW would be located south of the GRUSP site and irrigated using surface water from the Hennessey Drain. The MS would be north of the GRUSP site, immediately outside of the active channel and outside the 10-year floodplain, and would be irrigated using groundwater from a new well. In both areas the water wouldl be distributed by flood irrigation or by SBIN. Because the vegetated areas are near the GRUSP, water that has infiltrated can be used to support vegetation. On the south bank of the river, two areas of CW would be planted. One CW would be located in an abandoned quarry depression directly east of Gilbert Road and within the 5-year floodplain. The second CW would be a relatively narrow strip along the southern edge of the main channel. Both areas would be irrigated using surface water via flood irrigation.

A WT would be constructed in the riverbed near the existing Hennessey Drain outlet near the east end of Reach 6. A berm of coarse rock would be constructed on the upstream side of the WT to provide protection from scour. The WT would be lined with clay to help maintain surface water levels and the saturated soil conditions necessary for vegetation growth. The WT would be adjacent to a new CW stand at its upper (east) end, taking advantage of the saturated soil conditions, and would be irrigated using surface water from the Hennessy Drain and either SBIN or flood irrigation.

Reach 5: The Gilbert Quarry pit would be reshaped and converted to river bottom. CW, MS, and SD would be planted on the overbank area. The MS and SD would be irrigated using groundwater from a new well. The CW would be irrigated using surface water diverted from an irrigation canal. The water would be distributed using SBIN.

The river channel in the western portion of this reach would also be reshaped and converted to river bottom. WT and CW would be established at Evergreen Drain. The CW would be irrigated using groundwater from the new well, and the WT would be supported by runoff from Evergreen Drain.

The south bank would be vegetated with CW and a small stand of MS. Surface water and stormwater would be used to irrigate these areas, with the water distributed by a SBIN. A grade control structure would be placed in the main channel of the river at the center point of the former Gilbert Quarry help protect the Gilbert Road Bridge from head cutting.

Reach 4: A large portion of this reach is located on a terrace north of the channel at the site of the closed Tri-City Landfill. The majority of this area would be left unvegetated. A narrow strip of CW would be established along the north bank of the river, at the edge of the main channel. The area would be irrigated using surface and stormwater distributed by a SBIN.

Reach 3: A channel would be constructed to drain the southern portion of Reach 4 to supply water to a new CW stand along the south bank that would be a continuation of the CW stand at the western end of Reach 4. Water would be conveyed to the CW using the SBIN.

Reach 2: The northern portion would support a WT surrounded by CW to the west, south, and east and MS to the north. These features would be supported by surface water outlets and maintained using a SBIN. Additional water may be supplied by a golf course located north of the Salt River if the water is of sufficient quality.

The south bank would include a small WT and small areas of CW and MS. One stand of CW would surround the wetland; the second stand would be downstream of the first, with the stand of MS located between the two CW areas. The WT would be constructed near the Country Club Storm Drain on the existing river bottom.

Surface water would support two WT areas created at Alma School Road downstream of the old quarry. The western WT would be flanked by CW to the west and continue into Reach 1. The CW would be irrigated using SBIN. A small area south of the wetlands would be reshaped and converted to new river bottom.

Reach 1: The CW stand adjacent to the western WT of Reach 2 would continue westward into the main channel of the river. An old recharge area on the south side of the river would be planted with a CW stand. The irrigation system currently used for recharge purposes can be used or modified to irrigate the CW vegetation. The water source for this area is Mesa treatment facility water. No activity is planned for the north side of the river.

ALTERNATIVE O (PREFERRED ALTERNATIVE)

Under the Preferred Alternative, the Corps would vegetate large portions of the project area and provide minimal support or flood control structures.

Reach 9 and 8: Invasive plant species, primarily salt cedar (*Tamarix* sp.), would be removed if no threatened or endangered wildlife species are found associated with it. To prevent rapid reestablishment of the invasive species, native vegetation would be planted in its place. Because of the relatively good quality of the existing habitat in this reach, no other changes to the current conditions are proposed.

Reach 7: No changes were proposed in Reach 7 because of the Higley Quarry Plant. It is assumed that any vegetation planted would be damaged due to in-channel mining operations. The continual quarrying of the Higley Plant would cause scouring to occur along the main channel downstream, particularly in Reach 6. This could potentially damage any attempts to establish vegetation along Reach 6. To reduce the affect of the Higley mining operations the quarry operators should be encouraged to preserve a narrow corridor unaltered by mining within the existing main channel or to create a channel at grade to convey flows and bed load material to

Reach 6. By reducing the deposition, bed load material would continue to flow downstream, maintaining the stability of the channel within Reach 6.

Reach 6: Relatively large areas of CW and MS would be established along the north side of the river. The CW would be located south of the GRUSP site and irrigated using surface water from the Hennessey Drain. The MS would be north of the GRUSP site, immediately outside of the active channel and outside the 10-year floodplain, and would be irrigated using groundwater from a new well. In both areas the water would be distributed by flood irrigation or by a SBIN. Because the vegetated areas are near the GRUSP, water that has infiltrated can be used to support vegetation.

On the south bank of the river, two areas of CW would be planted. One CW would be located in an abandoned quarry depression directly east of Gilbert Road and within the 5-year floodplain. The second CW would be a relatively narrow strip along the southern edge of the main channel. Both areas would be irrigated using surface water and stormwater when available. Flood irrigation is the preferred method of irrigation.

A wetland (WT) would be constructed in the riverbed near the existing Hennessey Drain outlet near the east end of Reach 6. A berm of coarse rock would be constructed on the upstream side of the WT to provide some protection from scour during flow events and help force flows away from the south bank. The WT would be lined with clay to help maintain surface water level and the saturated soil conditions necessary for vegetation growth. The WT would be adjacent to a new CW stand at its upper (east) end, taking advantage of the saturated soil conditions, and would be irrigated using surface water from the Hennessy Drain and either SBIN or flood irrigation.

Reach 5: The Gilbert Quarry pit would be reshaped and converted to new river bottom. CW, MS, and a small pocket of SD would be planted on the overbank area. The MS and SD would be irrigated using groundwater from a new well. The CW would be irrigated using surface water diverted from the irrigation canal via the SBIN.

The river channel in the western portion of this reach would also be reshaped and converted to new river bottom. WT and CW would be established at Evergreen Drain on the north side of the channel. The CW would be irrigated using ground water from the new well, and the WT would be supported by (run–off) from Evergreen Drain.

The south bank would be vegetated with CW and a small stand of MS. Surface water and stormwater would be used to irrigate these areas. Irrigation of the CW and MS would be done by SBIN. A grade control structure would be placed in the main channel at the center point of the former Gilbert Quarry to protect the Gilbert Road Bridge from head cutting.

Reach 4: A large portion of this reach is located on a terrace north of the channel that is the site of the closed Tri-City Landfill. The majority of this area would be left unvegetated due to the presence of the landfill. However, a narrow strip of CW would be established along the north bank, at the edge of the main channel. The area would be irrigated using surface and storm water via the SBIN.

The area along the south bank would support CW, MS and WT. Two surface water outlets on the south bank would supply water via SBIN. The western outlet would support the WT as well as surrounding CW and MS.

Reach 3: A channel would be constructed to drain the southern portion of Reach 4 to supply water to the CW vegetation in Reach 3 via SBIN.

Reach 2: The northern portion would support a WT feature surrounded by CW to the west, south, and east. These features would be supported by surface water outlets, and maintained using a SBIN. Additional water may be supplied by a golf course located north of the Salt River if it is of sufficient quality.

The south bank would support two wetland features and small areas of CW and MS. One small stand of CW would surround the wetland, while the second stand would be downstream of the first. The wetland would be constructed near the Country Club Storm Drain on the existing river bottom and would need to withstand storm water runoff.

Three wetland features would be created at Alma School Road downstream of the old quarry. The western WT would be flanked by CW to the north while one larger WT to the east and a second smaller WT located just south would be surrounded by a CW stand. The CW would be irrigated using SBIN. A small area south of the wetlands would be reshaped and converted to new river bottom.

Reach 1: This Reach would support four wetland features and three CW stands. One WT would continue from Reach 2 into Reach 1. A second smaller WT would be located to the north, within the main channel and connect with a CW stand to the north. The remaining two wetland features would be created to the west of the existing quarry, above the hardbank. At the far west end, a CW stand would be established within the main channel. Finally, a small CW stand would be established to the north of the existing quarry. The percolation ponds found immediately outside of the southern bank would be planted with CW. This area would be supported using the existing irrigation infrastructure.

ALTERNATIVE E

Reaches 9 and 8: Invasive plant species, primarily saltcedar, would be removed if no threatened or endangered wildlife species are found associated with them. To prevent rapid reestablishment of invasive species, native vegetation would be planted in its place. Because of the relatively good quality of the existing habitat in this reach, no other changes to the current conditions are proposed.

Reach 7: No changes were proposed in Reach 7 due to the presence of the active Higley Quarry. It was assumed that any vegetation planted would be damaged due to in-channel mining operations.

Reach 6: The existing drainage channel along the north side of the GRUSP site would be extended past Gilbert Road to supply water to northern portion of Reach 5. This channel presently carries Salt River Project water from the Hennessey Drain to the GRUSP. CW would be planted south of the GRUSP site and MS and SD would be planted north of the GRUSP site. The CW would be irrigated using a SBIN. Water from the drainage channel would be diverted to the SBIN for CW use. MS and SD would be planted north of the drainage channel and irrigated using SBIN and/or a drip/bubbler system. Groundwater from a new well would be the source of water. Water that has infiltrated the ground near the GRUSP may support vegetation.

On the south bank, the former quarry would be reshaped and seeded to establish SD. MS would be planted upstream of the quarry outside of the 20-year floodplain, with the area irrigated using SBIN with water diverted from the Hennessey Drain. The south bank would be stabilized with soil cement or coarse rock to prevent headcutting that could compromise the establishment of vegetation.

A WT and CW area would be established at the Hennessey Drain and GRUSP diversion. A berm of coarse rock would be constructed on the upstream side of the WT to provide protection during flow events and contribute to forcing flow away from the south bank. The WT would be lined with clay to help maintain surface water level and the saturated soil conditions necessary for vegetation growth. The WT would be surrounded by CW, taking advantage of the saturated soil conditions, and would be irrigated using SBIN and or flood irrigation. Surface water from the Hennessey Drain would be used to irrigate this area.

Reach 5: The Gilbert Quarry pit would be reshaped and converted to river bottom. The north drain from Reach 6 would continue downstream to Reach 5 to provide water to CW, MS, and SD in and around the new river bottom. The MS and SD would be irrigated using SBIN with groundwater from a new well.

A WT would be created on a terrace at the Evergreen Drain outlet. Groundwater from a new well can be used for additional water, if necessary. The WT would be designed to handle stormflows and disperse stormwater laterally. Side drains would be constructed to disperse the stormwater. Irrigation of the CW and MS surrounding the WT will be provided by installing a SBIN. On the south bank, from Gilbert Road to Lehi Cemetery, SD would be established in the upland area and irrigated with a SBIN, using diverted surface water. The main channel of the river would be reshaped to allow the establishment of river bottom and to increase channel conveyance capacity.

Reach 4: A large portion of this reach is located on a terrace north of the channel that is the site of the closed Tri-City Landfill. MS could be established in this area if there are no water quality issues and the soil layer over the landfill cap is sufficiently deep to allow trees to establish an adequate root system. The area would be irrigated using surface water or stormwater redirected from the Evergreen Drain to the terrace via SBIN.

Reach 3: No activity is planned in this area.

Reach 2: Along the north bank and within the channel between Alma School Road and Longmore Road, SD would be established and irrigated using SBIN and surface water. A WT and small CW stand would also be established and irrigated using runoff from a golf course. Along the south bank, a WT would be constructed near the Country Club Storm Drain on the existing river bottom. It appears that the wetland area is protected from main channel flow, but the WT will need to be able to withstand stormwater runoff. CW would be planted immediately adjacent to the WT, as would a small stand of MS and SD. This area would be located in a high velocity area and would suffer damage during flow events, on average once every 3 years. However, these flow events would also allow the transport of seeds and vegetative propagules further downstream, aiding establishment of vegetation in new areas. The old quarry at Alma School Road would be converted to new river bottom. Bank stabilization with soil cement is recommended for the south bank between Country Club Road and Alma School Road (Figure 3-4) to prevent a southerly migration of the river resulting in damage to project features and Highway 202. Soil cement bank protection in this area would be 3,000 feet long, 40 feet tall, and 6 feet deep.

Reach 1: An abandoned water recharge area on the south side of the river would be converted from ruderal vegetation to a CW stand. The irrigation system currently used for recharge purposes can be used or modified to irrigate the CW vegetation. The water source for this area is Mesa treatment facility water. The only measure that would be applied to the main channel of the river is the eradication of invasive vegetation species, provided that no threatened or endangered species are associated with them, followed by possible enhancement plantings to avoid reoccurrence of invasive plants.

ALTERNATIVE A

Reach 9 and 8: Invasive plant species, primarily saltcedar, would be removed if no threatened or endangered wildlife species are found associated with them. To prevent rapid reestablishment of invasive species, native vegetation would be planted in its place. Because of the relatively good habitat in this reach, no other changes to the current conditions are proposed.

Reach 7: No changes are proposed in Reach 7 due to the presence of the active Higley Quarry. It is assumed that any vegetation planted would be damaged due to in-channel mining operations.

Reach 6: In the northern part of the reach, SD would be planted on both the north and south sides of the GRUSP site. The SD would be irrigated using a SBIN and water diverted from the drainage channel. Because the vegetated areas are near the GRUSP site, water that has infiltrated can be used to support vegetation. In the southern part of the reach, SD would be established at the Hennessy Drain, where the north and south GRUSP channels diverge. This area would be irrigated using SBIN and/or flood irrigation. Surface water from the Hennessey Drain would be used as a water source.

Reach 5: The old Gilbert Quarry would be reshaped to create new river bottom. A new groundwater well would be drilled to provide water to SD planted in and around the new river bottom. The SD would be irrigated by SBIN. This water source can also be supplemented by overland flow from water diverted from the Evergreen Drain during storm events. On the western end of the south bank, a small area of SD would be established along the upland area. The SD would be irrigated with SBIN using diverted surface water.

Reach 4: No activity is planned for this reach.

Reach 3: No activity is planned for this reach.

Reach 2: No activity is planned for this reach.

Reach 1: No activity is planned for this reach.

WITHOUT PROJECT PROJECTION

In the absence of active restoration efforts, particularly the attainment of a secure water source, it is unlikely that significant wetland or hydro-riparian vegetation would become established within this reach of the Salt River. Due to river management above the Granite Reef Diversion Dam, it is unlikely that this stretch of the Salt River would ever be characterized by perennial flow. Water would flow in the project area during periods of flood release from the dam, storm water runoff from storm drains, and natural precipitation which falls directly into the river. As described in the No-Action Alternative, this scenario would create no short-term adverse impacts associated with construction and restoration such as habitat fragmentation, sedimentation, and air quality degradation. There also would be no increase in flood protection downstream nor any improvement in water quality.

WITH PROJECT PROJECTION

Alternative F

This would be the most expansive alternative. A low-flow channel would be created from Hennessey Drain to Gilbert Road and from Country Club Road to Alma School Road. Cottonwood-willow and mesquite would be the dominant vegetation types. Water demand would be approximately 8,300 acre-feet/year. Alternative F would produce the most habitat value at 1,035 AAFCUs. Four areas of bank stabilization are proposed and a grade control structure would be placed near the Gilbert Quarry.

Alternative F would result in the most significant increase in cottonwood-willow, freshwater marsh, and open water; substantially increasing native habitat. This alternative would include the physical removal of salt cedar in areas where new habitat would be created, causing a short-term reduction in wildlife habitat. This would be minimized through phasing of project construction. On a long-term basis, habitat value in the region would increase. Cottonwood-willow and mesquite communities are expected to benefit songbirds and raptors. Wetlands are expected to benefit shorebirds, waterfowl, and amphibians. Predatory mammals would likely utilize all vegetation types.

Alternative N

Alternative N would result in the a significant increase in cottonwood-willow, freshwater marsh, and open water. Water demand would be approximately 7,736 acre-feet/year. Habitat values would increase 913 AAFCUs. Short-term impacts of construction on vegetation would be minimized through phasing. O&M activities would be conducted on a rotating basis.

Alternative O

This alternative would provide a diverse vegetation plan including CW, wetland, mesquite, and scrub shrub. Water demand would be approximately 8,500 acrefeet/year. Habitat values would increase 963 AAFCUs. Short-term impacts of construction on vegetation would be minimized through phasing. O&M activities would be conducted on a rotating basis.

Alternative E

Alternative E would result in an increase in cottonwood-willow, freshwater marsh, and open water. Water demand would be approximately 4,568 acre-feet/year. Habitat values would increase 926 AAFCUs. Short-term impacts of construction on vegetation would be minimized through phasing. O&M activities would be conducted on a rotating basis.

Alternative A

This alternative would provide a vegetation plan requiring the least amount of water, approximately 1,001 acre-feet/year. Sonoran desert scrub shrub is the sole vegetation type planned and would be limited to areas near the Hennessey storm drain and the Tri-City landfill. Habitat value would increase by approximately 373 AAFCUs. Short-term impacts of construction on vegetation would be minimized through phasing. O&M activities would be

DISCUSSION

The Va Shly' ay project not only offers a tremendous opportunity to restore native biotic communities within the project area, but also an opportunity to enhance existing biota on the Salt River system. The proximity of perennial portions of the Salt and Verde rivers could complement the Va Shly' ay project by providing habitat contiguity and source populations of desired wildlife. These river corridors provide habitat for a variety of small and large mammals, waterfowl, songbirds, reptiles, amphibians, fishes, and invertebrates that would surely benefit from the availability of new habitat areas.

We are pleased to participate in a project aimed at restoring native vegetation communities, particularly valuable wetland and riparian environments. We believe the most important aspect of wetland and riparian restoration projects is the identification and attainment of a secure water source to ensure adequate hydrologic conditions to support the desired wetland and riparian biotic communities. Mitsch and Gosselink (1993) believe that hydrology is the most important variable in wetland creation and restoration activities and state that if proper hydrologic conditions are developed, the biological and chemical conditions will respond accordingly. They offer several useful parameters to describe hydrologic conditions of restored wetlands including hydroperiod, water depth, and seasonal flood pulses. Additionally, they conclude that most wetland creation and restoration activities that fail do so because of the lack of proper hydrology. We would support efforts to secure WWTP effluent discharge and groundwater as a source of water to sustain the biological resources in the study area.

We believe it would be beneficial to explore opportunities to introduce surface water directly from the Salt and Verde rivers. We encourage efforts to restore a natural hydrograph and scouring flood events to historic river channels such as the Salt River. The proper sequencing of flooding plays an integral role in the maintenance of healthy population structures of Fremont cottonwood and Goodding willow through the deposition of nutrient-rich alluvium, scouring of herbaceous cover, and moistening of riparian soils (Ward *et al.* 1985, Stromberg and Patten 1991) thereby promoting a sustainable ecosystem that would require minimal active management. Assessments should be conducted to evaluate the potential for native riparian vegetation to regenerate naturally. We suggest that project maintenance should not preclude or hinder natural regeneration of native riparian plant species through the removal of seed beds or established saplings. Native riparian regeneration should be encouraged to the greatest extent compatible with other project amenities

We are pleased with the level of information gathered regarding groundwater conditions in the study area. We are also pleased with measures that will be taken to minimize effects of the proposed removal of salt cedar vegetation and revegetation with cottonwood, willow, and emergent vegetation. Although we support efforts to restore native riparian vegetation, we believe it important to ensure that areas currently occupied by salt cedar would be suitable environments for establishment, regeneration, and survival by native vegetation. Prior to committing to a restoration program, consideration should be given to microhabitat conditions such as depth to water table, soil texture, and salinity. Consideration should also be given to large-scale ecological processes such as floods, which species such as cottonwood and willow depend upon for seed-bed formation, seed dispersal, germination, seedling establishment, recruitment, and survival.

The majority of failed riparian restoration activities that included removal of salt cedar and subsequent replacement with native vegetation failed because of attempts to establish desirable species on degraded sites, typically with incompatible soil moisture or salinity (Briggs *et al.* 1994, Barrows 1998). In the absence of flooding at the time of seed production, it is unlikely that cottonwoods and willows would experience substantial reproduction or recruitment (Anderson 1998). If revegetation is unsuccessful, it is possible that removal of salt cedar could reduce habitat value for native wildlife. We suggest that a thorough assessment of site suitability for native vegetation be conducted before large-scale removal of salt cedar is performed. Consideration should be given to depth to groundwater, soil salinity and texture, flood frequency and intensity, groundwater fluctuations, site preparation, protection of plantings from herbivory, necessity of irrigation, potential for competition from undesirable species, and long-term management potential for the site. If assessments indicate that revegetation efforts have a high probability of success, we offer the following specific suggestions to hopefully improve the proposed project.

We encourage replanting with honey mesquite, because woodlands of honey mesquite have experienced significant decline. Seeds rather than rooted cuttings work best for producing mesquite container stock (Rorabaugh 1995).

We support examining soil quality and water table depth to determine the locations for restoration. Anderson (1995) indicates that where depth to the water table exceeds 2.5 meters, the growth of cottonwoods and willows is significantly restricted. This would be most important after irrigation ceases.

Plantings will likely need protection from mammals such as rabbits, gophers (*Thomomys* sp.), beavers, etc. which have been known to decimate revegetation projects. Where feasible, we suggest protecting trees with 3 foot by 18 inch, 1 inch mesh chicken wire baskets firmly supported with metal stakes. Honey mesquite may also be attacked by small insects known as psyllids (Psyllidae). Unfortunately, we know of no method to feasibly control psyllids.

The density of plantings will need to be decided. For southwestern willow flycatcher habitat, we would consider planting cottonwoods and especially willow trees only 10 feet from each other. It may be worthwhile to mix-up the density throughout the site. Up to 400 trees per acre may be reasonable. Use of pole plantings is an acceptable method for cottonwood and willow revegetation. Poles should be cut in late winter when plants are dormant. If groundwater is sufficiently shallow the Aknock-down@ method may be employed, whereby willow cuttings are placed horizontal to the ground to more closely mimic natural regeneration after flood events.

Irrigation should be conducted over the most important time frames or for as long a period as necessary. Irrigation should occur until the plants are dormant in the late fall or early winter. If many plants are found to have died, it may be necessary to increase irrigation (if irrigation is occurring) or to reinitiate irrigation (if irrigation has ceased). This may be a non-issue as the proposal contains a significant water distribution system.

It may be best to plant trees early in the growing season. If trees are planted in March or April, they should have a sufficient growing season and not be stressed from intense summer heat immediately after planting. Also, plants should be allowed to harden off prior to planting.

In addition to implementing strategies to improve the potential success of restored habitats, the Corps should proceed with restoration in a manner that minimizes or eliminates potential adverse effects on existing biological resources, particularly listed species. The conservation measures presented in the DEIS should be implemented, such as surveying salt cedar prior to removal and timing construction around breeding seasons. The Corps has initiated section 7 consultation under the ESA. Any additional measures produced from this consultation should be implemented as well. Additionally, it would be beneficial to time dredging and vegetation clearing outside of winter months when open water and wetlands would be expected to have a high density of waterfowl and shorebirds in the area (typically December through February). This could be closely coordinated with the AGFD.

We are pleased with conservation measures associated with the O&M plan that would be protective of endangered species and their habitats. We suggest the monitoring program include annual surveys and/or habitat assessments to track and evaluate the long-term status of threatened and endangered species and their habitats in the study area. The proposed project could eventually result in the establishment of habitats suitable for species listed as threatened and endangered or those that are candidates for listing. We encourage the local non-Federal sponsors to explore opportunities to develop Safe Harbor Agreements, Candidate Conservation Agreements, or Habitat Conservation Plans as appropriate to address future O&M activities that may affect listed species. Such an effort would greatly facilitate operation and maintenance while providing conservation benefits to listed species.

Finally, in regard to the HGM model, though we support the process and outputs generated for this project, we encourage the Corps to work with FWS and AGFD to evaluate opportunities to simplify the HGM methodology for future projects within Arizona.

RECOMMENDATIONS

1) Pursue efforts to secure effluent and groundwater as a source of water to support the biological resources within the study area. Explore opportunities to discharge all available effluent into the river channel in perpetuity.

2) Consider and evaluate opportunities to provide additional surface water to the project area directly from the Salt and Verde rivers by coordinating with water users, managers, agencies, communities, Tribes, and/or other parties interested in riparian habitat improvement (for listed and non-listed animal species) on the lower Verde River below Bartlett Dam from flows more consistent with the natural hydrologic regime.

3) Perform assessments to ensure that site specific microhabitat conditions would be conducive to establishment and growth of cottonwood, willow, and mesquite. Consider depth to groundwater, soil texture and salinity, and flooding. Implement the following specific suggestions if proceeding with revegetation:

a) Plant honey mesquite from containerized stock.

b) Examine soil quality and water table depth.

c) Protect plantings from mammals and other predators.

d) For flycatcher habitat, plant trees in tight dense patches.

e) Irrigate until plants are dormant.

f) Plant trees in the early growing season.

4) Complete section 7 consultation and implement any conservation measures developed during the process.

5) Encourage the local non-Federal sponsors to work with FWS to evaluate the need for Safe Harbor Agreements, Candidate Conservation Agreements, or Habitat Conservation Plans.

6) Work with FWS and AGFD on a programmatic basis to simplify the HGM methodology for future restoration within the state of Arizona.

We appreciate the opportunity to provide recommendations for the proposed project. If we can be of further assistance or you have any questions, please contact Mike Martinez (x224).

Sincerely,

for Steven L. Spangle
Field Supervisor

cc: Regional Director, Fish and Wildlife Service, Albuquerque, NM (ARD-ES)
Supervisor, Project Evaluation Program, Arizona Game and Fish Department, Phoenix, AZ
Kayla Eckert, Planning Branch, U.S. Army Corps of Engineers, Phoenix, AZ

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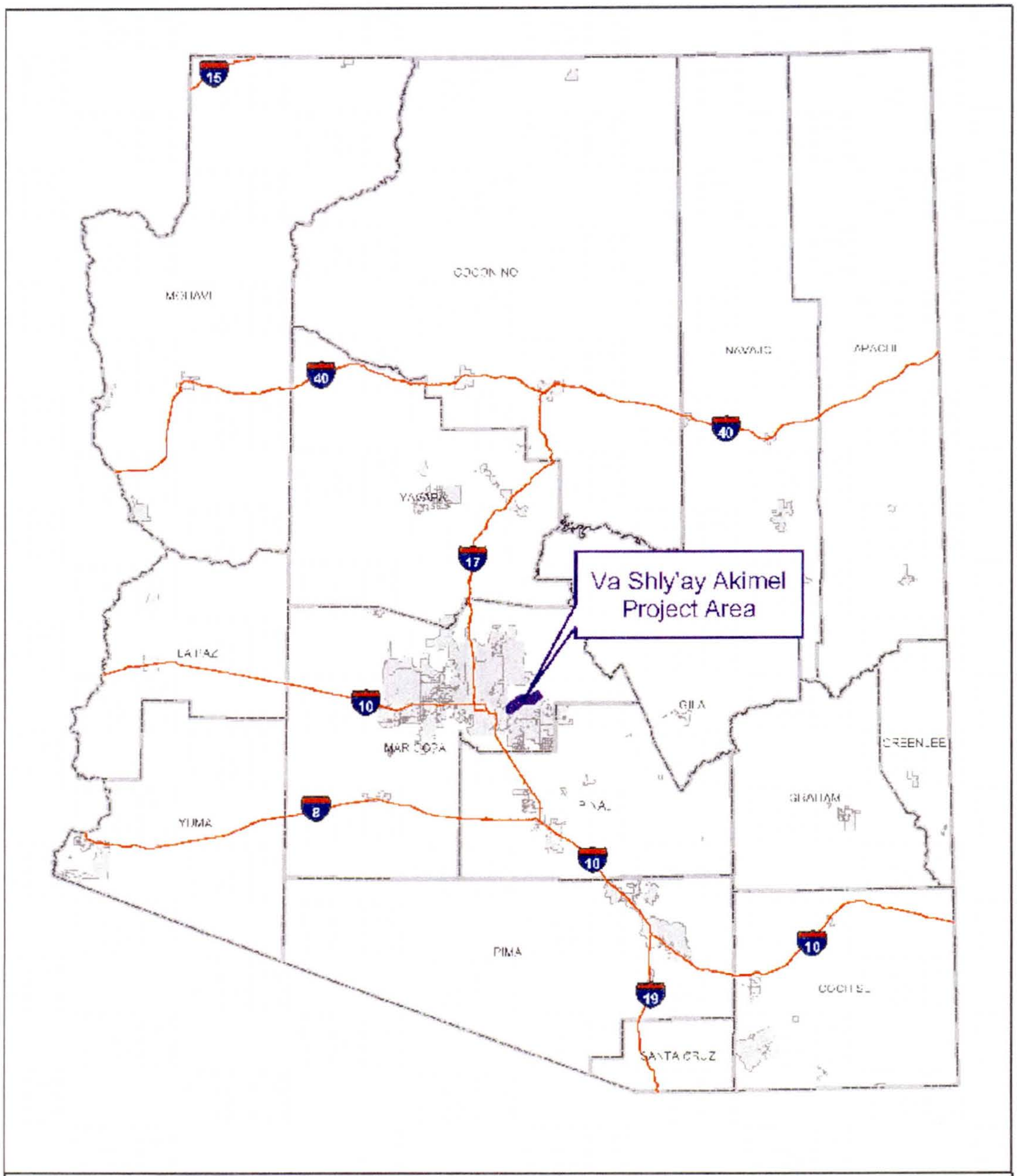

Figure 1-1
Regional Location Map

0 25 50 100
Miles

Mapped By:
Jones & Stokes
April 2003

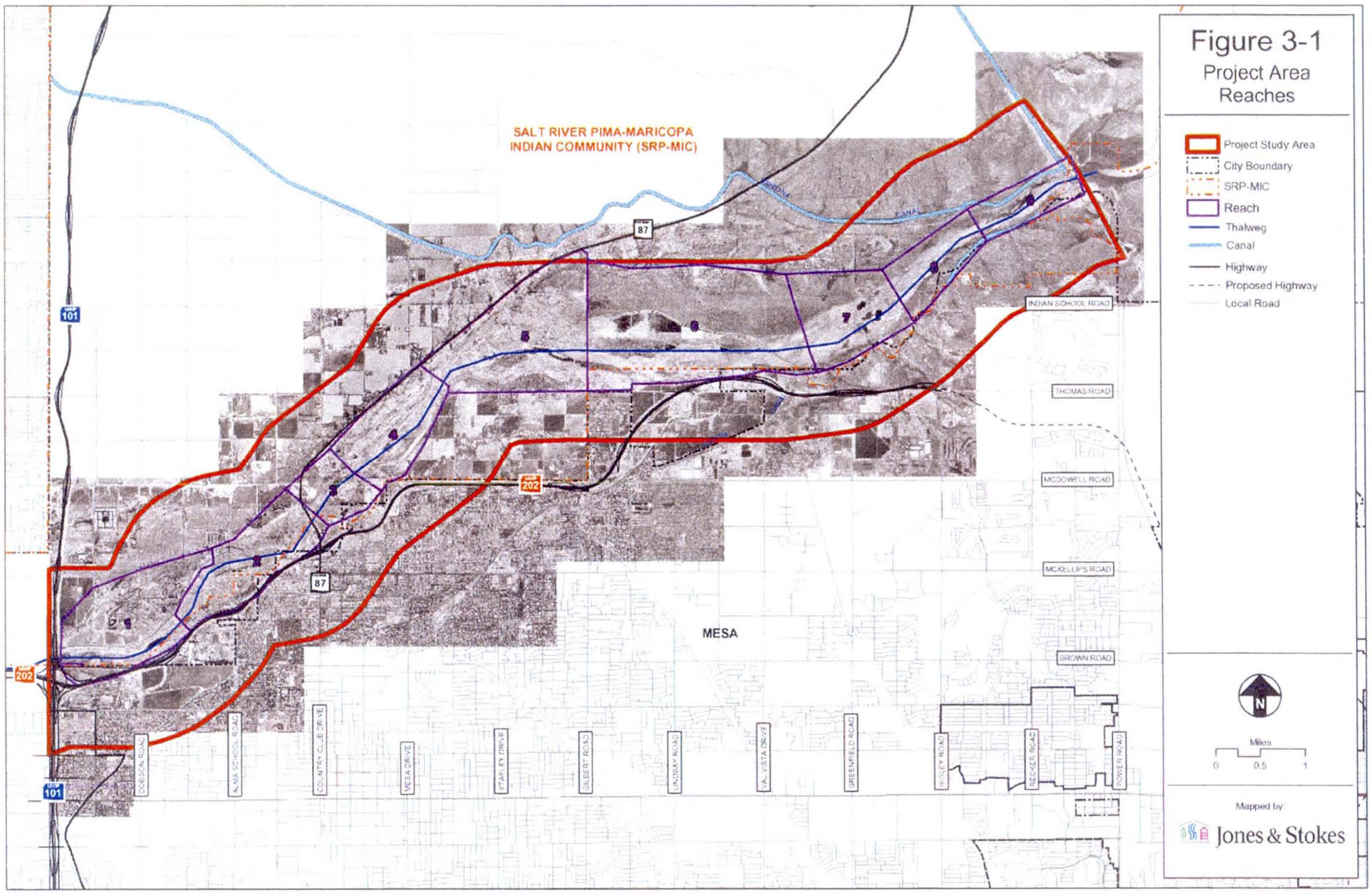
Figure 3-1
Project Area
Reaches
Project Study Area
City Boundary
SRP-MIC
Reach
Thalweg
Canal
Highway
Proposed Highway
Local Road
Mapped by
Jones & Stokes
SALT RIVER PIMA-MARICOPA
INDIAN COMMUNITY (SRP-MIC)
MESA
INDIAN SCHOOL ROAD
THOMAS ROAD
MCDOWELL ROAD
MCKELLIPS ROAD
BROWN ROAD
DOBSON ROAD
ALMA SCHOOL ROAD
COUNTRY CLUB DRIVE
MESA DRIVE
STAPLEY DRIVE
GILBERT ROAD
LINDSAY ROAD
VAL VISTA DRIVE
GREENFIELD ROAD
HIGLEY ROAD
RECKER ROAD
POWER ROAD
101
202
87

Appendix E

Biological Assessment and USFWS Section 7 Concurrence Letter

BIOLOGICAL ASSESSMENT FOR

VA SHLY'AY AKIMEL ENVIRONMENTAL RESTORATION PROJECT

DRAFT

AUGUST 2003

Chapter 1.0
INTRODUCTION

In compliance with the Endangered Species Act of 1973, as amended, this Biological Assessment (BA) allows the U.S. Fish and Wildlife Service (USFWS) and the U.S. Army Corps of Engineers (Corps) to evaluate the potential effects of the Proposed Action on federally listed species or species proposed for listing. The analysis also evaluates the potential effect on designated and proposed critical habitat for those species. This document is used to determine whether a formal consultation or conference is required. Upon receiving an acceptable BA and a request for consultation from a Federal agency, the USFWS enters into consultation with the Federal agency. Should the determination of the effects of the Proposed Action be "may affect but not likely to adversely affect" then informal consultation begins and culminates with a letter of concurrence from the USFWS. Should the determination of the effects of the Proposed Action be "may affect, likely to adversely affect", formal consultation will begin and culminate with a written Biological Opinion (BO). The BO determines whether the action is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat (i.e., a jeopardy opinion), or the action is not likely to jeopardize the continued existence of a listed species or result in adverse modification of critical habitat (i.e., a non-jeopardy opinion). Both forms of opinion shall include reasonable and prudent measures; if any, to be taken that will result in a reduction in the amount or extent of take.

The objective of this document is to provide the USFWS with the necessary information on the anticipated impacts to federally listed species occurring, or with the potential to occur, in the study area. The study area means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.

The Proposed Action involves the restoration of approximately 1500 acres of wetland, cottonwood/willow, mesquite, and Sonoran desert scrub shrub habitat along an approximately 17-mile reach of the Salt River in Maricopa County, Arizona. The Salt River Pima-Maricopa Indian Community (SRPMIC) and the City of Mesa are the local sponsors of this restoration effort.

Chapter 2.0
PROPOSED ACTION – VA SHLY'AY AKIMEL ECOSYSTEM RESTORATION PROJECT

2.1 PROJECT LOCATION

The study area is located in Maricopa County, Arizona, and includes portions of the SRPMIC and the City of Mesa. The study area is approximately 17 miles long, extending along the Salt River between the Pima Freeway and Granite Reef Dam. The study area is approximately 2 miles wide and comprises approximately 17,435 acres (Figure 1).

2.1.1 PROJECT AREA

The land surrounding the project area is made up of a patchwork of jurisdictional and political boundaries between the City of Mesa (the City), unincorporated areas of Maricopa County (the County), and the Salt River Pima-Maricopa Indian Community (SRPMIC).

Several gravel mining operations are located along the Salt River, with processing operations occurring along its banks. These facilities are expected to remain within the project area. The river also contains a large groundwater recharge basin in the central portion of the study area, just east of North Gilbert Road.

The land area north of the Salt River is generally within the SRPMIC reservation. Upland areas south of the river are generally within the City's jurisdiction, but islands of unincorporated areas of the County are also present. A clear contrast is evident between the rural and open character of the upland areas north of the river, within the SRPMIC reservation, and the more urbanized area south of the river, within the City's sphere of influence.

The SRPMIC consists of 52,600 acres, located 15 miles northeast of the City of Phoenix. The SRPMIC maintains 19,000 of its acres as natural preserve. The second most prominent land use is agriculture, which supports a variety of crops, including cotton, melons, potatoes, brown onions, and carrots (Salt River Pima-Maricopa Indian Community 2002). The majority of the central and eastern portions of the study area that are located directly north of the Salt River is a combination of natural preserve areas and agricultural lands. Gravel mining and processing, two closed landfills, and other industrial operations have a significant influence on land use patterns in the western portion of the study area that is located along the north banks of the river. Other land uses throughout the area along the north banks of the river include a shooting range, a recreational vehicle park, private farms, and a commercial golf course.

The west and central portions of the study area south of the river and within the City's sphere of influence are largely made up of very low-density rural residential uses to higher-density suburban residential uses. Industrial and commercial development, with some agricultural uses, has a strong influence on land use patterns in the eastern portion of the study area. The south banks of the river are also scattered with gravel mining and processing operations.

The proposed project will not change the usage within the area significantly. The primary usage of the river to date has been the sand and gravel mining operations. While their future plans have not yet been determined, it is assumed they will remain in some capacity. Recreation is not expected to increase significantly due to the SRPMIC's wishes to limit non-Community member's access to Community property. A more in-depth analysis of the effects of the proposed action can be found in the preliminary draft EIS provided to your office.

2.2 PURPOSE AND NEED

The purpose of the proposed action is to restore ecosystem functions and processes to improve overall ecological health and return the project area to a less degraded, more natural condition. Implementation of the proposed action would increase the diversity of native plants and animals, enhance the ability of the area to sustain larger populations of key indicator species or more biologically desirable species, and produce a viable, self-sustaining ecosystem that would require only minimal ongoing human intervention. Additionally, the proposed action would provide other of incidental benefits, including improving water quality and supply.

Flood control and water supply projects within the Gila River watershed have resulted in substantial alteration of the hydrological regime. This alteration, as well as increased agricultural development and urbanization of the metropolitan Phoenix area, has resulted in the substantial alteration of the native cottonwood/willow, mesquite bosque, freshwater marsh, and willow woodland habitat types. Without restoration, habitat values in the study area are expected to further decline within the next 50 years. This will decrease the overall habitat value for wildlife and reduce habitat for the endangered Yuma clapper rail, southwestern willow flycatcher, and other sensitive species.

This project is needed to provide an ecological connection between other riparian restoration projects that are currently underway along the Salt River (See Section 2.4.2, "Relationship to Other Projects," of the Environmental Impact Statement). Restoration of the area may also provide limited passive recreational opportunities.

2.3 DESCRIPTION OF PROPOSED ACTION

The proposed project will likely be completed in stages due to its large size and number of individual features. Currently, it is expected to be completed over a 5-year time frame. Construction will consist of a variety of activities that will involve surface grading and reshaping on both large and small scales (abandoned sand and gravel mine reshaping and irrigation channels), localized excavation (for wetland features), and large-scale plantings of a variety of habitat types. It can be assumed that work will be conducted throughout the year, but will not be continuous. Following is a detailed description of the proposed project features (Figures 2 and 3).

Reach 9 and 8: Invasive plant species, primarily Salt Cedar (*Tamarisk sp*), will be removed if no threatened or endangered wildlife species are found associated with it. To prevent rapid reestablishment of the invasive species, native vegetation will be planted in its place. Because of the relative habitat health in this reach, no other changes to the current conditions are proposed.

Reach 7: No changes were proposed in Reach 7 because of the Higley Quarry Plant. It was assumed that any vegetation planted would be damaged due to in-channel mining operations. The continual quarrying of the Higley Plant would cause scouring to occur along the main channel downstream, particularly in Reach 6. This could potentially damage any attempts to establish vegetation along Reach 6. To reduce the affect of the Higley mining operations the quarry operators should be encouraged to preserve a narrow corridor unaltered by mining within the existing main channel or to create a channel at grade to convey flows and bed load material to Reach 6. By reducing the deposition, bed load material will continue to flow downstream, maintaining the stability of the channel within Reach 6.

Reach 6: Large areas of CW and MS will be established in Area 6.1. The CW is located south of the GRUSP site and will be irrigated using surface water from the Hennessey Drain. The MS is located on the north bank, immediately outside of the active channel, outside of the 10-year flood plain and will be irrigated using ground water from the new well. In both areas the water will be distributed using a flood irrigation method or the Surface Braided Irrigation Network (SBIN). Because the vegetated areas are near the GRUSP, water that has infiltrated can be used to support vegetation. How well the vegetation can rely on infiltrated water is not known at this time; a more detailed analysis is needed.

In Area 6.2, located on the south bank of the river, two areas of CW will be planted; one in an abandoned quarry depression directly east of Gilbert Road and within the 5-year flood plain, and a second narrow strip along the southern edge of the main channel. Both areas will be irrigated using surface water and storm water when available. Flood irrigation is the preferred method of irrigation.

Area 6.3 will have a wetland feature; it will be constructed on the riverbed near the existing Hennessey drain outlet. A berm of coarse rock will be constructed on the upstream side of the wetland. This will provide some protection during flow events and contribute to forcing flow away from the south bank. The wetland will be clay lined to maintain the surface water level and allow for vegetation growth. The wetland will be flanked by a relatively large CW stand to the east, taking advantage of the saturated soil conditions, and will be irrigated using surface water from the Hennessy drain and SBIN or flood irrigation.

Reach 5: The Gilbert Quarry pit will be reshaped and converted to new river bottom, in Area 5.2. CW and MS, and a small pocket of SD will be located on the overbank area. The MS and SD will be irrigated using groundwater from a new well. The CW will be irrigated using surface water diverted from an irrigation canal. The water will be distributed using SBIN.

The channel in Area 5.1 and the western half of 5.3 will be reshaped and converted to new river bottom. A wetland feature at Evergreen drain will be established, as will CW. The CW will be irrigated using ground water from the new well, and the wetland will be supported by run off from Evergreen drain.

Area 5.3, located along the south bank, will be vegetated with CW and a small stand of MS. Surface water and storm water will be used to irrigate these areas. Irrigation of the CW and MS will be done by SBIN.

A grade control structure will be placed in Area 5.2, in the main channel at the center point of the old Gilbert quarry. This structure would help protect the Gilbert Road Bridge from head cutting due to the extensive mining that has occurred downstream. The structure would span the entire width of the riverbed, approximately 1500 feet, and be designed to the estimated scour depth.

<u>Reach 4:</u> The majority of Area 4.1 will be left unvegetated, due to the existence of the Tri-City Landfill. However, a narrow strip of CW will be established along the north bank, at the edge of the main channel. The area will be irrigated using surface and storm water by way of the SBIN.

Area 4.2, along the south bank, will support CW, MS and a large wetland feature. Two south bank surface water outlets will supply water to the SBIN used to irrigate the vegetation. The western outlet will support the wetland feature as well as surrounding CW and MS. Area 4.2 is relatively protected from the main channel so damages to the channel and the irrigation system would occur less frequently.

<u>Reach 3:</u> A channel will be constructed to drain Reach 4.2 to supply water to the CW vegetation of Area 3.1. Water will be dispersed using the SBIN.

<u>Reach 2:</u> Area 2.4 will support a wetland feature surrounded by CW to the west, south, and east. These features will be supported by surface water outlets, and maintained using a SBIN. Additional water may be supplied by a golf course located north of the Salt River, if it is of sufficient quality.

Along the south bank, Area 2.3 will support a two wetland features, and small areas of CW and MS. One small stand of CW will surround the wetland; a second larger stand will start in the eastern edge of Area 2.3 and extend into Area 2.2. The wetland will be constructed near the Country Club Storm drain on the existing river bottom and will need to withstand storm water runoff.

Three wetland features will be created in Area 2.2, at Alma School Road downstream of and within the old quarry. The western small wetland will be flanked by CW to the north while the larger wetland to the east will be surrounded by a CW stand. The CW will be irrigated using SBIN. A small area, south of the wetlands, will be reshaped and converted to new river bottom.

Reach 1: Area 1.1 will support four wetland features, and three CW stands. One wetland will continue from Area 2.2. A second smaller wetland will be located to the north, within the main channel and will connect with a CW stand to the north. The remaining two wetland features will be created to the west of the existing quarry, above the hardbank. A CW stand will be established within the main channel, at the far west end of Area 1.1. Finally, a small CW stand will be established to the north of the existing quarry. The percolation ponds found immediately outside of the southern bank in Area 1.2, will be planted with CW. This area will be supported using the existing irrigation infrastructure.

Water Sources: 9 new irrigation diversions structures and 1 new well are proposed for this alternative.

2.4 OTHER ALTERNATIVES CONSIDERED

An initial array of 15 alternatives (including the No-Action Alternative) was developed by the Corps and the local sponsors (Salt River Pima-Maricopa Indian Community and the City of Mesa) during the alternatives formulation process. The alternatives represented varying combinations of restoration treatments (e.g., vegetation types, channel modification, water source, infrastructure). Alternatives were initially developed based on the Corps' federal planning objectives for water resource projects, specific planning objectives developed for the Va Shly'ay Akimel Ecosystem Restoration Project, and project-specific opportunities and constraints for implementing restoration activities. These alternatives were later refined based on input received through public meetings and coordination with local and regional agencies.

Following formulation and refinement of the project alternatives, the alternatives were ranked and screened based on associated habitat benefits and implementation costs. The Hydrogeomorphic (HGM) wetland assessment method was used by the Corps' planning team to identify and quantify the anticipated habitat benefits associated with the proposed restoration alternatives. The HGM method assesses and quantifies the functional values of existing wetland habitat types (e.g., water storage, plant community characteristics) and evaluates and quantifies future changes in these characteristics and associated habitat benefits resulting from implementation of the restoration alternatives.

Results of the HGM assessment were incorporated into the Corps' standard cost evaluation analysis (ICA) to identify the alternatives that provided the highest habitat benefits per unit cost. The four highest-ranking alternatives were then evaluated in greater detail.

2.4 NO ACTION ALTERNATIVE

Under the No-Action Alternative, the Corps would take no action to restore the ecosystem and wildlife habitat within the study area. Plans with potential incidental benefits to improve water quality and water supply also would not be provided by the Corps. Although it is possible that local agencies would implement limited improvements, restoration efforts would not occur on the scale of the proposed project.

Chapter 3.0
SPECIES ACCOUNT

Viable habitat for most species of concern is limited to an area immediately downstream of the Granite Reef Dam and near the Pima Freeway and Highway 202 Loop interchange. The preferred alternative recommends only exotic species removal below the Granite Reef Dam, with potential replanting of native species to prevent reoccurrence; at the downstream end, new cottonwood/willow will be established on the eastern end of the existing habitat.

The following list of federally threatened, endangered, or proposed species was obtained from the USFWS, Arizona Ecological Services website (http://arizonaes.fws.gov).

Wildlife Species

Bald eagle (*Halieaetus leucocephalus*) – threatened
Yuma clapper rail (*Rallus longirostris yumanensis*) – endangered
Cactus ferruginois pygmy-owl (*Glaucidium brasilianum cactorum*) – endangered
Southwestern willow flycatcher (*Empidonax traillii extimus*) – endangered
Yellow-billed cuckoo (*Coccyzus americanus*) – candidate/wildlife species of concern
Lesser long-nosed bat (*Leptonycteris curasoae yerbabuena*) – endangered
California Brown Pelican (*Pelecanus occidentalis californicus*) – endangered
Mexican spotted owl (*Strix occidentalis lucida*) – threatened
Sonoran pronghorn (*Antilocapra Americana sonoriensis*) – endangered
Desert pupfish (*Cyprinodon macularius*) – endangered
Razorback sucker (*Xyrauchen texanus*) – endangered
Gila topminnow (*Poeciliopsis occidentalis occidentalis*) – endangered
Gila chub (*Gila intermedia*) – proposed endangered

Plant Species

Arizona agave (*Agave arizonica*) - endangered
Arizona cliffrose (*Purshia subintegra*) - endangered

The assessment of species within the study area included a background literature search, discussions with resource agencies, and completion of site evaluations and in some cases, wildlife surveys. Literature used in this analysis includes: *Birds of Phoenix and Maricopa County, Arizona; Clearing of phreatophytic vegetation from the Salt and Gila Rivers, Ninety-first Avenue to Gillespie Dam, Maricopa County, Arizona: Draft environmental assessment; Salt-Gila River baseline ecological characterization; Wildlife of special concern in Arizona; Clapper rail* (*Rallus longirostris*) *In: The birds of North America*; *Coccyzus americanus*; *Glaucidium brasilianum*; *Bats of the United States; Amphibians and reptiles of western North America;* and *Threatened native wildlife in Arizona.*

3.1 SENSITIVE PLANT SPECIES

Sensitive plants include those species that are listed by Federal or state resource agencies. Species that are proposed to be listed by the USFWS are assessed in a manner similar to listed species by that agency; however, in the case of proposed species, recommendations of the USFWS are advisory rather than mandatory. There are two listed plant species of concern that occur within Maricopa County: Arizona agave (*Agave arizonica*) and Arizona cliffrose (*Purshia subintegra*).

3.1.1 Arizona agave – No effect

Arizona agave has bright green leaves with dark mahogany margins and yellow flowers. This species of agave is found in the transition zone between oak-juniper woodland and mountain mahogany-oak scrub between 3000 and 6000 feet in elevation. It is usually found on steep, rocky slopes in the New River Mountains and Sierra Ancha. It is possibly found in the Mazatal Mountains and can occur on drainage bottoms or relatively gentle slopes or saddles. This species has experienced a decline in habitat due to herbivory of flowering stalks and historic overuse by livestock, feral burros, and wildlife (http://arizonaes.fws.gov). The terrain that surrounds the project area is relatively flat with no significant or mountainous landforms in the near vicinity. The project elevation is roughly 1200 feet with no oak-juniper woodland or mountain mahogany-oak scrub present. Therefore, habitat does not exist for this species. The proposed project will have no effect on the Arizona agave.

3.1.2 Arizona cliffrose – No effect

The Arizona cliffrose is an evergreen shrub approximately 5 feet in height. The bark is pale gray and shreddy and the flowers have 5 white or yellow petals. It is found only on Teritiary limestone lakebed deposits at elevations below 4000 feet. The known site within Maricopa County is at Horseshoe Lake, although it may have the potential to occur at other sites where Teritiary limestone lakebed deposits occur. Threats to this species include its localized habitat, urbanization, mining, overuse by cattle and burros and off-road vehicle traffic (http://arizonaes.fws.gov). The project site occurs within a river channel bed and does not support the necessary soil substrate or habitat for this species. Therefore, the proposed project will have no effect on the Arizona cliffrose.

3.2 SENSITIVE WILDLIFE SPECIES

Sensitive wildlife species include those federally or state-listed threatened or endangered species, those species proposed for Federal or state listing, and Federal candidate species. There are thirteen federally listed species that occur within Maricopa County: bald eagle (*Halieaetus leucocephalus*), Cactus ferruginois pygmy-owl (*Glaucidium brasilianum cactorum*), California Brown Pelican (*Pelecanus occidentalis californicus*), Mexican spotted owl (*Strix occidentalis lucida*), Southwestern willow flycatcher (*Empidonax traillii extimus*), Yuma clapper rail (*Rallus longirostris yumanensis*), the proposed Yellow-billed cuckoo (*Coccyzus americanus*), Lesser long-nosed bat (*Leptonycteris *curasoae yerbabuena*), Sonoran pronghorn (*Antilocapra Americana sonoriensis*), Desert pupfish (*Cyprinodon macularius*), Gila topminnow (*Poeciliopsis occidentalis occidentalis*), Razorback sucker (*Xyrauchen texanus*), and the proposed Gila chub (*Gila intermedia*).

3.2.1 **Birds**

3.2.1.1 Bald eagle – May affect, not likely to adversely affect

The bald eagle was reclassified from endangered to threatened in July 1995 and in 1999 was proposed to be removed from the list of Endangered and Threatened Wildlife in the lower 48 states of the U.S. Although the nesting populations are increasing throughout the U.S., the bald eagle is still threatened by habitat loss, human encroachment on nesting sites, reduction in native fish species, illegal shooting, and heavy metals (http://arizonaes.fws.gov). Bald eagles nest in large trees near lakes and streams, and hunt for waterfowl and fish in wetlands and along rivers and lakes. They also feed on small mammals and carrion. Bald eagles have been reported nesting along the Salt River east of Phoenix since the 1930s (Witzeman et al. 1997). Although they do not nest in the project study area due to lack of suitable habitat, they occur in the area as winter visitors and migrants (Benham-Blair Associates 1980) and have been observed foraging along the rivers in the project study area (CH2M HILL et al. 1997). The open water marsh near the project study area (immediately downstream of the Pima Freeway and Highway 202 Loop interchange) may be suitable foraging habitat for bald eagles. However, the area of open water currently found at the furthest downstream portion of the study area is very small in size, approximately 1 acre and linear in shape (pers. Comm.. A. Gibbons, Jones & Stokes). A second open water area further upstream, but still within Reach 1 of the proposed project is approximately seven acres in size during the wet season. Due to the relatively small size and likely very low fish populations found within the open water currently on-site these areas are not likely a significant source of foraging habitat, considering the higher quality habitat further downstream. In the furthest downstream area of existing open water, exotic vegetation species will be removed and replaced with native vegetation. No other construction activity is planned within these areas. Multiple wetlands within the greater project area will increase the overall foraging habitat of this species by approximately 200 acres, providing a beneficial effect. Due to the temporary disturbance associated with the existing open waters and the significant increase in open water features, the proposed project may affect but is not likely to adversely affect any potentially existing bald eagles.

3.2.1.2 Cactus ferruginous pygmy-owl – No effect

The cactus ferruginous pygmy-owl is a small reddish-brown owl with a cream-colored belly streaked with reddish-brown. The pygmy-owl's diet includes birds, lizards, insects, and small mammals. It is non-migratory throughout its range. Historically, the cactus ferruginous pygmy-owl occurred as far north as the confluence of the Salt and Verde Rivers but recent observations have been limited to Pima and Pinal Counties. This species occurs in riverbottom woodlands, and palo verde cacti-mixed scrub associations of the Sonoran desert. In southern Arizona, the pygmy-owl is currently found primarily in Sonoran desert scrub vegetation with some locations in riparian drainages and semi-desert grassland vegetation communities. It will nest in saguaro cacti or tree cavities below 4000 feet in elevation (http://arizonaes.fws.gov). Pygmy-owls have declined in part because of urban development, reduction of suitable habitat, and competition from other cavity-nesting birds (Arizona Game and Fish Department 1996, Arizona Game and Fish Department 2001a). The proposed project will establish approximately 24 acres of new scrub, 380 acres of new mesquite and 880 acres of new cottonwood/willow habitat; significantly increasing the suitable habitat for this species. Because the project site is currently limited to creosote dominated scrub shrub, only 4 acres of existing mesquite, little mature cottonwood, and no observations of cactus ferruginous pygmy-owls have been recently recorded within 50 miles of the project area (CH2M HILL et al. 1997, Witzeman et al. 1997), it can be determined that this project will have no effect on the cactus ferruginous pygmy-owl.

3.2.1.3 California brown pelican – No effect

The California Brown pelican is considered an uncommon transient in Arizona on many Arizona lakes and rivers. The pelican has recently been observed on Tempe Town Lake; and there are tentative plans to conduct a relocation effort to move the Tempe Town Lake pelicans back to habitat more suitable for their needs (pers. Comm., M. Martinez, USFWS). During a recent Yuma clapper rail survey conducted in May 2003, two pelicans were observed flying over the project sight. However, the pelicans were not seen using the habitat and are not expected to nest in the area. Because the California brown pelican was not seen using the project site and is known to use Tempe Town Lake, an area approximately 4 miles from the project site, it can be determined that the proposed action will have no effect on this species.

3.2.1.4 Mexican spotted owl – No effect

The Mexican spotted owl is a medium sized owl with large dark eyes and no ear tufts. It's plumage is brown with numerous white spots and posterior underparts have short, horizontal bars or spots. It generally nests in older forests of mixed conifer or ponderosa pine/gambel oak type, in canyons. In forested habitat, uneven-aged stands with a high canopy closure, high tree density, a sloped terrain and cool microclimates appear to be of importance. The spotted owl's nests are found in live trees, snags, and on canyon walls between 4100 and 9000 feet (http://arizonaes.fws.gov). Currently, the Mexican spotted owl is patchily distributed in Arizona and occurs in all but the arid southwestern portion of the state. The proposed project is found in the arid portion of Arizona and is completely void of the required habitat; therefore the project will have no effect on the Mexican spotted owl.

3.2.1.5 Southwestern willow flycatcher – No effect

The southwestern willow flycatcher is a small migratory bird with a grayish-green back and wings, a white throat, a light gray-olive breast, and a pale yellowish belly. Two wingbars are visible. It prefers nesting in dense willow riparian habitats and is also found in areas of saltcedar in the Sonoran Life Zone (e.g., the lower Big Sandy River, lower Santa Maria River, Bill Williams Delta, upper Gila River, Grand Canyon, and middle Salt River). Nests are found in thickets of trees and shrubs about 13-23 feet in height, among dense and homogenous foliage at elevations below 8500 feet. Historically, the southwestern willow flycatcher nested along the Salt, Gila, and Agua Fria Rivers (CH2M HILL et al. 1997). Currently, there are just over 900 breeding pairs documented in the Southwest and recent statewide surveys indicate that fewer than five nesting pairs occupy most sites. Individuals in Arizona are found in the middle Salt River and upper Verde River, among sites along other rivers (http://arizonaes.fws.gov) and are currently considered an uncommon transient in Maricopa County, with only a few historic summer records (Witzeman et al. 1997). The flycatcher has declined for a variety of reasons, including habitat loss and fragmentation resulting from flood control projects, development, and intensive grazing. Brown-headed cowbird nest parasitism may also have contributed to the species' decline (Arizona Game and Fish Department 1996). The project area has approximately 130 acres classified as willow, cottonwood/willow, and willow saltcedar habitat in the project study area. However, these acres are sparse, patchy and almost exclusively a single row of trees (pers. Comm., A. Gibbons, Jones & Stokes). To date, focused surveys have not been completed due to lack of suitable habitat (pers. Comm., A. Gibbons, Jones & Stokes; T. Corman, AGFD). The proposed project will increase the cottonwood/willow habitat by approximately 880 acres, creating a significant positive benefit for this species. Because of the current lack of suitable habitat, and proposed increase in cottonwood/willow, the proposed project will have no effect on the southwestern willow flycatcher.

Yuma clapper rail – No effect

The Yuma clapper rail is a long marsh bird with long legs and a short tail. Its bill is long, slender, and curved downward slightly. It is mottled brown on a gray background; its flank and underside are dark gray with narrow vertical white stripes (http://arizonaes.fws.gov). This inland clapper rail occurs in cattail, sedges, and bulrush marshes along the Colorado River, the lower Gila and Salt Rivers below the Verde/Salt River confluence, and Pichacho Reservoir (Arizona Game and Fish Department 1996, Eddelman and Conway 1998) and is often associated with dense riparian and marsh vegetation. This species has declined because of the loss and fragmentation of river marshes. Toxic levels of heavy metals, such as selenium, could also have contributed to the species' decline (Arizona Game and Fish Department 1996). Its current distribution is along the Colorado River, from Lake Mead to Mexico; on the Gila and Salt rivers upstream to the area of the Verde confluence; at Picacho Reservoir; and on the Tonto Creek arm of Roosevelt Lake (http://arizonaes.fws.gov). The Yuma clapper rail is known to occur as a rare and local summer resident in cattail marshes in the Salt River south and west of Phoenix (Witzeman et al. 1997). There is sufficient marshland habitat for this species to occur within the downstream portion of the project study area, therefore, a USFWS protocol level survey was conducted in May 2003. A copy of the survey report can be found in Appendix A of this document. Surveys resulted in no Yuma clapper rails. Therefore, the proposed action will have no effect.

3.2.1.6 Yellow-billed cuckoo – No effect

The yellow-billed cuckoo is a medium-sized bird with a slender, long-tailed profile. It has a fairly stout and slightly down-curved bill, which is black with yellow on the basal half of the lower mandible. The bird is grayish-brown above and white below with rufous primary flight feathers. The tail feathers are boldly patterned with black and white below. In Arizona, the yellow-billed cuckoo is found locally in streamside cottonwood and willow groves, and prefers to nest in willow or mesquite thickets (Arizona Game and Fish Department 2001b). Historically, this species was widespread and locally common in Arizona; currently, based on preliminary results of a statewide survey, one hundred sixty-eight pairs and 80 individuals were located in Arizona in 1999 (http://arizonaes.fws.gov). The primary reason for population decline is the loss, degradation, and fragmentation of riparian habitat. Prior to 1998, approximately thirteen cuckoo territories were found along the Salt River, although none were located within this proposed project site. Additional surveys have been completed by state agencies since 1998. Results showed one pair of cuckoos between upstream of the Granite Reef Dam and the confluence of the Salt and Gila rivers (pers. Comm.., B. Wilson, Jones & Stokes). Consequently, the yellow-billed cuckoo is considered an uncommon local summer resident (Witzeman et al. 1997). Although candidate species do not benefit from the same protection as listed species, their current rarity warrants protection. Due to lack of suitable habitat, and no findings within the project area during recent surveys, it is determined that the proposed project will have no effect on the yellow-billed cuckoo.

3.2.2 Mammals

3.2.2.1 Lesser long-nosed bat – No effect

The lesser long-nosed bat, previously known as Sanborn's long-nosed bat, is medium-sized with yellowish-brown or pale gray above and cinnamon-brown below. It has a slender elongated nose with a small nose-leaf on the tip, and a minute tail. It is found mainly in desert scrub habitat, and roosts in caves, abandoned mines, and unoccupied buildings at the base of mountains where agave, saguaro, yucca, and organ pipe cacti are present (http://arizonaes.fws.gov; Harvey et al. 1999). It forages at night on nectar, pollen, and fruit of paniculate agaves and columnar cacti. Considerable evidence exists for the interdependence of *Leptonycteris* bat species and certain agaves and cacti (http://arizonaes.fws.gov). The lesser long-nosed bat population has declined for reasons that include: human disturbance at breeding and roosting sites, habitat loss, and excessive harvest of certain agaves and cacti; however, the population appears stable (Arizona Game and Fish Department 1996). This bat is a summer resident (April – September) of central and southeastern Arizona. Although there are records for this species from the Phoenix area, the project area does not support roosting sites, nor does it support the necessary foraging vegetative species. Desert areas within the project site are dominated by creosote bush with scattered white bursage and other small shrubs, and limited areas of creosote bush, saguaro, yellow paloverde, cholla and barrel cactus. Because the proposed project site does not support the necessary foraging species or roosting sites for the lesser long-nosed bat, the project will have no effect.

3.2.2.2 Sonoran pronghorn – No effect

The Sonoran pronghorn are long-legged, small-bodied artiodactyls (hoofed animals with an even number of toes on each foot). Their upper parts are tan; the underpart, rump and two bands across the neck are white. Both sexes have horns, although they are larger in males. All Sonoran pronghorn populations occur in Sonoran desert scrub vegetation communities; creosote and white bursage comprise the major vegetation in the Lower Colorado River Valley subdivision. Plant species along major watercourses include ironwood, blue palo verde, and mesquite; species in the Arizona Upland include foothill palo verde, catclaw acacia, chain fruit cholla, teddy bear cholla, buckhorn cholla and staghorn cholla. Typcial habitat ranges between 2,000 and 4,000 feet in elevation within broad intermountain alluvial valleys separated by block-faulted mountain and surface volcanic (http://arizonaea.fws.gov). Historical ranges within southwest Arizona included south of the Bill Williams River and east to the Santa Cruz River. Currently, an extant population exists in southwestern Arizona. The primary cause of pronghorn population decline includes barriers to movement caused by roads, canals, and fences, and conversion of habitat to other uses (http://arizonaes.fws.gov). The proposed project study site is at approximately 1200 feet in elevation and is surrounded by development and urban areas to the south. Therefore, the project site does not contain suitable habitat and will have no effect on the Sonoran pronghorn.

3.2.3 **Fish**

3.2.3.1 Desert pupfish – May affect, not likely to adversely effect

The desert pupfish is a small fish with a smoothly rounded body shape and narrow, vertical dark bars on its sides. Breeding males are blue on the tops and sides, and have yellow fins. Females and juveniles are tan to olive colored on their backs and silvery on their sides. These fish are found in shallow water of desert springs, small streams, and marshes below 5, 000 feet in elevation. The pupfish also tolerates high salinities and high water temperatures. This species was once common in desert springs, marshes, backwaters, and tributaries of several large rivers in Arizona but is currently restricted to one natural population in Quitobaquito Spring Pond in Pima County due to the introduction of exotic predatory and competitive fishes, water impoundment and diversion, water pollution, stream channelization, and habitat modification (http://arizonaes.fws.gov). Reintroductions have been made in Maricopa County in the past but were unsuccessful. Additional reintroductions were made northwest of Lake Pleasant and others are planned (Pers. comm., J. Voeltz, AGFD). Although no known populations occur within the project area, it is possible that suitable conditions exist immediately downstream of Granite Reef Dam and at the Pima Freeway and Highway 202 interchange. The project proposes only to remove exotic vegetation from the Granite Reef area and replace with native species; the Pima Freeway/Highway 202 Loop interchange existing habitat will not be affected. The project also proposes to increase the wetland area by approximately 200 acres creating substantially more potential habitat. Because suitable habitat may exist within the project area, the determination is that the project may affect the desert pupfish. However, because the existing potential habitat will not be removed, and substantial new habitat will be added, the project will not adversely affect the pupfish.

3.2.3.2 Gila topminnow – May affect, not likely to adversely affect

The Gila topminnow is a small guppy-like, live-bearing fish that lacks dark spots on its fins. It occurs in small streams, springs, and cienegas below 4500 feet in elevation primarily in shallow areas with aquatic vegetation and debris for cover. This species can also tolerate relatively high water temperatures and low dissolved oxygen. Historically it was one of the most common fish found throughout the Gila River drainage in Arizona. However, due to the introduction and spread of exotic predatory and competitive fishes, water impoundment and diversion, water pollution, groundwater pumping, stream channelization, and habitat modification, it is restricted to the Santa Cruz River system and other small streams in several counties, including Maricopa (http://arizonaes.fws.gov). Although of lower quality, potential habitat exists immediately below the Granite Reef Dam and at the Pima Freeway and Highway 202 interchange. The project proposes only to remove exotic vegetation from the Granite Reef Dam area and replace it with native species; the Pima Freeway/Highway 202 Loop interchange existing habitat will not be affected. The project also proposes to increase the wetland area by approximately 200 acres creating substantially more potential habitat. Because suitable habitat may exist within the project area, the determination is that the project may affect the Gila topminnow. However, because the existing potential habitat will not be removed, and substantial new habitat will be added, the project will not adversely affect the minnow.

3.2.3.3 Razorback sucker – May affect, not likely to adversely affect

The Razorback sucker has a head that is flattened on top with a stout body with olive-brown above to yellowish on the belly. A long, high, sharp-edged keel-like hum is found behind the head. This fish is found in backwaters, flooded bottomlands, pools, side channels and other slower moving habitats below 6000 feet in elevation. Historically the sucker was found near strong currents in all major rivers and larger streams in the Colorado River Basin. Currently, in the Lower Basin, populations are isolated to Lakes Mohave, Mead, and the lower Colorado River below Havasu. Alteration of river conditions and loss of habitat caused by dam construction, irrigation dewatering and channelization, as well as the introduction of exotic fish, are all responsible for this species decline (http://arizonaes.fws.gov). Several areas of critical habitat have been designated but none are found within Maricopa County. Reintroductions have been done in the Salt and Verde rivers with ongoing introductions near Childs, AZ (Pers. Comm., J. Voeltz, AGFD). Because of the recent introductions and the potential for suitable habitat for the Razorback sucker, the proposed project may affect this species. However, the project proposes only to remove exotic vegetation from the Granite Reef Dam area and replace it with native species; the Pima Freeway/Highway 202 Loop interchange existing habitat will not be affected. The project also proposes to increase the wetland area by approximately 200 acres creating substantially more potential habitat, providing a beneficial effect. Therefore, the project will not adversely affect the Razorback sucker.

3.2.3.4 Gila chub – No effect

The Gila chub is a small-finned, deep-bodied chubby member of the minnow family. It is dark colored with diffuse lateral bands that are rarely present. They are commonly found in pools, springs, cienegas, smaller streams, and artificial impoundments between 2,000 and 3,500 feet in elevation. Common riparian plants associated with these populations include willow, tamarisk, cottonwoods, seep-willow, and ash. Historically, the chub's range likely included suitable habitat throughout the entire Gila River basin, except the Salt River drainage above Roosevelt Lake. Currently, they have been recorded in approximately 30 rivers, streams, and spring-fed tributaries throughout the Gila River basin, although none have been recorded in Maricopa County. Roughly 90% of suitable habitat has been degraded or destroyed due to extensive grazing, mining operations, increased recreation usage and the introduction of exotic species (http://arizonaes.fws.gov). Proposed critical habitat sites have been identified, but none exist within Maricopa County. Because the Gila chub has not been recorded in Maricopa County within recent surveys and its lowest habitat elevation range is approximately 800 feet above the elevation of the proposed project, it can be determined that there will be no effect on this species.

Chapter 4.0
CONCLUSIONS

As a result of ongoing coordination with the USFWS, project features that would most likely increase and improve habitat conditions for a variety of species, including those listed as federally endangered or threatened, were given greatest consideration. Given the rarity of riparian ecosystems within the arid southwest, the proposed project attempted to establish as many acres of wetland, and cottonwood/willow as was practicably feasible, given the limitations of available surface water and current land use. Additional acres of new mesquite and desert scrub shrub are also planned to complete the upper slopes of desert riparian systems.

Through examination of the project site, current literature searches and survey results, and discussions with resource agency personnel, the proposed project was determined to have either "no effect" or "no adverse affect" on the 15 federally listed threatened, endangered, proposed, or candidate species. The determinations are as follows:

Arizona agave (*Agave arizonica*) – No effect.
Arizona cliffrose (*Purshia subintegra*) – No effect.
Bald eagle (*Halieaetus leucocephalus*) – May affect, not likely to adversely affect
Yuma clapper rail (*Rallus longirostris yumanensis*) – No effect
Cactus ferruginois pygmy-owl (*Glaucidium brasilianum cactorum*) – No effect
Southwestern willow flycatcher (*Empidonax traillii extimus*) – No effect
Yellow-billed cuckoo (*Coccyzus americanus*) – No effect
Lesser long-nosed bat (*Leptonycteris curasoae yerbabuena*) – No effect
California Brown Pelican (*Pelecanus occidentalis californicus*) – No effect
Mexican spotted owl (*Strix occidentalis lucida*) – No effect
Sonoran pronghorn (*Antilocapra Americana sonoriensis*) – No effect
Desert pupfish (*Cyprinodon macularius*) – May affect, not likely to adversely affect
Razorback sucker (*Xyrauchen texanus*) – May affect, not likely to adversely affect
Gila topminnow (*Poeciliopsis occidentalis occidentalis*) – May affect, not likely to adversely affect
Gila chub (*Gila intermedia*) – No effect

This Biological Assessment serves as the documentation of these determinations and will be accompanied by a cover letter asking for written concurrence by the USFWS. The Corps understands that should the project or project site conditions change in a way that may affect threatened or endangered species, or the determinations made in this document, the USFWS would be notified and Section 7 Consultation would be reinitiated.

Chapter 5.0
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In Reply Refer to:
AESO/SE
02-21-03-I-0171

February 20, 2004

Ms. Ruth Villalobos
Chief, Planning Division
Attn: Sarah Laughlin
U.S. Army Corps of Engineers, Los Angeles District
P.O. Box 532711
Los Angeles, California 90053-2352

Dear Ms. Villalobos:

Thank you for your October 22, 2003 letter requesting consultation under section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended, for the proposed Va Shly'ay Akimel Environmental Restoration Project located along the Salt River in Maricopa County, Arizona. We have also received your October 2003 Biological Assessment (BA) and May 2003 preliminary Draft Environmental Impact Statement (DEIS). Subsequent coordination with your agency has indicated that the proposed action includes the 3-5 year construction phase and implementation of the 5 year monitoring and adaptive management plan (MAMP), presented in Appendix A of the DEIS. Based on discussion with your staff, the Corps has determined that the proposed action may affect, but is not likely to adversely affect, bald eagle (*Haliaeetus leucocephalus*), cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*), Yuma clapper rail (*Rallus longirostris yumanensis*), southwestern willow flycatcher (*Empidonax traillii extimus*), and California brown pelican (*Pelecanus occidentalis californicus*).

We have reviewed the BA and DEIS and have revisited our draft Fish and Wildlife Coordination Act Report. The detailed project description contained in those documents is rather lengthy and will not be repeated here. In general, the proposed action would include the removal of undesirable vegetation, delivery of water, and planting of native riparian plant species along the Salt River from Granite Reef Dam to the Loops 101 and 202 freeway crossings. The Corps would turn responsibility for operation and maintenance (O&M) over to the local non-Federal sponsors after the fifth year following completion of construction.

The following summarizes relevant information on each species:

Yuma clapper rail: Suitable habitat for the clapper rail is currently limited to the area where the Loop 101 Freeway crosses the Salt River. A large wetland community characterized by perennial water and cattail (*Typha* sp.) exists in this area. This wetland was surveyed extensively during May 2003, and no clapper rails were detected. Also, project construction would not entail native vegetation removal or dewatering within suitable rail habitats.

Southwestern willow flycatcher: Riparian woodlands characterized by cottonwood (*Populus fremontii*), willow (*Salix* sp.), and salt cedar (*Tamarix* sp.) within the project area are generally sparse, patchy, and unsuitable for the southwestern willow flycatcher. Additionally, prior to construction, if suitable habitat has developed in an area scheduled for disturbance (likely in the form of salt cedar thickets), the Corps will re-evaluate the situation in coordination with us, and conduct surveys for flycatcher if necessary.

Cactus ferruginous pygmy-owl: The species has not been detected within or near the study area since 1971 when an owl was heard near Blue Point on the Salt River. The species commonly occurred in the cottonwood forests near the confluence of the Gila and Salt Rivers until about 1900. Currently, riparian woodlands characterized by cottonwood and/or mesquite within the project area are generally sparse, patchy, and unsuitable for the pygmy-owls. Also, project construction would not entail removal of native riparian woodland communities that could potentially develop into pygmy-owl habitat.

Bald eagle: Bald eagles have been observed foraging within the project area. However, nesting does not occur in the project area. This may be due to lack of suitable nesting trees, inadequate fish prey base, and/or proximity to human population centers. A pair of breeding bald eagles is known to nest just upstream of Granite Reef Dam. Project construction would not entail removal of native riparian woodland communities that could potentially develop into suitable nesting habitat.

California brown pelican: Typically, brown pelicans only occur along the Salt River when they have been incidentally carried in from the coast by severe storms. Recently, immature pelicans have been observed at Tempe Town Lake. It is possible that these pelicans could forage within wetlands near the Loops 101 and 202 Freeway crossings. However, project construction would not entail native vegetation removal or dewatering within these areas.

Additionally, the following mitigation and monitoring measures, which are part of the proposed action, should be noted.

Minimize disturbance of vegetation during construction: During the final design of the project, disturbance to areas of existing vegetation that are not within the project footprint would be minimized through careful phasing of project construction. In addition, areas of desirable vegetation would be delineated on construction plans as areas that are not to be disturbed.

Conduct long-term maintenance activities on a rotating basis and only during non-nesting periods: Sediment removal and other activities would be conducted during non-nesting periods of the southwestern willow flycatcher, Yuma clapper rail, and the western yellow billed-cuckoo (*Coccyzus americanus occidentalis*). In the case of sediment removal, activities would be conducted on a rotating basis so that no more than 25% of the marsh area would be affected in any one year.

Implement the monitoring and adaptive management plan: The MAMP will track and evaluate the success of revegetation and habitat restoration. The plan includes success criteria and reporting requirements. The Corps and/or non-Federal sponsor would be responsible for collecting monitoring data and preparing annual reports. A technical committee consisting of at least the U.S. Fish and Wildlife Service, U.S. Bureau of Reclamation, and Arizona Game and Fish Department will assist in collecting and reviewing monitoring data, and providing recommendations of possible adaptive management measures.

Furthermore, we have coordinated with your staff and jointly identified the following conservation measures to be incorporated into the proposed action.

1) Following adoption of the preliminary engineering design and prior to construction, the Corps will reevaluate the suitability of vegetation communities for threatened and endangered species. If suitable habitat has developed that was not considered in this consultation, the Corps will coordinate with FWS to determine the necessity of surveys.

2) The MAMP will be designed to quantitatively and qualitatively monitor the success of the proposed project goals and objectives through measurements of specific parameters that include changes in species abundance and shifts in vegetation cover or structure. The FWS will be provided all survey information and reports completed for the project.

3) The FWS and local non-Federal sponsors will continue to coordinate regarding the development and implementation of a Safe Harbor Agreement (SHA), Habitat Conservation Plan (HCP), or other appropriate mechanism to address potential effects to, and take of, listed species which may result from O&M. If possible, applicable elements of a SHA or HCP, such as baseline condition, mitigation, and/or monitoring provisions, should be developed prior to the local sponsor(s') acceptance of the project from the Corps to ensure that O&M activities may be conducted in a manner that satisfies the original project goals. Because a SHA or HCP would be agreements solely between the FWS and the local sponsor, the completion of such an agreement is not required for completion of the section 7 consultation process as it relates to Federal agencies.

Based on our review of the proposed action, including conservation measures, we concur that the Va Shly'ay Akimel Environmental Restoration Project may affect, but is not likely to adversely affect, the Yuma clapper rail, southwestern willow flycatcher, cactus ferruginous pygmy-owl, California brown pelican, and bald eagle. We appreciate your efforts to manage for threatened and endangered species as part of the Va Shly'ay Project. As a final note, copies of survey protocols and recovery plans for listed species are available from our web page at http://arizonaes.fws.gov.

Where discretionary agency involvement or control over the action has been retained (or is authorized by law) by the Corps Planning Division, reinitiation of consultation is necessary if: a) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in this consultation, b) the action is subsequently modified in a manner that causes an effect to listed species or critical habitat in a manner not considered in this consultation, c) a new species is listed or critical habitat designated that may be affected by the action, or d) incidental take of a listed species is anticipated. In instances where incidental take occurs, any operation causing such take must cease pending reinitiation.

We thank the Corps and all cooperators for engaging in this habitat restoration effort. Should project plans change, or new information on the distribution or abundance of listed species becomes available, our determination of effects to listed species may need to be reconsidered. We also encourage you to continue to coordinate review of this project with the Arizona Game and Fish Department. If we can be of further assistance or you have questions, please contact Mike Martinez (x224).

Sincerely,

Steven L. Spangle
Field Supervisor

cc: Regional Director, Fish and Wildlife Service, Albuquerque, NM (ARD-ES)
Supervisor, Project Evaluation Program, Arizona Game and Fish Department, Phoenix, AZ
Kayla Eckert, Planning Branch, U.S. Army Corps of Engineers, Phoenix, AZ

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Appendix F
Background Information on Acoustics

APPENDIX F.
BACKGROUND INFORMATION ON ACOUSTICS

SOUND TERMINOLOGY

Sound travels through the air as waves of minute air pressure fluctuations caused by some type of vibration. In general, sound waves travel away from the sound source as an expanding spherical surface. The energy contained in a sound wave is consequently spread over an increasing area as it travels away from the source. This results in a decrease in loudness at greater distances from the sound source. The following terms are commonly used in acoustics.

Decibel

Sound-level meters measure the pressure fluctuations caused by sound waves. Because of the ability of the human ear to respond to a wide dynamic range of sound pressure fluctuations, loudness is measured in terms of decibels (dB) on a logarithmic scale. This results in a scale that measures pressure fluctuations in a convenient notation and corresponds to our auditory perception of increasing loudness.

A-Weighted Decibels

Most sounds consist of a broad range of sound frequencies. Because the human ear is not equally sensitive to all frequencies, several frequency-weighting schemes have been used to develop composite decibel scales that approximate the way the human ear responds to sound levels. The "A-weighted" decibel scale (dBA) is the most widely used for this purpose. Typical A-weighted sound levels for various types of sound sources are summarized in Figure F-1.

Equivalent Sound Level

Time-varying sound levels are often described in terms of an equivalent constant decibel level. Equivalent sound levels (L_{eq}) are used to develop single-value descriptions of average sound exposure over various periods of time. Such average sound exposure values often include additional weighting factors for annoyance potential attributable to time of day or other considerations. The L_{eq} data used for these average sound exposure descriptors are generally based on A-weighted sound-level measurements.

Day-Night Average Sound Level

Average sound exposure over a 24-hour period is often presented as a day-night average sound level (L_{dn}). L_{dn} values are calculated from hourly L_{eq} values, with the L_{eq} values for the nighttime period (10:00 p.m.-7:00 a.m.) increased by 10 dB to reflect the greater disturbance potential from nighttime noises.

Community Noise Equivalent Level

The community noise equivalent level (CNEL) is also used to characterize average sound levels over a 24-hour period, with weighting factors included for evening and nighttime sound levels. L_{eq} values for the evening period (7:00 p.m.-10:00 p.m.) are increased by 5 dB, while L_{eq} values for the nighttime period (10:00 p.m.-7:00 a.m.) are increased by 10 dB. For given set of sound measurements, the CNEL value will usually be about 1 dB higher than the L_{dn} value. In practice, CNEL and L_{dn} are often used interchangeably.

Percentile-Exceeded, Maximum, and Minimum Sound Level

The sound level exceeded during a given percentage of a measurement period is the percentile-exceeded sound level (L_x). Examples include L_{10}, L_{50}, and L_{90}. L_{10} is the A-weighted sound level that is exceeded 10% of the measurement period, L_{50} is the level exceeded 50% of the period, and so on. L_{50} is the median sound level measured during the measurement period. L_{90}, the sound level exceeded 90% of the time, excludes high localized sound levels produced by nearby sources such as single car passages or bird chirps. L_{90} is often used to represent the background sound level. L_{50} is also used to provide a less conservative assessment of the background sound level.

The maximum sound level (L_{max}) and the minimum sound level (L_{min}) are the maximum and minimum sound levels respectively, measured during the measurement period. When a sound meter is set to the "slow" response setting as is typical for most community noise measurements, the Lmax and Lmin values are the maximum and minimum levels measured over a one second period.

Ambient Sound

Ambient sound is the all-encompassing sound associated with a given community site, usually being a composite of sounds from many sources, near and far, with no particular sound being dominant.

EQUIVALENCIES BETWEEN VARIOUS SOUND DESCRIPTORS

The L_{dn} value at a site calculated from a set of measurements taken over a given 24-hour period will be slightly lower than the CNEL value calculated over the same period. Except in situations where unusually high evening sound levels occur, the CNEL value will be within 1.5 dB of the L_{dn} value for the same set of sound measurements.

The relationship between peak hourly L_{eq} values and associated L_{dn} values depends on the distribution of traffic over the entire day. There is no precise way to convert a peak hourly L_{eq} value to an L_{dn} value. However, in urban areas near heavy traffic, the peak hourly L_{eq} value is typically 2-4 dB lower than the daily L_{dn} value. In less heavily developed areas, the peak hourly L_{eq} is often equal to the daily L_{dn} value. For rural areas with little nighttime traffic, the peak hourly L_{eq} value will often be 3-4 dB greater than the daily L_{dn} value.

WORKING WITH DECIBEL VALUES

The nature of the decibel scale is such that the individual sound levels for different sound sources cannot be added directly to give the combined sound level of these sources. Two sound sources producing equal sound levels at a given location will produce a composite sound level that is 3 dB greater than either sound alone. When two sound sources differ by 10 dB, the composite sound level will be only 0.4 dB greater than the louder source alone.

Most people have difficulty distinguishing the louder of two sound sources if they differ by less than 1.5-2.0 dB. Research into the human perception of changes in sound level indicates the following:

- a 3-dB change is just perceptible,
- a 5-dB change is clearly perceptible, and
- a 10-dB change is perceived as being twice or half as loud.

A doubling or halving of acoustic energy will change the resulting sound level by 3 dB, which corresponds to a change that is just perceptible. In practice, this means that a doubling of traffic volume on a roadway, doubling the number of people in a stadium, or doubling the number of wind turbines in a wind farm will, as a general rule, only result in a 3-dB, or just perceptible, increase in noise.

OUTDOOR SOUND PROPAGATION

There are a number of factors that affect how sound propagates outdoors. These factors, described by Hoover and Keith (1996), are summarized below.

Distance Attenuation

As a general rule, sound from localized or point sound sources spreads out as it travels away from the source and the sound level drops at a rate of 6 dB per doubling of distance. If the sound source is long in one dimension, such as traffic on a highway or a long train, the sound source is considered to be a line source. As a general rule, the sound level from a line source will drop off at a rate of 3 dB per doubling of distance. If the intervening ground between the line source and the receptor is acoustically "soft" (e.g., ground vegetation, scattered trees, clumps of bushes), an attenuation rate of 4.5 dB per doubling of distance is generally used.

Attenuation from Barriers

Any solid structure such as a berm, wall, or building that blocks the line of sight between a source and receiver serves as a sound barrier and will result in additional sound attenuation. The amount of additional attenuation is a function of the difference between the length of the sound path over the barrier and the length of the direct line of sight path. Thus, the sound attenuation of a barrier between a source and a receiver that are very far apart will be much less than the attenuation that would result if either the source or the receiver is very close to the barrier.

Molecular Absorption

Air absorbs sound energy as a function of the temperature, humidity of the air, and frequency of the sound. Additional sound attenuation on the order of 1 to 2 dB per 1,000 feet can occur.

Anomalous Excess Attenuation

Large-scale effects of wind speed, wind direction, and thermal gradients in the air can cause large differences in sound transmission over large distances. These effects when combined result in anomalous excess attenuation, which can be applied to long-term sound-level estimates. Additional sound attenuation on the order of about 1 dB per 1,000 feet can occur.

Other Atmospheric Effects

Short-term atmospheric effects relating to wind and temperature gradients can cause bending of sound waves and can influence changes in sound levels at large distances. These effects can either increase or decrease sound levels depending on the orientation of the source and receptor and the nature of the wind and temperature gradient. Because these effects are normally short-term, it is generally not practical to include them in sound propagation calculations. Understanding these effects, however, can help explain variations that occur between calculated and measured sound levels.

GUIDELINES FOR INTERPRETING SOUND LEVELS

Various agencies have developed guidelines for evaluating land use compatibility under different sound-level ranges. The following is a summary of federal guidelines.

The federal Noise Control Act of 1972 (Public Law 92-574) established a requirement that all federal agencies administer their programs to promote an environment free of noise that jeopardizes public health or welfare. The U.S. Environmental Protection Agency (EPA) was given the responsibility for:

- providing information to the public regarding identifiable effects of noise on public health or welfare,

- publishing information on the levels of environmental noise that will protect the public health and welfare with an adequate margin of safety,

- coordinating federal research and activities related to noise control, and

- establishing federal noise emission standards for selected products distributed in interstate commerce.

The federal Noise Control Act also directed that all federal agencies comply with applicable federal, state, interstate, and local noise control regulations.

Although EPA was given major public information and federal agency coordination roles, each federal agency retains authority to adopt noise regulations pertaining to agency programs. EPA can require other federal agencies to justify their noise regulations in terms of the federal Noise Control Act policy requirements. The Occupational Safety and Health Administration retains primary authority for setting workplace noise exposure standards. The Federal Aviation Administration retains primary jurisdiction over aircraft noise standards, and the Federal Highway Administration (FHWA) retains primary jurisdiction over highway noise standards.

In 1974, in response to the requirements of the federal Noise Control Act, EPA identified indoor and outdoor noise limits to protect public health and welfare (communication disruption, sleep disturbance, and hearing damage). Outdoor L_{dn} limits of 55 dB and indoor L_{dn} limits of 45 dB are identified as desirable to protect against speech interference and sleep disturbance for residential, educational, and healthcare areas. Sound-level criteria to protect against hearing damage in commercial and industrial areas are identified as 24-hour L_{eq} values of 70 dB (both outdoors and indoors).

The FHWA has adopted criteria for evaluating noise impacts associated with federally funded highway projects and for determining whether these impacts are sufficient to justify funding noise mitigation actions (23 CFR 772). The FHWA noise abatement criteria are based on peak hourly L_{eq} sound levels, not L_{dn} or 24-hour L_{eq} values. The peak 1-hour L_{eq} criteria for residential, educational, and healthcare facilities are 67 dB outdoors and 52 dB indoors. The peak 1-hour L_{eq} criterion for commercial and industrial areas is 72 dB (outdoors).

The U.S. Department of Housing and Urban Development has established guidelines for evaluating noise impacts on residential projects seeking financial support under various grant programs (44 FR 135:40860-40866, January 23, 1979). Sites are generally considered acceptable for residential use if they are exposed to outdoor L_{dn} values of 65 dB or less. Sites are considered "normally unacceptable" if they are exposed to outdoor L_{dn} values of 65-75 dB. Sites are considered unacceptable if they are exposed to outdoor L_{dn} values above 75 dB.

REFERENCE

Hoover, R. M., and R. H. Keith. 1996. Noise control for buildings and manufacturing plants. Houston, TX: Hoover and Keith, Inc.

Sound Source	Sound Level (dBA)*	Response
Carrier deck jet operation	140	
Civil defense siren (at 100 feet)	130	Painfully loud
Jet takeoff (at 200 feet)	120	Threshold of feeling pain
Riveting machine (at 1 foot) Rock music concert	110	
Pile driver (at 50 feet) Ambulance siren (at 100 feet)	100	Very loud
Heavy truck (at 50 feet)	90	
Pneumatic drill (at 50 feet) Freight train cars (at 50 feet) Garbage disposal in home	80	
Freight train cars (at 100 feet) Freeway traffic (at 50 feet) Vacuum cleaner (at 10 feet)	70	Moderately loud
Air conditioning unit (at 20 feet)	60	
Speech in normal voice (at 15 feet)	50	
Residence-typical movement of people, no TV or radio	40	Quiet
Soft whisper (at 5 feet)	30	
Recording studio	20	
	10	
	0	Threshold of hearing

*** Typical A-weighted sound levels in decibels. "A" weighting approximates the frequency response of the human ear.**

Figure F-1
Weighted Sound Levels and Human Response

Appendix G

Air Quality Assumptions and Calculations

APPENDIX G .
ASSUMPTIONS USED TO GENERATE AIR EMISSION ESTIMATES FOR THE VA SHLY'AY AKIMEL PROJECT

The following assumptions were used to estimate emissions associated with each of the Va Shly'ay Akimel project alternatives. Detailed assumptions and emission factors for each calculation are presented in the attached spreadsheets. To calculate construction and O&M emissions, emission factors developed by EPA's AP-42, Compilation of Air Pollutant Emission Factors, have been used to calculate exhaust and fugitive dust emissions. Calculations are also based on earthwork quantity and import fill quantity information provided in the feasibility study. The following types of air pollutant emission sources were included in the calculations:

- Fugitive dust emissions from haul trucks and passenger cars on unpaved roads were estimated based on the assumed number of vehicle trips and travel distance, using AP-42 emission factors applicable for the western United States. Truck travel on unpaved roads was calculated for the following types of vehicles: worker commute vehicles; haul trucks carrying import fill; haul trucks carrying concrete and rebar for diversion structures; and haul trucks carrying plants for revegetation. For the construction phases, it was assumed unpaved haul roads would be aggressively watered to reduce dust emissions in accordance with Maricopa County Air Quality Regulation 310, thereby providing an assumed 80% reduction in dust emissions. During the restoration phases and operational (recreational) phases it was assumed the unpaved access roads would not be watered.
- Fugitive dust emissions from excavating, loading, dumping, and spreading of bulk soil during channel excavation and bank stabilization were estimated based on the assumed earthwork volumes, using AP-42 emission factors for surface mining operations. The assumed silt content of the excavated material was reduced from the default AP-42 values to account for the fact that the material excavated from the river channel consists mainly of depositional soil with coarse sand and gravel, rather than silty overburden typically encountered at surface mines.
- Fugitive dust emissions from bulldozer operations to spread excavated material over the site were estimated using AP-42 emission factors, with a reduction in the assumed silt content to account for the predominant soil type consisting of coarse sand and gravel.
- Emissions from construction equipment tailpipes were estimated based on the type and number of equipment, using recent emission factors for off-road equipment.

BANK STABILIZATION/CONSTRUCTED WETLANDS CONSTRUCTION

- Equipment used for construction (assuming 10 hours/day, 200 days per year):
  - front end loader
  - two dump trucks

- scraper
- dozer
- grader
- backhoe
- water truck
- roller

- Bank stabilization materials will be obtained from the constructed wetland excavation sites. Any additional materials needed for the bank stabilization will be obtained from the other proposed restoration sites within the river channel.
- Construction will occur approximately 200 days per year.
- For employee trips, assumed a 40-mile round-trip commute per day.

Table G-1. Assumptions for Channel Excavation and Bank Stabilization Emission Estimates

Alternative	Years of Heavy Earthwork Construction	Total Earthwork Volume (CY)	Daily Employee Trips	Employee Commute Distance (round trip miles)
O	5	4,161,000	15	40
F	5	8,400,000	25	40
N	5	4,678,500	15	40
E	5	5,605,000	15	40
A	1	23,000	10	40

RESTORATION AND MAINTENANCE

- Construction will occur approximately 200 days per year.
- Restoration implementation will consist of three general steps: clearing and grubbing, excavation, and preparation for planting.
- Vegetation removal emissions based on dozer emissions only.
- Saltcedar removed during initial implementation will be disposed of by burning.
- Equipment used for construction (assuming 10 hours/day, 200 days per year).
  - front end loader
  - two dump trucks
  - dozer
  - backhoe

- For employee trips, assumed a 40-mile round-trip commute per day.

Table G-2. Assumptions for Construction Emissions Associated with Restoration and Maintenance

Alternative	Annual Dump Truck Trips on Unpaved Roads	Daily Employee Trips	Truck Distance on Unpaved Roads (round trip miles/load)	Employee Commute Distance (round trip miles)
O	300	15	2	40
F	500	25	2	40
N	300	15	2	40
E	300	15	2	40
A	200	10	2	40

RECREATIONAL USE

Vehicle trips were based on the revised study prepared by the Va Shly'ay Akimel recreation technical committee (see Table H-3). In addition, 25 employees would work onsite traveling 40 miles round trip. Recreational trip emissions were assumed not to vary by alternative.

Table G-3. Estimated Traffic Associated with Recreational Use

Period	Daily Recreationist Trips (round trips)	Daily Employee Trips (round trips)	Total Daily Trips (round trips)
Summer			
Prime	273	25	298
Non-prime	69	25	94
Winter			
Prime	409	25	434
Non-prime	137	25	162

Appendix H

Va Shly'ay Akimel Phase I Environmental Site Assessment

PHASE I ENVIRONMENTAL SITE ASSESSMENT

APPROXIMATE 17-MILE PORTION OF THE SALT RIVER
SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY

PREPARED FOR:

SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY
10005 EAST OSBORN ROAD
SCOTTSDALE, ARIZONA 85256

JUNE 21, 2002

LIESCH PROJECT NUMBER 52734.00

LIESCH

Liesch Companies

Minneapolis, MN • Madison, WI • Scottsdale, AZ

PHASE I ENVIRONMENTAL SITE ASSESSMENT

APPROXIMATE 17-MILE PORTION OF THE SALT RIVER
SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY

PREPARED FOR:
Salt River Pima-Maricopa Indian Community
10005 East Osborn Road
Scottsdale, Arizona 85256

PREPARED BY:

Liesch Southwest, Inc.
4300 North Miller Road, Suite 200
Scottsdale, Arizona 85251
(480) 421-0853

June 21, 2002
Project #52734.00

This report was prepared by me
or under my direct supervision.

Julianne M. Hamilton, R.G.
Project Manager

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APPENDICES

EXECUTIVE SUMMARY

Liesch Southwest, Inc. (Liesch) was retained by Salt River Pima-Maricopa Indian Community (SRPMIC) to perform a Phase I Environmental Site Assessment (ESA) of the Property identified as an approximate 17-mile stretch of the Salt River from Highway 101 to the Granite Reef Dam including about ¼ mile area on each side of the center of the river. The purpose of this assessment is to provide general information with regard to environmental issues as part of the initial stage for a proposed Salt River Restoration Project that is being led by the Army Corp of Engineers.

The Property consists of approximately 17-miles of the Salt River that is bordered by the SRPMIC on the north, Highway 101 to the west, Highway 202 and the City of Mesa to the south, and the Granite Reef dam near the confluence of the Salt and Verde Rivers to the east. Developed and/or utilized portions within and/or on the north side of the river include: Salt River Sand and Rock (SRSR) (quarry operations with subleases to Vulcan, Chandler Ready Mix, Hanson, and United Metro), five recharge ponds operated by the SRPMIC which receive treated water from the City of Mesa, several irrigation run-off ponds, Arizona Propane, Saddleback Communications, Cypress Landfill (old Tri-Cities Landfill/Country Club Landfill), Cypress golf course, RV Storage facility, JR's Convenience Store, United Metro quarry operations, Tri-Cities Landfill and SRP methane gas power plant, Granite Reef Underground Storage Project (GRUSP) recharge ponds, the Arizona Canal, South Canal, Salt River Sand and Rock (Higley quarry operations with subleases to Vulcan, Hanson and United Metro) and the Granite Reef dam. Developed and/or utilized portions within and/or on the south side of the river include: four recharge ponds operated by the City of Mesa, the Mesa northwest wastewater treatment plant, Cemex quarry operations, various commercial businesses (including, but not limited to, Car Smart, Little Dealer, Little Prices, Superstition Springs Crushing, Pete's Diesel Repair, Heritage Trucking, Redburn Tire Company, Carports Etc., Allpride Marble and Granite, Artistic Ice Creations, and Alumi-Cover Inc.), residential properties, ADOT storage yard, Mesa storage yard, Mesa Police Department Firing Range, North Center Street Landfill, Tri-Cities Landfill, Vulcan demolition debris landfill, agricultural land, Lehi Cemetery, Highway 202 Construction and storage area, Chandler Ready Mix quarry, horse farm, southern canal, Salt River Sand and Rock (Higley operations – offices), primate research center, and the Granite Reef Dam. Access to private properties within the City of Mesa on the south side of the River; private allotments within the SRPMIC; and, to the Cypress golf course, RV storage facility, JR's Convenience Store, and Saddleback Communications were not provided at the time of Liesch's site visit, therefore, only the portions of these areas visible from public right-of-ways were observed.

Based on Liesch's assessment, the following environmental issues were identified for the Property.

Salt River Sand and Rock

- Maintenance shop – wash rack, chemical/waste storage
- Lube shop – staining and chemical/waste storage practices
- Sand blasting/paint area – bare ground
- Vehicle repair and storage area – bare ground
- Large quantities of debris (disposal practices)
- Cement dump area
- Former leaking UST (historic)

Chandler Ready Mix at SRSR

- Maintenance shop –storage practices, staining
- Wash down area – corrosion, staining

Hanson/United Metro/Vulcan Cement Batch Plants at SRSR and Higley

- Wash down areas – staining, corrosion
- Vehicle maintenance – staining, storage practices
- Chemical storage – leakage, some without secondary containment

Vulcan Maintenance Yard and Asphalt Batch Plant

- Wash down chemical storage area - staining
- Former USTs – (historic)
- Four existing USTs
- 1999 Explosion (historic)
- Debris/parts storage area

CEMEX Operations (and associated operations)

- Assumed issues same as other quarries

Arizona Propane

- Former site operations (Forest Homes)
- Stockpile of debris/waste
- Maintenance sump

Various Commercial Businesses

- Chemical/waste storage
- References to spills/releases in the database
- USTs/ASTs

United Metro

- Chemical storage area (numerous drums and staining)
- Cement batch plant chemical storage
- Cement/asphalt dump area – extending over hard bank
- Wash down area – corrosion, staining, pond water
- Former USTs (historic)

Enviro-Systems

- Soil contamination clean-up (historic)
- Former site operations (unknown)

Tri-City Landfill (north and south sides)

- Groundwater contamination
- Methane migration

North Center Street Landfill

- No information available

Cypress Landfill

- Known contamination currently requesting brownfield pilot study funding

Mesa Firing Range

- Lead contamination
- Berms constructed of debris/soil mixture

Vulcan Demolition Debris Landfill

- Unknown

Chandler Ready Mix – at Gilbert Road

- Assumed issues same as other quarries

1.0 INTRODUCTION

Liesch Southwest, Inc. (Liesch) was retained by Salt River Pima-Maricopa Indian Community (SRPMIC) to perform a Phase I Environmental Site Assessment (ESA) of the Property identified as an approximate 17-mile stretch of the Salt River from Highway 101 to the Granite Reef Dam including about ¼ mile area on each side of the center of the river. The purpose of this assessment is to provide general information with regards to environmental issues as part of the initial stage for a proposed Salt River Restoration Project that is being led by the Army Corp of Engineers.

An experienced ESA investigator conducted a reconnaissance of the Property on March 20, 22, 25, 26, and April 15 through 19, 2002. This report presents the information obtained by Liesch during the course of this ESA investigation. Access to properties, which are located within the boundaries of the SRPMIC, was provided by Mr. Morris Paukgana, Ms. Dawn Daw, Ms. Debra Frein and Mr. Rich Allen of the SRPMIC. Mr. Gordon Haws and Ms. Christine Zielonka with the City of Mesa provided access to the City of Mesa firing range and wastewater treatment plant.

Figure 1 (**Appendix A**) shows the Property and indicates the approximate location of the relevant sites within the Property. In addition, included in **Appendix B** is client-supplied information. Within these documents there are various figures and diagrams showing specific site boundaries that were provided by SRPMIC or individual site representatives.

2.0 SCOPE OF WORK

The scope of work conducted by Liesch for this ESA includes the following items:

- A visual walkover assessment of the referenced property, identifying existing surface conditions and any obvious signs of contamination.
- A visual survey of adjacent properties for current land use and any obvious signs of contamination.
- Personal contacts with state, county and city regulatory agencies to determine if any environmental problems or spills have been reported on or adjacent to the site under investigation.
- Review of the USGS quadrangle map for locations of canals, wells, pipelines and other features that may potentially affect the Property.
- Review of available plans and specifications, drawings, site plans, surveys and similar documents concerning the Property.
- Review of historical aerial photographs and Sanborn Maps (if available).
- Review of historic property records made available by the property owner.

- Assessment of the possible presence of PCBs at the Property.
- Review of a regulatory database search (FirstSearch Report).
- Personal interviews with persons knowledgeable of past and present activities on the Property.
- Preparation of a report summarizing the factual findings of the assessment.

Due to the extensive nature of this project, Liesch has focused on identifying general environmental issues that may be of concern to the project study team as part of the proposed Salt River Restoration project. Access to private properties within the City of Mesa on the south side of the River and to the Cypress golf course, RV storage facility, JR's Convenience Store, Saddleback Communications, and private allotted land within SRPMIC was not provided at the time of Liesch's site visit. Therefore, only the portions of these areas visible from public right-of-ways were observed. More detailed assessment of individual areas within the Property may be necessary depending upon the specific proposed restoration. This site assessment does not include a comprehensive compliance analysis regarding local, state or federal environmental laws, rules or regulations. The following sections discuss the information obtained for this project. **Section 10.0** presents Liesch's conclusions.

3.0 PROPERTY BACKGROUND

3.1 Property Location

The Property is located within Township 1 North, Range 5 East, Sections 3, 4, 7, 8 and 9, Township 2 North, Range 5 East Sections 25, 26, 33, 34, and 35, and Township 2 North, Range 6 East, Sections 13, 14, 22, 23, 24, 27, 28, 29, and 30 of the Gila and Salt River Baseline and Meridian.

3.2 Property Description

The Property consists of approximately 17-miles of the Salt River that is bordered by the SRPMIC on the north, Highway 101 to the west, Highway 202 and the City of Mesa to the south, and the Granite Reef dam near the confluence of the Salt and Verde Rivers to the east. Developed and/or utilized portions within and/or on the north side of the river include: Salt River Sand and Rock (quarry operations with subleases to Vulcan, Chandler Ready Mix, Hanson, and United Metro), five recharge ponds operated by the SRPMIC which receive treated water from the City of Mesa, several irrigation run-off ponds, Arizona Propane, Saddleback Communications, Cypress Landfill (old Tri-Cities Landfill/Country Club Landfill), Cypress golf course, RV Storage facility, JR's Convenience Store, United Metro quarry operations, Tri-Cities Landfill and SRP methane gas power plant, Granite Reef Underground Storage Project (GRUSP) recharge ponds, the Arizona Canal, South Canal, Salt

River Sand and Rock (Higley quarry operations with subleases to Vulcan, Hanson and United Metro) and the Granite Reef dam. Developed and/or utilized portions within and/or on the south side of the river include: four recharge ponds operated by the City of Mesa, the Mesa northwest wastewater treatment plant, Cemex quarry operations, various commercial businesses (including, but not limited to, Car Smart, Little Dealer, Little Prices, Superstition Springs Crushing, Pete's Diesel Repair, Heritage Trucking, Redburn Tire Company, Carports Etc., Allpride Marble and Granite, Artistic Ice Creations, and Alumi-Cover Inc.), residential properties, ADOT storage yard, Mesa storage yard, Mesa Police Department Firing Range, North Center Street Landfill, Tri-Cities Landfill, Vulcan demolition debris landfill, agricultural land, Lehi Cemetery, Highway 202 Construction and storage area, Chandler Ready Mix quarry, horse farm, southern canal, Salt River Sand and Rock (Higley operations – offices), primate research center, and the Granite Reef Dam.

The following is a description of the various areas of the Property:

Salt River Sand and Rock – Mesa Operations (Including Vulcan, Hanson, United Metro cement batch plants, maintenance areas, and wash down areas; Chandler Ready Mix operations; and, Salt River Sand and Rock Construction)

Liesch Southwest, Inc. toured this portion of the Property with Mr. Morris Paukgana of the SRPMIC on March 25, 2002. We were unaccompanied by a representative from SRSR during our walkover. However, prior to our walkover Mr. Vern Wilson and Mr. Wayne Hills provided general information regarding site operations.

The Salt River Sand and Rock (SRSR) – Mesa Operations is an SRPMIC enterprise business that operates a sand and gravel quarry. SRSR encompasses over 150 acres of developed land between approximately Dobson and Alma School Roads and McKellips Road and the Salt River. In addition, SRSR-Mesa Operations have active mining operations ongoing with two portions of the River, including just south of the developed portion and further east between Mesa Drive and Gilbert Road. Within the developed portion of SRSR, there are subleased areas that include Vulcan, Hanson, United and Mega-Mix, and Chandler Ready Mix (RMC) cement batch plants, maintenance areas, and cement truck wash down areas. SRSR also subleases space to Salt River Sand and Rock Construction. This company has several storage trailers and stores large sections of pipe used for highway road construction projects. A one million-gallon aboveground storage tank (AST) containing fly ash is also present on the property. Phoenix Cement owns this AST.

SRSR operational areas include an office complex, a testing lab, a maintenance shop, a lube shop, welding shop, equipment storage areas, a sand blasting area, a fueling area, aggregate crusher area, a cement dump area and water distribution pond. At the lube shop, Liesch observed numerous 55-

gallon drums and various sized ASTs containing new and used automotive chemicals. Significant staining was observed in this area and the containers appeared to be stored in a haphazard manner. The maintenance shop also included several areas where drums and small quantities of new and used automotive chemicals were stored. In addition, a wash rack was observed on the north side of the shop. The wash rack water reportedly drains to a containment basin and is periodically pumped out. Petroleum based staining was observed in the area of the wash rack. The sand blasting and equipment storage areas were at various locations at the site. These areas are situated on bare soil and sand blasting material and petroleum stained soils were observed in these areas.

The subleased areas operated by Vulcan, United Metro, Hanson and RMC each included a cement mixing area, a vehicle maintenance area (except Vulcan), and a truck wash down area. Each batch plant was similar in construction and each stored cement admixture chemicals in ASTs. There were approximately 8 to 12 ASTs of various sizes at each location. With the exception of the Hanson Plant each had secondary containment structures. The vehicle maintenance and wash down areas (Vulcan is located in a separate leased area) are relatively small and are for conducting minor repairs on the cement trucks. The wash down areas are for washing the exterior of the cement trucks prior to leaving the site. Typical observations in maintenance areas included one or more AST fuel tanks and various quantities of new and used automotive chemicals. At the wash down areas, Liesch observed high-pressure washers along with rinse wax, an acid based solution to remove cement, and a neutralizing chemical. Most of the ASTs and some of the smaller quantities of stored chemicals and waste were within containment structures. Some soil staining was observed in areas where secondary containment was not present. In the wash down areas, pooled water was observed and corrosion of the ground surface from the acid solution was visible in these areas.

To the southeast of the developed portions of the SRSR site, Liesch observed numerous areas of stockpiled soils, empty containers, construction debris, large pieces of metal, and other debris. Reportedly some of this material is the result of a washout from the upstream landfill. Mr. Paukgana also reports that there have been complaints of illegal dumped materials, possibly drums, in this area. Also in this area, Liesch observed an area where irrigation run-off water from the agricultural fields to the north drain to this area. Also along the southern portion of the site is a cement dump area where excess cement from the trucks is dumped. Pond water in this area appeared to be a blue-green color.

A previous underground storage tank (UST) had been located at this facility. The UST had leaked and remedial activities consisting of excavation were implemented. According to Mr. Paukgana remediation and closure was granted.

A complete Phase I ESA was prepared for this site titled "Phase I Environmental Site Assessment, Proposed TSA Multipurpose Facility SE of McKellips Road and Dobson Road, Maricopa County, Arizona". The report was prepared for SRPMIC by Geotechnical and Environmental Consultants, Inc. (GEC) and is dated March 8, 2002. According to the report, "a portion of the Site is being offered to the Tourism and Sports Authority (TSA) for development of a new multipurpose facility".

Vulcan Asphalt Batch Plant and Maintenance Yard – Mesa Operations

Liesch toured this portion of the Property with Mr. Morris Paukgana of the SRPMIC on March 22, 2002. Mr. Kevin Derossett and Mr. Eddie Centers of Vulcan accompanied us along with their environmental consultant.

The Vulcan asphalt batch plant and maintenance yard is located just east of the SRSR operations and encompasses approximately 40 acres. In the area of the asphalt batch plant, Liesch observed four large ASTs containing diesel fuel, asphalt oil and burner fuel. All ASTs were in secondary containment structures and appeared to be in good condition. Also in this area, several small ASTs, 55-gallon drums and various sized containers of lubricants used for the asphalt plant operations were observed. Some minor staining was associated with these storage containers. The asphalt batch plant is only a few years old. Reportedly, this batch plant was constructed following an explosion that occurred at the former batch plant that was just west of the current location. The explosion occurred in 1999. Mr. Paukgana has indicated that there were some petroleum-contaminated soils associated with the explosion that required clean up. Mr. Paukgana further noted that the clean up was completed to the satisfaction of the SRPMIC.

According to records provided by the SRPMIC, there were six USTs located at this facility. Two USTs were removed and leaks were reported. Mr. Paukgana indicated that all leak incidents with respect to these USTs have been resolved. There are currently four existing USTs on the site which are no longer in use but once were used to contain asphalt mixtures.

The maintenance area consisted of a shop, a 10,000-gallon AST fueling area, and a wash down area-space. Within and surrounding the shop there were numerous small quantities of automotive chemical/fluids and wastes. These containers appeared to be in good condition and within a secondary containment structure. The wash down chemicals, which are similar to those at the cement batch plants at SRSR, were stored on a platform without secondary containment. The storage location immediately adjoins the hard bank of the river. Leakage from the chemical containers was observed along the hard bank. In addition, corrosion from the acid was observed on the ground surface. In the areas surrounding the maintenance shop and wash down area, Liesch observed several areas where large quantities of debris were stored. Some of the debris appeared to be associated with former cement batch plant operations in this area. Other debris included concrete, old ASTs and/or USTs, scrap vehicles and other equipment.

City of Mesa Northwest Wastewater Treatment Plant and Recharge Ponds

Liesch toured this portion of the Property with Ms. Dawn Daw and Ms. Debra Frein of the SRPMIC on April 15, 2002. Mr. Gordon Haws, Mr. Collum Hunter and Ronnie Lopez of the City of Mesa accompanied us.

The Mesa northwest wastewater treatment plant is located on the south side of the River, south of Highway 202, and east of Highway 101. The site has existed since the 1940s and began reuse of wastewater activities in the 1960s. The eastern portion of the plant has been in existence since 1990. They are currently constructing a large expansion on the western portion of the site. The wastewater effluent from this treatment plant is reclaimed into nine recharge ponds. Four of the ponds are located on the south side of the south bank of the river and five are located north of the north bank of the river. The treatment plant also discharges to the river on occasion. They conduct discharge monitoring in accordance with their Aquifer Protection Permit.

Waste treatment chemicals stored on site include sodium hydroxide, sodium hypochlorite, hydrochloric acid, methanol, and ferrous chloride. A diesel tank for fueling is also present on site. All chemicals are stored in ASTs and are within secondary containment structures and no indications of leaks were observed. Small quantities of laboratory chemicals are also used and stored on the site. Liesch observed a 30,000-gallon gas recovery AST on the site. This tank is used to collect gas generated within the digesters and is used for energy.

CEMEX Operations (Including various associated operations)

Liesch observed the CEMEX operations from publicly accessible areas. CEMEX is located on the south side of the River, on either side of Alma School Road. CEMEX appears to be primarily within the City of Mesa. However, Mr. Bill Garrard with the SRPMIC – Economic Development Office indicated that they lease a small portion of the River from SRPMIC. The operational activities appeared similar to those observed at the SRSR operations. There appeared to be various associated businesses within the general area. In addition, Liesch observed signs with the name Johnson and Stewart. Johnson and Stewart appears to be the name of the company prior to CEMEX. Liesch assumes that similar environmental issues, such as those at SRSR exist for this facility.

Arizona Propane

Liesch toured this portion of the Property with Mr. Morris Paukgana of the SRPMIC on March 26, 2002. Mr. Martin Dawson, the owner of Arizona Propane, accompanied us.

Arizona Propane is located near the intersection of Alma School Road and McKellips Road. Arizona Propane is a commercial supplier of propane and has been located at this site for approximately 5 years. Prior to occupancy by Arizona Propane, this site was utilized by Forest Homes, a company that manufactured pre-fabricated cabins. Arizona Propane occupies approximately 2.5 acres of land and includes an office building, a shop, two canopy covered storage areas, a propane storage area, a fuel storage area, and a sand blasting and paint booth shed. Small quantities of automotive chemicals and wastes were present near the shop in containers ranging in size from less than one gallon to a 500 gallon AST. Some significant staining was observed in the area surrounding these containers. The floor drains within the shop area reportedly connected to a sump that is periodically pumped out. Liesch also observed a 6,000 and 10,000-gallon diesel ASTs. These ASTs were in secondary containment and no signs of leakage were observed.

To the south of the Arizona Propane site, Liesch observed a large stockpile of soil and debris that included cement and asphalt. According Mr. Dawson, this material was scrapped from the surface of the Arizona Propane site prior to their occupancy to remove the debris that had been left by the former tenant. Mr. Dawson also indicated that there were some materials they had disposed of off-site.

Prior to occupancy of the site by Arizona Propane, an Environmental Assessment (EA) was conducted at the site by SRPMIC. A draft copy of the EA report, dated March 1995, was available for review within the lease file at the SRPMIC Economic Development Office (EDO). According to this document "no evidence of distressed vegetation or accidental or intentional dumping of hazardous waste was observed". However, Liesch also reviewed several documents within the file that pre-dated the EA. These documents indicate that the previous tenant had left numerous materials including drums of solvent, barrels of waste and transmission oil and barrels of stains and varnish. These documents further indicated consideration of a clean-up fee/reimbursement to be written into the Arizona Propane lease. It is assumed that this material was disposed of by Arizona propane.

Saddleback Communications

Saddleback Communications is the telecommunication company for the SRPMIC. This facility is located near the intersection of Alma School and McKellips Road. Liesch observed this site from publicly accessible areas. No indications of chemical or hazardous waste storage were observed. In addition, Mr. Paukgana is not aware of any environmental concerns at this facility.

JR's Convenience Store

JR's Convenience Store is a gasoline station and convenience store that is owned by a SRMPIC community member. It is located at the northeast corner of the Country Club Drive and McDowell Road. According to SRMPIC database records, three 10,000-gallon USTs were installed at this site in 1987. No indications of releases have been reported for this site.

RV Storage Yard

A RV Storage Yard, owned by a SRPMIC community member, is located at the southwest corner of Country Club Drive and McDowell Road. Liesch observed this site from publicly accessible areas. No indications of chemical or hazardous waste storage were observed. In addition, Mr. Paukgana is not aware of any environmental concerns at this facility

Cypress Golf Course

The Cypress Golf Course is located at the west Country Club Drive and south of McDowell Road. Liesch observed this site from publicly accessible areas. Mr. Paukgana is not aware of any environmental concerns at this facility. This site is listed on the FirstSearch database as a spill site. The database indicates that a release of 60-gallons of an unknown material was released on April 10, 2001.

Various Commercial Businesses - South of River at Country Club Drive

Various commercial businesses were observed south of the River at Country Club Drive. These businesses were all observed from publicly accessible areas. To the north of Highway 202 and east of Country Club Drive, Liesch observed Superstition Springs Crushing, Pete's Diesel Repair, Heritage Trucking, Redburn Tire Co. and the Arizona Department of Transportation (ADOT) maintenance/storage yard. On the south side of Highway 202 and west of Country Club Drive, Liesch observed Car Smart, Little Dealer Little Prices, Carports Etc. All Pride Marble and Granite, Artistic Ice Creations, and Alumi-Cover Inc. Several of these facilities are listed on the FirstSearch Database as having USTs or LUSTs. In addition, Liesch observed the presence of several ASTs, maintenance areas, welding shops, and other operations that could be considered environmental issues.

City of Mesa Firing Range/Storage Yard/North Center Street Landfill

Liesch toured this portion of the Property with Ms. Dawn Daw and Ms. Debra Frein of the SRPMIC on April 15, 2002. Mr.Gordon Haws, Mr. Collum Hunter, and Christine Zielonka with the City of Mesa accompanied us.

The site is located on the south side of the River at North Center Street. The firing range has been in operation since the 1960's and initially consisted of one range, which is now utilized as a retention basin. There are currently 5 operational ranges that are used for training, two classroom buildings, an office, an armory, and a car impoundment lot. Chemicals used on site include small quantities of gun cleaning solutions and lubricating oils. They also maintain a parts washer that utilizes a citrus-based solvent. Some investigations have been conducted at the firing range with regard to the presence of lead dust. This has resulted in the asphalt pavement covering of the firing range surface to minimize dispersion of lead dust. At the current time, there is no lead recovery system in place at the firing range. However, the City of Mesa has indicated that a system will be installed in the near future to recover lead. The lead recovery system will include recovery of existing lead within the embankments.

To the south and of the firing range is a City of Mesa storage yard. The storage yard included empty trash dumpsters, vehicles, and a large pile of ground asphalt (roto-mill). Other items of note include: the side embankments of each firing range appear to be constructed of fill soil material (including a large percentage of waste debris) and the facility is on a septic system.

Prior to use of the site as firing range and storage yard, this area was utilized for disposal of waste by the City of Mesa. The City of Mesa has referred to this landfill as the North Center Street Landfill. This landfill should be distinguished from an adjoining landfill located immediately east of North Center Street that was operated by the SRPMIC. The landfill to the east of North Center Street has also been referred to as the North Center Street Landfill in some documents but typically is referred to as Tri-Cities Landfill (an extension of the Tri-Cities landfill located on the north side of the River). According to Ms. Christine Zielonka virtually no information exists for this landfill. Within the City of Mesa records there is reference to this landfill, as a part of an overall discussion of the landfills in the area, including a map showing the approximate extent of the waste boundaries. However, no investigations have been conducted specifically for this landfill. Based upon discussion with Ms. Christine Zielonka and Mr. Rich Allen and given the fact that the firing range has been in existence since the 1960s, this landfill may have pre-dated the Cypress and Tri-Cities landfills on the north side of the River.

SRPMIC Cypress Landfill (old Tri-Cities Landfill/old Country Club Landfill) and Tri-Cities Landfills

There are three landfills located within the SRPMIC near the Salt River. These landfills include the Cypress Landfill (also known as the old Tri-Cities Landfill and the old Country Club Landfill), the Tri-Cities Landfill on the north side of the River, and the Tri-Cities Landfill on the south side of the River (referred to as North Center Street landfill in some documents). The Cypress Landfill is located north of the River and south of the Cypress Golf Course between Alma School Road and Country Club Drive. This landfill operated from at least the early 1960s until approximately 1980. This landfill was never permitted nor have closure procedures been initiated. Investigations conducted at the site included a 1990 inspection by Ecology and Environment, Inc. on behalf of the US Environmental Protection Agency. This investigation was conducted in response to the discovery of the visible presence of 60 to 65 drums in various stages of decay. Fourteen of the drums were removed under emergency procedures through the ADEQ WQARF program. No additional investigations have been conducted since that time. According to the SRPMIC, they are currently in the process of submitting the site into US EPA Brownfield Pilot Project program. It is the intent of the SRPMIC to clean up the site for future development.

The Tri-Cities Landfill on the north side of the River operated from 1972 until 1993 and contains approximately 40 million cubic yards of waste. Tri-Cities Landfill on the south side of the River operated from approximately 1979 to 1980 and contains approximately 3 million cubic yards of waste. This landfill was used by the SRPMIC when flow in the River restricted access to the Tri-Cities Landfill on the north side of the River. The landfills accepted residential waste, commercial construction and demolition materials, landscaping waste, and some inert soil, asphalt, and concrete.

Information regarding these landfills was obtained from discussions with Mr. Rich Allen and a report titled "Final Closure Report and Post Closure Maintenance Plan, Tri-Cities Landfill and North Center Street Landfill" dated September 1994 and prepared by CH2M Hill. According to the information, both landfills are unlined but were closed with final grading, a barrier layer, and a vegetative layer. Historically, there had been concerns regarding methane generation and migration and groundwater contamination from the landfills. To control methane gas migration, each landfill has a methane gas collection system. The landfill on the south side of the River has a perimeter system with a flare. The landfill on the north side of the River has a collection system that is currently being directed to the SRP methane gas power generation system. Previously the gas was flared.

Groundwater monitoring has been on going with regard to these landfills since approximately 1980. The monitoring system includes five wells. The most recent round of sampling (February 2002) included sampling of two wells at SRSR. According to Mr. Rich Allen, volatile organic compounds (VOCs) in the groundwater had posed a concern several years ago. Since, the installation of the methane gas extraction systems, the groundwater quality has drastically improved. Therefore, suggesting that the groundwater contamination was the result of landfill gases rather than leaching. According to the summary of the February 2002 groundwater quality data, no Maximum Contaminant Levels (MCLs) for VOCs were exceeded.

A UST was formerly located at the maintenance shop at the Tri-Cities landfill on the north side of the River. This UST has been removed and no releases were reported.

SRP Methane Gas Power Plant

The SRP Methane Gas Power Plant has been in operation for approximately 6 months. The plant utilizes landfill gas extracted from the adjoining Tri-City landfill. Chemical and waste storage at the plant includes new oil stored in a 2,600 gallon AST and a 1,500 gallon waste oil AST. The oil is used for the generating engines. Liesch also observed the presence of an AST used to collect condensed water from the system. The ASTs were stored in secondary containment structures. No indications of leakage were observed.

Vulcan Demolition Debris Landfill

The Vulcan demolition debris landfill is located south of the River and south of the Tri-City landfill on the east side of North Center Street. This site is located in area that is within an unincorporated portion of Maricopa County. Liesch viewed this site from publicly accessible areas.

United Metro

Liesch toured this portion of the Property with Mr. Morris Paukgana of the SRPMIC on March 26, 2002. We met with Mr. Russ Hampton, Manager of United Metro. During the site visit, Mr. Joe Delarosa, an employee of United Metro, accompanied us.

United Metro operations are located on the southeast side of Highway 87 and approximately ¼ mile north of McDowell Road. United Metro's lease encompasses approximately 170 acres. The operational portion of United Metro's leased space includes a cement batch plant, an asphalt batch plant, office area, a maintenance shop with fueling area, a distribution pond, a chemical/waste chemical storage area, a welding area, a asphalt soap down area, a cement truck wash down area, and a cement/asphalt dump area. Operations at the facility began in approximately 1954 as Union Rock. United Metro took over operations in 1995.

At the maintenance shop area, Liesch observed numerous containers of new and used automotive chemicals including lubricants, new and used oil, new and used antifreeze, parts cleaner, and oil filters. These chemicals/waste were stored in various size containers. A 1,000-gallon waste oil tank along with 15 empty 55-gallon drums were observed to be in a secondary containment structures. The remaining containers were on bare ground. The fueling areas consisted of two ASTs (15,000 gallons and 2,000 gallons) that were within secondary containment. Prior to the ASTs, the facility utilized two underground storage tanks for fuel containment. These USTs were removed in 1991. Releases were detected from both USTs and remediation efforts were initiated. Mr. Paukgana indicated that clean up has been completed to the satisfaction of SRPMIC.

Both the cement truck wash down and asphalt soap down areas utilize release agent chemicals. In the cement truck wash down area, corrosion and staining from the acid solution was visible on the ground surface.

Liesch observed an area of chemical/waste storage adjoining the welding area. Reportedly this was the former maintenance shop area. In this area, there were over 50 55-gallon drums of used oils and solvents, numerous buckets of oils, and various other containers. Most of these containers were haphazardly stored within a secondary containment structure. Extensive staining was observed within and surrounding the containment structure.

Toward the southern and southeastern portion of the site (near the River), Liesch observed an area where excess asphalt and cement are dumped. This area is also utilized to dispose the fine sediments that are removed from the clarifier that handles the process water. The water is recycled back to the distribution pond. In some areas, the cement/asphalt has extended beyond the River embankment. Also in this general area, Liesch observed pond water. According to Mr. Delarosa, this water is from run-off from the cement truck wash down and cement dump areas.

The cement and asphalt batch plants both stored chemicals/materials in ASTs. Approximately eight ASTs containing admixtures were observed in a secondary containment structure at the cement batch plant area. Chemicals/materials at the asphalt batch plant included two ASTs with burner fuel and two ASTs containing hot oil. Small quantities of release agents and lubricant oils were also observed in the asphalt batch plant area.

Former Enviro-Systems

Enviro-Systems formerly occupied a site located just west of the United Metro Facility. Enviro-Systems is a pre-cast concrete operation that occupied the site from approximately 1978 until approximately 2001. Prior to their occupancy, the site was reportedly occupied by Defiance of

Arizona from approximately 1968 to 1978. No information regarding the operations performed by Defiance of Arizona was available. According to information provide by SRPMIC, Enviro-Systems utilized form oil as part of their operations. In 1999, four areas of stained soil were identified at the site. At the request of the SRPMIC, an investigation, followed by removal activities, was performed to address the stained areas. A report titled "Stained Soil Excavation Former Enviro-Systems Facility", dated October 21, 2001, prepared by Terrane Engineering Corporation, documents the activities performed. According to Mr. Paukgana clean up has been completed to the satisfaction of the SRPMIC.

Private and Allotted Residential Land

Some private and SRPMIC allotted land parcels were observed throughout the Property. The majority of the SRPMIC allotted land was located south of Thomas Road and east of Mesa Drive. Several trailer parks were observed near Country Club Drive and the River. A horse farm is present on the south side of the River at approximately the Val Vista Road alignment. Liesch assumes minimal environmental issues would exist for these properties.

Lehi Cemetery

The Lehi Cemetery is located on the south side of the River, north of Thomas Road and east of Stapley Drive. The cemetery is used by the SRPMIC. According to Mr. Bob Ronzo with the SRPMIC Public Works Department, this is a tribal cemetery and no chemicals are utilized in the burial process. There is a small shed on site, which is utilized for the storage of lawn equipment.

Granite Reef Underground Storage Tank Project

The Granite Reef Underground Storage Project (GRUSP) is headed by SRP and includes the Cities of Mesa, Scottsdale, Tempe and Gilbert as participants. The SRP leases land from the SRPMIC to implement the project. The project consists of banking water originating from the Arizona, South, and Central Arizona Project (CAP) Canals for future utilization. The water is recharged into a series of ponds within the River that extend from Gilbert Road east to approximately the Val Vista Road alignment. The project was originated in approximately 1994 with a total of 5 ponds. The two ponds located furthest east were constructed approximately 1.5 years ago. No chemicals are utilized on the water, and vegetation within the ponds is removed by hand.

According to information provided by Mr. Rich Allen, localized groundwater levels have increased drastically since the project was initiated. In addition to monitoring conducted by GRUSP, the

SRPMIC landfill personnel continue to monitor water levels to ensure that the proper separation distance between the base of the operating Salt River Landfill and the water table is maintained.

Chandler Ready Mix Operations

Liesch observed the Chandler Ready Mix Operation located south of the River and on the east side of Gilbert Road from publicly accessible areas. It is Liesch's understanding that these operations are within the City of Mesa. The operational activities appeared similar to those observed at the SRSR operations. Liesch assumes that similar environmental issues exist.

Talley Defense Systems

Liesch observed the northern most portion of the Talley Defense Systems (Talley) property from publicly accessible areas. Talley is located south of the SRSR-Higley operations. Talley is an industrial complex designed for the development of testing and manufacturing of propellant-based products. Talley is listed as a RCRA Generator and is noted on the RCRA Corrective Action database. Based upon the fact that this facility is listed as a RCRA Correction Action site is an indicator that contamination has occurred. During Liesch's inspection of the SRSR-Higley operations, the explosive testing which occurs at Talley Defense Systems was capable of being heard and vibrations experienced.

Salt River Sand and Rock – Higley Operations (Including Vulcan, Hanson, United cement batch plants, maintenance areas, and wash down areas; Vulcan asphalt batch; and, JD Excavating)

Liesch toured this portion of the Property with Mr. Morris Paukgana of the SRPMIC on March 25, 2002. We were accompanied Mr. Bob Mackey, Manager for SRSR-Higley.

The Salt River Sand and Rock (SRSR) – Mesa Operations is an SRPMIC enterprise business that operates a sand and gravel quarry. SRSR encompasses over 160 acres of land within and on the south side of the River between approximately the Val Vista Road and Higley Road alignments. Operations in this area began in approximately 1985. Within the developed portion of SRSR, there are subleased areas that include Vulcan, Hanson, and United Metro cement batch plants, Vulcan asphalt batch plant, and J&D Excavating (equipment and dynamite storage). Other areas within the developed portion of the site include maintenance areas, fueling areas, distribution pond, and cement truck wash down areas.

J & D Excavating maintains an equipment yard, a dynamite storage unit, a separate unit for the dynamite caps, and a semi-trailer storage unit with fertilizer. No indications of leakage or soil staining were observed in this area.

Hanson, United Metro, and Vulcan each included a cement mixing area, a vehicle maintenance and fueling area, and a truck wash down area. Each batch plant was similar in construction and each stored cement add-mixture chemicals in ASTs. There were approximately 8 to 12 ASTs of various sizes at each location. The vehicle maintenance and wash down areas are relatively small and are for conducting minor repairs on the cement trucks. The wash down areas are for washing the exterior of the cement trucks prior to leaving the site. Typical observations in maintenance areas included one or more AST fuel tanks and various quantities of new and used automotive chemicals. At the wash down areas, Liesch observed high-pressure washers along with rinse wax, an acid based solution to remove cement, and a neutralizing chemical. Most of the ASTs and some of the smaller quantities of stored chemical and waste were within containment structures. Some soil staining was observed in areas where secondary containment was not present and/or within the containment structures. In the wash down areas, pooled water was observed and corrosion of the ground surface from the acid solution was visible in these areas. The wash down water from the United Metro wash rack is discharged to a cesspool.

The Vulcan asphalt batch plant included four ASTs with burner fuel and/or diesel, and a 20,000-gallon asphalt storage tank. All ASTs were within secondary containment structures.

The SRSR-Higley maintenance and fueling area included two diesel ASTs, one gasoline AST, and approximately eight new and used oil and lubricant containers. All of these containers were within secondary containment structures.

Primate Research Center

Liesch visited the primate research center on March 21, 2002 and was accompanied by Ms. Jo Fritz and Mr. Jim Murphy. Ms. Fritz is the originator of this federally funded center. The primate research center is located on the south side of the River between the Granite Reef Dam and the SRSR-Higley operations. The primate research center has been at this location for approximately 25 years and has been constructed using the framework of a former hydro-generating station that predated the construction of the dams upstream on the Salt River. The hydro-generating station dates back to the early 1900's and has historical significance.

The center consists of several modular offices, a building with cages for the primates, a maintenance shed, and several mobile structures for residences. The center conducts behavioral research on chimps and apes.

Very few chemicals are used and/or stored at the site. Chemicals observed include small quantities of cleaning supplies, landscape equipment fuels and lubricants, and several containers of compressed gases.

Ms. Fritz has indicated that all biowaste is cleaned up daily and transported to a landfill for disposal.

Granite Reef Dam, Central Arizona Project (CAP), Arizona and South (formerly recognized as Southern) Canals

The Granite Reef Dam is the northeastern boundary of the Property area. The CAP, Arizona and South canals are within in the Property area near the Granite Reef Dam. The US Government owns the canals and dam. They are operated and maintained by SRP. The Granite Reef Dam is a diversion dam located down stream of the confluence between the Salt and Verde Rivers. Water from the dam is diverted in to the Arizona and South canal for irrigation and municipal purposes. Some of the water from canals, including the CAP canal, is diverted to the GRUSP.

According to Mr. Rick Anduze of the SRP, the dam and canals are all controlled remotely from a central location. Mr. Anduze further indicated that he is not aware of the use of any chemicals associated with the dam, canals and/or GRUSP project. He indicated that there might be small quantities of lubricants or oils associated with the dam.

3.3 Current Ownership

The majority of the portion of the River lies within boundaries of the SRPMIC. Within the Community there is leased land and private allotted land (owned by community members). Other portions of the River and surrounding areas include property that is owned by the State of Arizona, City of Mesa and private individuals and businesses within the City of Mesa and unincorporated portions of Maricopa County.

3.4 Prior Use

The use of the Property has not varied significantly since the time of development. Initially, the River and surrounding portions were undeveloped. Over time, the quarry operations and associated operations have developed. In addition, increased commercial businesses have been established on the Mesa side of the River primarily near Country Club Drive. Landfill operations appear to have been an ongoing activity along the River since at least the early 1960s. The various locations of the landfills have changed.

3.5 Adjacent Properties

Due to the extensive Property area, the adjacent properties have not been identified. Liesch has attempted to discuss all sites within a ¼ mile of the River that may have some impact on the potential restoration project.

4.0 PROPERTY HISTORY

4.1 Aerial Photograph Review

A 1936 aerial photograph was reviewed at the City of Phoenix Historical Records Department. Aerial photographs were also reviewed at the Landiscor Aerial Photography in Phoenix in approximate three-year increments. Negative N-19 covered the Salt River beginning at Loop 101 ending at Mesa Drive from the years 1966 through 2002. Negative M-20 covered the Salt River beginning at Mesa Drive ending at Val Vista Drive from the years 1964 through 2002. Negative M-21 covered the Salt River beginning at Val Vista Drive ending at Power Road from the years 1962 through 2002. Liesch also reviewed aerial photographs made available by the SRPMIC for the years 1997, 2000, and 2002. Copies of Negative N-19 for the years 1966, 1971, 1981 and 1991; Negative M-20 for the year 1964; and M-21 for the year 1962 are included in **Appendix C**. The information obtained during the review is summarized as follows:

1930's

In the 1936 photograph, no structures or man-made objects were observed in or adjacent to the Salt River.

1960's

The Salt River appeared relatively unchanged from Mesa Drive to Power Road. The United Metro Operations were visible in the early 1960's. There appeared to be some commercial development south of the River near Alma School Road and Country Club Drive. The Cypress golf course is also present. The United Metro facility occupied a much smaller area that it currently does. A quarry is present to the west of the current location of the Highway 101.

1970's

A quarry appeared east of Gilbert Road (RMC location). A structure was present at the approximate location of the Arizona Propane propane facilities in the early 1970's. The primate research center appeared in the mid 1970's. What appears to be landfill activity was observed in the area of the Cypress landfill. McKellips Road appears in the early 1970's.

1980's

The Lehi Cemetery and the SRSR Mesa Operations, appear in the early 1980's. In addition, quarry operations on the south side of the River near Alma School are ongoing. In the mid to late 80's operations at the SRSR-Higley Plant are apparent. The United Metro operations appear to be expanded in the mid 1980's. The Tri-Cities landfill is apparent in the 1980's. There is increased commercial development south of the River near Country Club Drive.

1990's

The Mesa wastewater recharge ponds located south of the south bank of the River appeared in the early 1990's. The GRUSP groundwater recharge ponds appeared in the mid 1990's. Operations appear to be expanded at SRSR-Mesa in the 1990s.

2000-2002

The hard bank along the north and south sides of the River was present in 2000. The SRP Methane Gas Power Plant appeared in 2002.

4.2 Topographic Maps, City Directories, And Sanborn Maps

Liesch reviewed the USGS 7.5-minute series topographic maps "Tempe, Arizona", dated 1952/1982, "Mesa, Arizona", dated 1952/1982, "Buckhorn, Arizona", dated 1956/1982, and "Granite Reef", dated 1964/1974. Topographical maps may identify structures, roads and general use of a Property for the year determined by the date of the map. These maps were used extensively in conjunction with the 2002 aerial photographs to verify locations of the developed portions along the Property area.

4.3 Interviews

The following individuals were interviewed in compiling the information contained within this report. Please refer to the individual site descriptions for interview details.

CONTACT	PROGRAM	NUMBER	INFORMATION
Ms. Dawn Daw	SRPMIC – CES	480-850-8950	General property information
Mr. Morris Paukgana	SRPMIC – CES	480-850-8062	General, UST, and site walk-over information
Mr. Abel Ramirez	SRPMIC – CES	480-850-8500	General, landfills
Mr. John Wharam	SRPMIC – ECS	480-850-7284	GRUSP
Mr. Kimball Siegfried	SRPMIC – ECS	480-850-7228	2002 aerial photographs
Mr. Bill Garrard	SRPMIC-EDO	480-850-8526	Land lease information
Mr. Richard Allen	SRPMIC–Landfill Serv.	480-941-3427	Landfill information
Mr. Bob Ronzo	SRPMIC – Public Works	480-850-8260	Lehi Cemetery
Mr. Eddie Centers	Vulcan – Mesa	480-947-8135	Vulcan-Mesa
Mr. Kevin Derrossett	Vulcan - Mesa	480-947-8135	Vulcan-Mesa
Mr. Wayne Hills	SRSR-Mesa	480-990-1987	General information SRSR
Mr. Vern Wilson	SRSR-Mesa	480-990-1987	General information SRSR
Mr. Bob Mackey	SRSR-Higley	480-981-5895	SRSR-Higley
Mr. Russ Hampton	United Metro	480-990-0847	general information
Mr. Joe Delarosa	United Metro	480-990-0847	operational information
Ms. Jo Fritz	Primate Research Center	480-832-3780	Primate center operations
Mr. Martin Dawson	Arizona Propane	480-990-2245	Arizona Propane
Mr. Gordon Haws	Mesa, Engineering Design	480-644-3380	General Mesa information, Mesa WWTP
Ms. Christine Zielonka	Mesa, Environmental Programs	480-644-3833	Landfill, Firing Range, Storage Yard
Mr. Richard Anduze	Salt River Project	480-236-2804	Dam, GRUSP, Central canals

5.0 ASSESSMENT INFORMATION

5.1 Regulatory File Search

A computerized file search organization, First Search, conducted an evaluation of regulatory databases to determine if identifiable environmental concerns exist on or within the ASTM-defined radii from the Property. For the purposes of this project a linear search was completed. The radii search extended from a line through the approximate center of the River. The FirstSearch report, dated April 26, 2002, is included as **Appendix D.** The database search included the following components:

The EDR response consisted of an examination of the following U.S. Environmental Protection Agency (EPA) and ADEQ databases, as follows:

1)	US EPA	National Priorities List (NPL) – 1 mile;
2)	US EPA	RCRA Corrective Actions and associated TSD (CORRACTS, TSD) – 1 mile;
3)	State	State Equivalent Priority List (SPL, or WQARF) 1 mile;
4)	State	State Equivalent CERCLIS List (SCL, or ACIDS) – 1 mile;
5)	US EPA	Sites currently or formerly under review by US EPA (CERCLIS) - ½ mile;
6)	US EPA	RCRA Permitted Treatment, Storage and Disposal Facilities (TSD) - ½ mile;
7)	State	Leaking Underground Storage Tanks (LUST) – ½ mile;
8)	State	Permitted Solid Waste Landfills, Incinerators or Transfer Stations (SWLF) – ½ mile;
9)	US EPA	RCRA Violations / Enforcement Actions - 1 mile;
10)	US EPA	Toxic Release Inventory Database (TRIS) - 1 mile;
11)	State	Registered Underground or Aboveground Storage Tanks (REG UST/AST) – ¼ mile;
12)	US EPA	Emergency Response Notification System of Spills (ERNS) – ¼ mile;
13)	US EPA	RCRA Registered Small or Large Quantity Generators of Hazardous Waste (RCRA GEN) – ¼ mile;
14)	State	Hazardous Materials Incident Logbook (SPILLS) – ¼ mile;
15)	State	Registered Dry Wells (Permits) – ¼ mile.

A review of the database indicates that the following sites were identified within the Property area. These sites have been determined to be within the Property area, based upon address or general location provided and or based upon observation of the facility during the site-walk over.

FirstSearch Database Information		
Data Base Type	Site Name & Address (*unknown if within Property boundaries)	General Information
NPL	Indian Bend Wash Area McDowell Road & Hayden, Scottsdale, AZ	The Indian Bend Wash encompasses 12 square miles in parts of Scottsdale, Tempe and Phoenix, AZ. Groundwater is contaminated with TCE and other chlorinated solvents. The EPA is developing a Remedial Action Plan outlining the investigations needed to determine the full extent of cleanup required at the site.
CERCLIS	North Center Street Landfill End of Center Street at River	Status is listed as no further remedial action planned
CERCLIS	Mesa Area Groundwater Contamination T1N, R5E	Status is listed as no further remedial action planned
CERCLIS	Tri-City Landfill Salt River Indian Reservation	Status is listed as no further remedial action planned
SWL	City of Mesa Northeast Corner of Center St Mesa, AZ	Closed
SWL	Salt River/Pima Tribe/Tri-City 1 Mile North of McDowell Gilbert, AZ	Closed
UST/LUST	ADOT Mesa Maintenance 2409 North Country Club Drive Mesa, AZ	Four removed USTs and two current USTs One LUST incident listed as Undefined or unknown soil contamination One LUST incident listed as Free product on Groundwater and/or SW
UST/LUST	Bingo Hall/Ray Station 2435 North Country Club Drive Mesa, AZ	Three removed USTs One LUST incident listed as Closed soil levels meet RBCA Tier 1
UST/LUST	DPS/AZ Dept of Public Safety 2409 North Country Club Drive Mesa, AZ	One removed UST One LUST incident listed as Closed soil levels meet RBCA Tier 1
UST/LUST	Tevizo Hay Co. 1747 North Alma School Mesa, Arizona	Three removed USTs One LUST soil contamination undefined
LUST	Karl Watkins 2116 N. Country Club Mesa, Arizona	One LUST incident listed as Closed soil levels meet RBCA Tier 1
LUST	Contreras Contractors 2110 North Country Club Mesa, Arizona	Seven LUST incidents all listed as Closed soil levels meet RBCA Tier 1
LUST	Sunward Materials/BCW 1564 North Alma School Mesa, Arizona	One LUST incident listed as Closed soil levels meet RBCA Tier 1
LUST	Cashway Concrete & Materials 650 W. McKellips Road Mesa, Arizona	One LUST incident listed as Closed soil levels meet RBCA Tier 1

FirstSearch Database Information		
Data Base Type	Site Name & Address (*unknown if within Property boundaries)	General Information
LUST	Valley Wide Contracting 620 W. McKellips Mesa, Arizona	One LUST incident listed as Closed soil levels meet RBCA Tier 1
LUST	Chandler Ready Mix 3250 E. Lehi Road Mesa, Arizona	Six LUST incidents all listed as Closed soil levels meet RBCA Tier 1
UST	Sun Valley Crushing Co 2343 North Country Club Drive Mesa, AZ	One removed UST
UST	Superstition Crushing 2343 North Country Club Drive Mesa, AZ	One inactive UST
UST	W R Skousen Contractor Inc 2333 North Country Club Drive Mesa, AZ	One removed UST
RCRACOR	Talley Defense Systems, Inc. 4111 & 4301 N. Higley Road Mesa, Arizona	RCRA Corrective Action ongoing associate with land disposal activities and storage and treatment. No reference to media contaminated. Numerous violations that have been resolved are listed.
RCRAGN	Salt River Indian Community 11134 Beeline Highway Scottsdale, AZ	Generates less than 100 KG/Month of hazardous waste
RCRAGN	Calmat Companies 1900 Longmore Road Mesa, AZ	Generates less than 100 KG/Month of hazardous waste
RCRANLR	Valley Oil Services 1747 N. Alma School Road, Ste. B Mesa, Arizona	No longer regulated
RCRANLR	Salt River Indian Community 11134 Beeline Highway Scottsdale, AZ	No longer regulated
RCRANLR	StatewideEnvironmental Svcs. 1747 N. Alma School Road Mesa, Arizona	No longer regulated
RCRANLR	Calmat Companies 1900 Longmore Road Mesa, Arizona	No longer regulated
SPILLS	City of Mesa Salt River & Alma School Mesa, AZ	Spill date: July 26, 1990. An unknown material was released form trucks
SPILLS	*Moreno Trucking Salt River Indian Reservation Scottsdale, AZ	Spill date: July 10, 1991. 30-gallon of unknown substance was released from bottles
SPILLS	SRPMIC Tribal Golf Course Scottsdale, AZ	Spill date: April 10, 2001. a threat of 60-gallon of unknown substance from drums

FirstSearch Database Information		
Data Base Type	Site Name & Address (*unknown if within Property boundaries)	General Information
SPILLS	Unknown/SRIC Country Club & McDowell Rd Scottsdale, AZ	Spill date: July 15, 1996. a threat of 50 to 60-drums of unknown substance from drums
SPILLS	Talley Defense 1 mile N of 4111 N Higley Mesa, AZ	Spill date: June 5, 1992. a fire 1000 pounds of unknown substance

Liesch has also obtained a copy of the US EPA database for UST and LUST sites within the Property. Mr. Morris Paukgana provided this database to Liesch. Database print outs received from Mr. Paukgana are included in **Appendix E**. The following is a summary of the information within the database. The database information indicates that there are several open LUST sites. However, according to Mr. Paukgana there are no current open LUST sites within the Property. There are four existing USTs within the Property. These are located at the Vulcan asphalt batch plant.

US EPA UST/LUST DATABASE	
Site Name	General Information & Notes
Industrial Asphalt Inc-CalMat (Vulcan-Mesa) [1]	No site closure or remediation date listed
Salt River CalMat – CalMat of Arizona (Vulcan-Mesa) [1]	1993 remediation completed
Salt River Sand & Gravel (SRSR-Mesa)	1992 Site closure letter sent
Union Rock & Materials Corp (United Metro) [2]	There was no site closure or remediation date
JR's Convenience Store	No releases reported at this site
Industrial Asphalt (Vulcan – Mesa) [1]	No releases reported at this site
Tri City Landfill [3]	No releases reported at this site

1-Based upon discussions with Mr. Mark Paukgana, there is some duplication in this database. These three sites are the same site. There were six USTs on site. To have been removed and four remain on-site. Further Mr. Paukgana indicated that the two removed USTs have been granted closure.
2-According to Mr. Morris Paukgana clean up is complete for this site.
3-This UST has been removed and no releases have been reported.

6.0 PHYSICAL SETTING

6.1 Topography

Based on the USGS 7.5-minute series topographic maps "Tempe, Arizona" dated 1952 photorevised 1982, "Mesa, Arizona" dated 1952 photorevised 1982, "Buckhorn, Arizona" dated 1956 photorevised 1982, "Granite Reef, Arizona" dated 1964 photorevised 1974 the Property is approximately between 1,200 and 1,300 feet above mean sea level. Regional topography of the Property is generally slopes gradually to the west to southwest.

<u>1952 & 1956</u>
Unimproved roads were depicted throughout the project area.

<u>1964 &1974</u>
Granite Reef Dam was depicted at the east boundary of the project area. Unimproved roads were depicted throughout the project area. Gauging Stations were depicted east and west of the Granite Reef Dam. The generally northeast/southwest aligned South Canal was depicted beginning at the Granite Reef Dam. The generally east/west aligned Arizona Canal was depicted beginning at the Granite Reef Dam. Talley Defense Systems is present in the 1974 edition.

<u>1982</u>
Generally northeast/southwest aligned high-tension power transmission lines were depicted from the Highway101 (south of McKellips) and continuing northeast just south of the Highway 87. Quarry operations pits were depicted in the River from the approximate alignment of Longmore Road to the approximate alignment of Country Club Drive. An intricate surface area indicates the Tri-Cities landfill. The RMC quarry operations (at Gilbert Road) are depicted by an intricate surface area. Quarry operations were noted at the River between the Greenfield and Higley Road alignments.

6.2 Soils

Based on a soil survey of Eastern Maricopa and Northern Pinal County by the Soil Conservation Service (SCS), soils within the Salt River bed primarily consist of Alluvial Land. Alluvial land is nearly level land that generally has a hummock appearance. Alluvium consists of stratified, recently deposited stream sediment in the channels of the Salt River. Texture of the surface layer ranges from gravelly sand or very gravely sand to fine sandy loam. The material beneath the surface layer is very gravelly sand to very fine sandy loam and loam. Permeability ranges from very rapid to moderate, runoff is slow, and soil blowing is generally a hazard.

6.3 Regional Geology

The Property is located in the central portion of the Phoenix Active Management Area (Laney and Hahn, 1986). The Salt River Valley is a broad alluvial basin within the Basin and Range Physiographic Province in south central Arizona (Wilson, 1962). The basin is almost completely surrounded by mountains composed primarily of granitic, metamorphic and volcanic rocks. The valley floor is underlain by unconsolidated to semi-consolidated basin-fill sediments that are more than 10,000 feet thick in the central part of the basin. Depth to bedrock in the project area varies extensively.

6.4 Surface and Groundwater Hydrology

The principal drainage through the Phoenix Basin is the Salt River, an ephemeral stream that normally flows only in response to reservoir releases or significant precipitation events. The Property is located within the Salt River. Other drainage features in the Property area include the South, Arizona and CAP canals near the eastern end of the Property. There were several irrigation run-off collections ponds as wells as distribution ponds for the mining operations.

According to the Arizona Department of Water Resources (ADWR) well registration database, dated July 2001, depth to groundwater in the project area varies from around 10 to 440 feet below ground surface. Local drainage features that may alter or influence the groundwater depth and flow direction include: wastewater treatment recharge ponds, GRUSP, quarry operation distribution ponds, water well pumping, and canals.

7.0 WALK-OVER SURVEY

On March 20, 2002 two Liesch teams of two individuals conducted a walkover of the Riverbed within the Property. Access to the Riverbed was from roadways along the hard bank, quarry operation haul roads, canals, and public roadways. The purpose of this walkover was to assess conditions within the Riverbed and to obtain a general understanding of the sites located on the banks of the river. During March 22 through March 27, 2002, Liesch representative, Ms. Julianne Hamilton conducted individual site visits of businesses and operations within the SRPMIC. On April 15, 2002, Ms. Hamilton conducted a site visit of the Mesa northwest wastewater treatment plant, firing range and North Center Street Landfill. During April 15 through April 19, 2002, Liesch conducted an inspection of the sites located along the south side of the River from publicly accessible areas. Photographs taken during the walkover are included in **Appendix F.**

7.1 Vegetation and Stained Soil

Vegetation types varied throughout the Property and included natural desert vegetation and landscaped vegetation. Also within the River, Liesch observed wetland vegetation. In many areas of the Property, particularly the quarry operations, there was no vegetation, rather bare soil.

Stained soil was observed throughout the Property. Most stained areas appeared to be associated with automotive chemicals and wastes. Staining and corrosion was observed associated with the cement truck wash down areas. Staining was also observed in the areas where vehicle storage and repair were occurring on bare soil. Section 3.2 provides additional detail with regards to stained areas at individual sites.

7.2 Chemicals and Raw Materials

Numerous chemicals and raw materials were stored throughout the Property. Chemicals included petroleum products for fueling, automotive/equipment chemicals such as oils, lubricants, degreasers, antifreeze, blended fuels and oils for the asphalt batch plants, various varieties of add-mixture chemicals for the cement batch plants, acid and neutralizing solutions for cement truck wash down, release agency for asphalt truck wash down, wastewater treatment chemicals, dynamite, fertilizer, cement color dye, fly ash, and propane. Some of these chemicals were stored within secondary containment structures while others were not. In several areas, leakage and staining was observed. Raw material storage included aggregate rock, asphalt, cement and roto-mill. Additional information regarding chemical and raw material storage for individual sites is included in Section 3.2

7.3 Polychlorinated Biphenyls (PCBs)

Numerous electrical transformers were observed on the Property. In addition, potential PCB-containing equipment was observed on the Property. Liesch was not provided with any information regarding testing of the transformers and equipment for PCBs.

7.4 Asbestos-Containing Materials (ACMs)

Based upon the age of some of the structures on the property it is possible that asbestos-containing materials are present on the Property. Liesch did not conduct an asbestos survey as part of this scope of work.

7.5 Hazardous Wastes and Hazardous Substances

Several sites within the Property area were listed as RCRA generators (some no longer regulated) and Talley Defense Systems site is listed as RCRA Corrective action site which indicates that some degree of corrective action was required for the site with respect to a release of hazardous wastes/substances.

7.6 Landfills, Dumps, Debris Piles

Liesch observed the presence of four landfills within the Property included Cypress Landfill; North Center Street Landfill, and the Tri-Cities Landfills (north and south sides of the River). A discussion of each landfill is provided in Section 3.2.

Liesch observed numerous areas of stockpiles of soils, debris piles, and dumped debris throughout the Property. The majority of the material was along boundaries of the River and canals. However, some debris was observed within the Salt Riverbed. The debris consisted of soils, concrete, old tanks, asphalt, household debris, and vegetative wastes. Of particular concern is the large debris piles located at the southeast portion of the SRSR-Mesa. This debris reportedly contains waste resulting from past washouts of the upstream landfills during periods when the River flowed and prior to construction of the hard banks. In addition, Mr. Paukgana reports that there have also been indications of illegal dumping, including drums, have occurred in this area.

7.7 Pits, Wells, Sumps, Drywells, Catch Basins

Liesch observed water wells throughout the Property including wells used for quarry operations, domestic supplies, and SRP wells. Numerous pits/sumps/catch basins were observed throughout the Property including a wash racks, bay drain sumps, cesspool for cement truck wash down water, and floor drain sumps. No drywells were observed on the Property.

At SRSR-Mesa, SRSR-Higley, United Metro, CEMEX, and RMC on Gilbert Road water distribution ponds were observed. Reportedly the water within these ponds is supplied by well water and/or natural groundwater infiltration. Some water within SRSR's pond is recirculated after removal of fine sediment.

Liesch also observed several areas within the River where irrigation run-off water and storm water is collected.

7.8 On-Site Storage Tanks (Aboveground and Underground)

Based upon information provided by Mr. Morris Paukgana there are four USTs associated with the Vulcan asphalt plant. In addition, there are three USTs listed for JR's Convenience Store. The ADOT storage yard and numerous other business near the River at Country Club Drive, Alma School Road, and McKellips Road are listed on the database has having registered USTs. Numerous USTs have been removed and have been listed a LUST incidents. All LUST incidents within SRPMIC have been resolved and are closed. It also appears that the majority of the LUST incidents on the south side of the River within the City of Mesa have also received a "case closed" status.

Numerous ASTs were observed throughout the site including ASTs for fuel, new and used oil, water storage, asphalt storage, add mixture chemicals, blended fuels for asphalt productions, cement and asphalt release agents, fly ash, propane, digester gas, and waste water treatment chemicals. The majority of the ASTs were within secondary containment structures. In some areas, staining was observed within the containment or on the ground surface.

8.0 PREVIOUS ENVIRONMENTAL REPORTS

In preparation of this report, Liesch reviewed numerous documents that were provided by the SRPMIC. Some of these documents are included in Appendix B. Other documents are referenced in Section 3.2 as they related to specific sites.

9.0 QUALIFICATIONS

Qualifications of this author are attached in **Appendix G**.

10.0 CONCLUSIONS

Liesch has focused on identifying general environmental issues that may be of concern specifically to the design and planning of the proposed Salt River Restoration project, which is focused primarily along the Salt River bed and banks.- Access to private properties within the City of Mesa on the south side of the River and to the Cypress golf course, RV storage facility, JR's Convenience Store, Saddleback Communications, and private allotted land within SRPMIC was not provided at the time of Liesch's site visit. Therefore, only the portions of these areas visible from public right-of-ways were observed. More detailed assessment of individual areas within the Property may be necessary depending upon the specific proposed restoration. This site assessment does not include a comprehensive compliance analysis regarding local, state or federal environmental laws, rules or regulations.

Based on Liesch's assessment, the following environmental issues were identified for the Property.

Salt River Sand and Rock

- Maintenance shop – wash rack, chemical/waste storage
- Lube shop – chemical/waste storage and staining
- Sand blasting/paint area – bare ground
- Vehicle repair and storage area – bare ground
- Large quantities of debris (potential disposal issues)
- Cement dump area
- Former leaking UST (historic)

Chandler Ready Mix at SRSR

- Maintenance shop – storage, staining
- Wash down area – corrosion, staining

Hanson/United Metro/Vulcan Cement Batch Plants at SRSR Mesa and Higley

- Wash down areas – staining, corrosion
- Vehicle maintenance – staining, storage
- Chemical storage – leakage, some without secondary containment

Vulcan Maintenance Yard and Asphalt Batch Plant

- Wash down chemical storage area - staining
- Former USTs – (historic)
- Four existing USTs
- 1999 Explosion (historic)
- Debris/parts storage area

CEMEX Operations (and associated operations)

- Assumed issues same as other quarries

Arizona Propane

- Former site operations (Forest Homes)
- Stockpile of debris/waste
- Maintenance sump

Various Commercial Businesses

- Chemical/waste storage
- References to spills/releases in the database
- USTs/ASTs

United Metro

- Chemical storage area (numerous drums and staining)
- Cement batch plant chemical storage
- Cement/asphalt dump area – extending over hard bank
- Wash down area – corrosion, staining, pond water
- Former USTs (historic)

Enviro-Systems

- Soil contamination clean-up (historic)
- Former site operations (unknown)

Tri-City Landfill (north and south sides)

- Groundwater contamination
- Methane migration

North Center Street Landfill

- No information available

Cypress Landfill

- Known contamination currently requesting brownfield pilot clean-up funding

Mesa Firing Range

- Lead contamination
- Berms constructed of debris/soil mixture

Vulcan Demolition Debris Landfill

- Unknown

Chandler Ready Mix – at Gilbert Road

- Assumed issues same as other quarries

Salt River Sand and Rock – Higley Operations

- Wash down areas/sump/cesspool
- Chemical storage – some staining

Talley Defense Systems

- Existing contamination
- Explosive testing

General Issues – Property Wide

- Irrigation run-off water
- Debris/illegal dump areas
- Wastewater recharge ponds
- Septic systems
- Water wells

11.0 REFERENCES

CH2M Hill, 1994, Final closure Report and Post Closure Maintenance Plan, Tri-Cities Landfill and North Center Street Landfill, September.

Geotechnical and Environmental Consultants, Inc., 2002, Phase I Environmental Site Assessment Proposed TSA Multipurpose Facility, SE of McKellips Road and Dobson Road, Maricopa County, Arizona, March.

Laney, R.L. & Hahn, M.E., 1986, Hydrogeology of the Eastern Part of the Salt River Valley Area, Maricopa and Pinal Counties, Arizona, U.S. Geological Survey Water-Resources Investigations Report 86-4147.

Soil Conservation Service (SCS), 1974, Eastern Maricopa and Northern Pinal Counties Area by the Soil Conservation Service, United States Department of Agriculture, November.

Terrane Engineering Corporation, 2001, Stained Soil Excavation, Former Environ-Systems Facility, Beeline Highway, ¼ Mile North of McDowell Road, SRPMIC, Arizona for Enviro-Systems Corporation, October.

U.S. Geological Survey (USGS), 1952, Tempe, Arizona 7.5-minute Series Topographic Map, photorevised 1982.

U.S. Geological Survey (USGS), 1956, Buckhorn, Arizona 7.5-minute Series Topographic Map, photorevised 1982

U.S. Geological Survey (USGS), 1952, Mesa, Arizona 7.5-minute Series Topographic Map, photorevised 1982

U.S. Geological Survey (USGS), 1964, Granite Reef, Arizona 7.5-minute Series Topographic Map, photorevised 1974

Wilson, E.D., 1962, A Resume of the Geology of Arizona, The Arizona Bureau of Mines, Bulletin 171.

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Appendix I

Yuma Clapper Rail Survey Report

Yuma Clapper Rail Survey Report for the Va Shly'ay Akimel Project Study Area Maricopa County, Arizona

Prepared for:

U.S. Army Corps of Engineers, Los Angeles District
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602/640-2003

Prepared by:

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Contact: Amy Gibbons
602/256-6662

August 2004

Jones & Stokes. 2004. *Yuma Clapper Rail Survey Report for the Va Shly'ay Akimel Project Study Area, Maricopa County, Arizona*. August 2004. (J&S 03-048.) Phoenix, AZ.

Yuma Clapper Rail Survey Report for the Va Shly'ay Akimel Project Study Area, Maricopa County, Arizona

Project Location

The U.S. Army Corps of Engineers (Corps) is proposing restoration of the Salt River between Granite Reef Dam and the interchange of the Loop 101 and Loop 202 in Maricopa County, Arizona. The area proposed for restoration has been designated by the Corps the "Va Shly'ay Akimel Project Study Area." Project boundaries encompass both banks of the Salt River channel between dam and Loop 101/202 to a distance of ½-mile to either side of the *thalweg*, or deepest portion of the river channel. Suitable habitat for the Yuma clapper rail is located within the boundaries of the project area in Township 1 North, Range 5 East, Section 18 (Figure 1).

Survey Area

Elevation of the project area is approximately 1,200 feet above mean sea level, and topography in the vicinity is predominantly flat. The project area is located within the Lower Colorado River Subdivision of the Sonoran Desertscrub biotic community (Brown et al. 1994). However, the project area is within an urban setting and the river bottom exhibits signs of long-term disturbance, including roads, landfills, mining operations, and illegal trash dumping.

During the planning process for the restoration project, it was determined that suitable habitat for the Yuma clapper rail is present in wetlands located adjacent to the interchange of the Loop 101 and Loop 202. The wetland has year-round water present and vegetation in the survey area is dominated by cattail (*Typha domingensis*). Table 1 details plant species occurring in and around the surveyed wetland during field activities.

Table 1. Plants Documented in the Salt River During Surveys

Species Name (Common Name)	Scientific Name
Bermuda-grass	*Cynodon dactylon*
Rabbits-foot	*Polypogon monspeliensis*
Fountain-grass	*Pennisetum ciliare*
Mexican sprangletop	*Leptochloa dubia*
Curly-dock	*Rumex crispus*
Cattail	*Typha domingensis*
Yellow nut-sedge	*Cyperus esculentus*
Bulrush	*Scirpus validus*
Bulrush	*Scirpus paludosus*
Knotweed	*Polygonum argyrocoleon*
Water speedwell	*Veronica anagallis-aquatica*
Salt heliotrop	*Heloptropium curassavicum*
Euphorbia	*Euphorbia albomarginatus*
Desert bedstraw	*Stephanomeris pauciflora*
Sweetbush	*Bebbia juncea*
Sowthistle	*Sonchus asper*
London rocket	*Sisymbrium irio*
Brittle-bush	*Encelia farinosa*
Cockle-bur	*Xanthium strumarium*
Turpentine-bush	*Apolopappus* sp.
Arrowweed	*Pluchea sericea*
Goodding's willow	*Salix gooddingii*
Fremont cottonwood	*Populus fremontii*
Salt-cedar	*Tamarix ramosissima*
California fan palm	*Washingtonia filifera*

Survey Information

Yuma Clapper Rail (*Rallus longirostris yumanensis*)

Life History

The Yuma clapper rail is a grayish-brown marsh bird with long legs and a short tail; adults of the species are typically 35–41 centimeters (14–16 inches) tall. During the breeding season, adult Yuma clapper rail males display a tawny-orange or burnt-orange breast and orangish beak while females display a brick-orange breast. (Arizona Game and Fish Department 2001)

The current range for the Yuma clapper rail includes the Lower Colorado River drainage from the Gulf of California in Mexico north to Topock Marsh in the Havasu National Wildlife Refuge (NWR), Arizona. In Arizona, this subspecies also occurs in several major river drainages in the central and southwestern portions of the state, including the Bill Williams River drainage, the Lower Gila River drainage, and the lower Salt and Verde River drainages (Arizona Game and Fish Department 2001).

Breeding occurs after territories are established in March or April. Breeding activities are known to occur at Mittry Lake, Bill Williams River drainage, Topock Gorge and Topock Marsh in the Havasu NWR, and Cibola NWR (Arizona Game and Fish Department 2001). Average clutch size is 8 to 10 eggs with incubation lasting about 21–23 days. Hatching success is usually high, but mortality among young is usually high as well. Family groups of clapper rails stay together for approximately 24–30 days post-hatching. Chicks become independent from their parents at 35–42 days, and first flight usually takes place 63–70 days post-hatching (Terres 1980).

This subspecies is the only clapper rail to breed in freshwater marshes. They also inhabit brackish water marshes and river sidewaters. They prefer tall, dense cattail and bulrush marshes found in the Lower Colorado River Subdivision of the Sonoran Desert Biome at an elevation between below sea level to approximately 400 meters (1,300 feet) above mean sea level. Clapper rails prefer to feed on crustaceans, including amphipods, but will also feed on fish, frogs, clams, spiders, large insects, and aquatic plant seeds. On the Colorado River, introduced crayfish are the most common food consumed in bulk (Arizona Game and Fish Department 2001).

The decline in numbers of this species has been attributed to river channelization, dredging, drying and flooding of marshes, wildfires, and toxic levels of heavy metals.

Survey Methodology and Results

Yuma clapper rail surveys were conducted May 21, May 23, May 28, and May 30, 2003. Biologists Ron Van Ommeren and Amy Gibbons, Jones & Stokes, conducted all surveys under U.S. Fish and Wildlife Service (USFWS) permit number TE013086-0.

Observation Methodology

Topographic maps and a site visit were used to determine the boundaries of the survey area. A total of 30 call points were established, approximately 100 feet apart, and GPS coordinates of these points were logged for quality control purposes (Table 2). These points are shown in Figures 2 and 3.

Table 2. GPS Coordinates for Survey Call Points (UTM)

Call Point	Easting	Northing
1	0417270	3700084
2	0417257	3700111
3	0417255	3700141
4	0417258	3700170
5	0417255	3700200
6	0417258	3700232
7	0417287	3700239
8	0417293	3700221
9	0417288	3700197
10	0417289	3700160
11	0417284	3700126
12	0417289	3700099
13	0417319	3700104
14	0417315	3700136
15	0417315	3700168
16	0417311	3700198
17	0417314	3700231
18	0417316	3700266
19	0417349	3700131
20	0417347	3700159
21	0417346	3700193
22	0417377	3700187
23	0417407	3700174
24	0417408	3700206
25	0417377	3700214
26	0417351	3700229
27	0417376	3700248
28	0417413	3700238
29	0417441	3700252
30	0417381	3700145

All surveys were conducted in compliance with the USFWS *Yuma Clapper Rail Survey Protocol* (U.S. Fish and Wildlife Service 2000). Call playback tapes were used at the 30 call points in an effort to elicit a response from resident Yuma clapper rails. In addition to recording responses, a log was kept of other species of birds that were seen or heard at the call sites (Table 3).

Table 3. Bird Species Documented in the Salt River During Surveys

Species Name (Common Name)	Scientific Name
Abert's towhee	*Pipilo aberti*
American avocet	*Recurvirostra americana*
American coot	*Fulica americana*
Black phoebe	*Sayornis nigricans*
Black-crowned night-heron	*Nycticorax nycticorax*
Brown pelican	*Pelecanus occidentalis*
Brown-headed cowbird	*Molothrus ater*
Cliff swallow	*Petrochelidon pyrrhonota*
Common moorhen	*Gallinula chloropus*
Common yellowthroat	*Geothlypis trichas*
Costa's hummingbird	*Calypte costae*
Double-crested cormorant	*Phalacrocorax auritus*
Gambel's quail	*Callipela gambelii*
Great blue heron	*Ardea herodias*
Great egret	*Adrea alba*
Great Horned owl	*Bubo virginianus*
Great-tailed grackle	*Quiscalus mexicanus*
Green heron	*Butorides virescens*
House finch	*Carpodacus mexicanus*
Killdeer	*Charadrius vociferus*
Mallard	*Anas platyrhynchos*
Marsh wren	*Cistothorus palustris*
Mourning dove	*Zenaida macroura*
Northern rough-winged swallow	*Stelgidopteryx serripennis*
Red-winged blackbird	*Agelaius phoeniceus*
Rock dove	*Columba livia*
Snowy egret	*Egretta thula*
Song sparrow	*Melospiza melodia*
Turkey vulture	*Cathartes aura*

Survey Results

The survey did not result in a response from a Yuma clapper rail. However, two brown pelicans, a species federally listed as endangered, were observed in flight in the project area.

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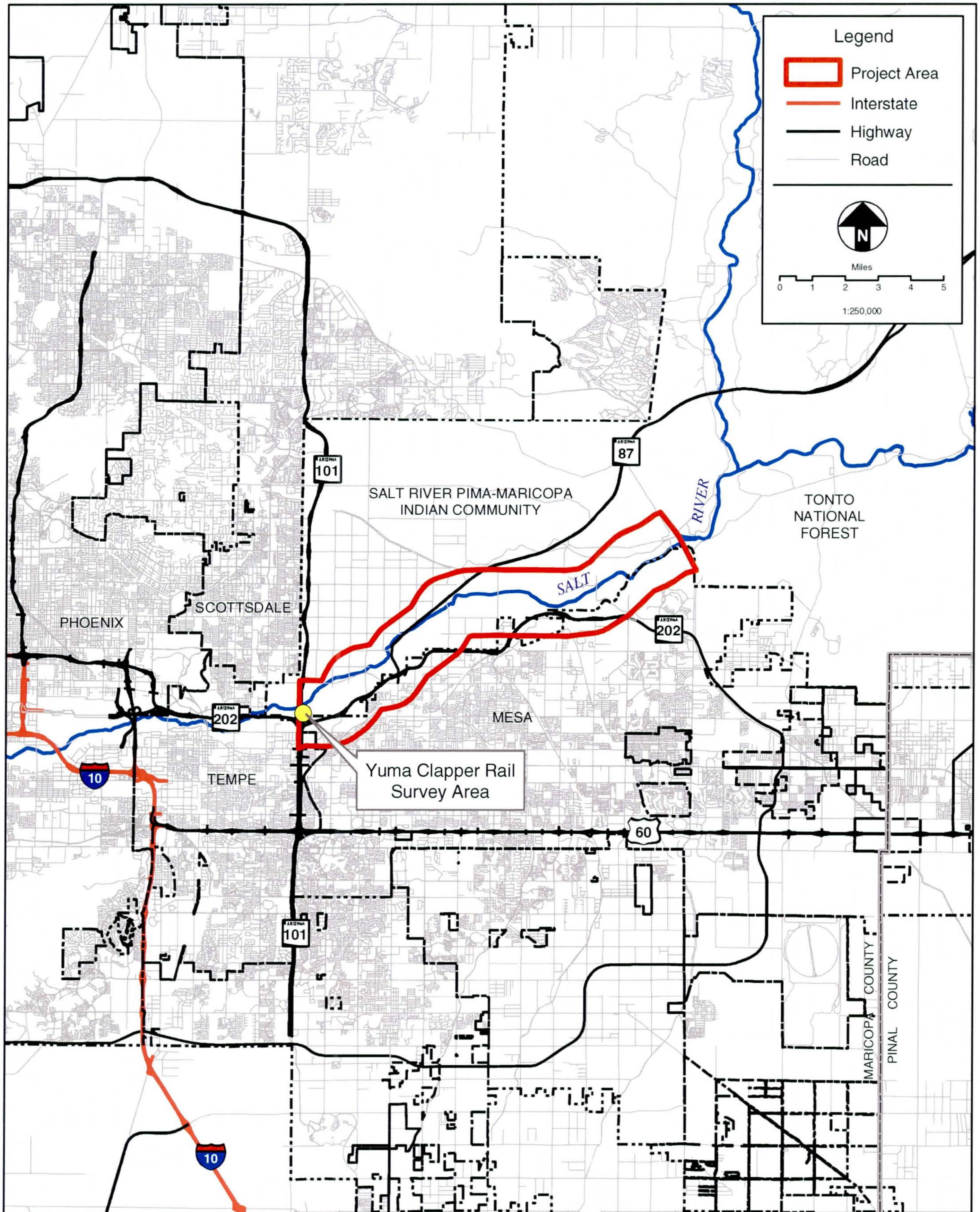
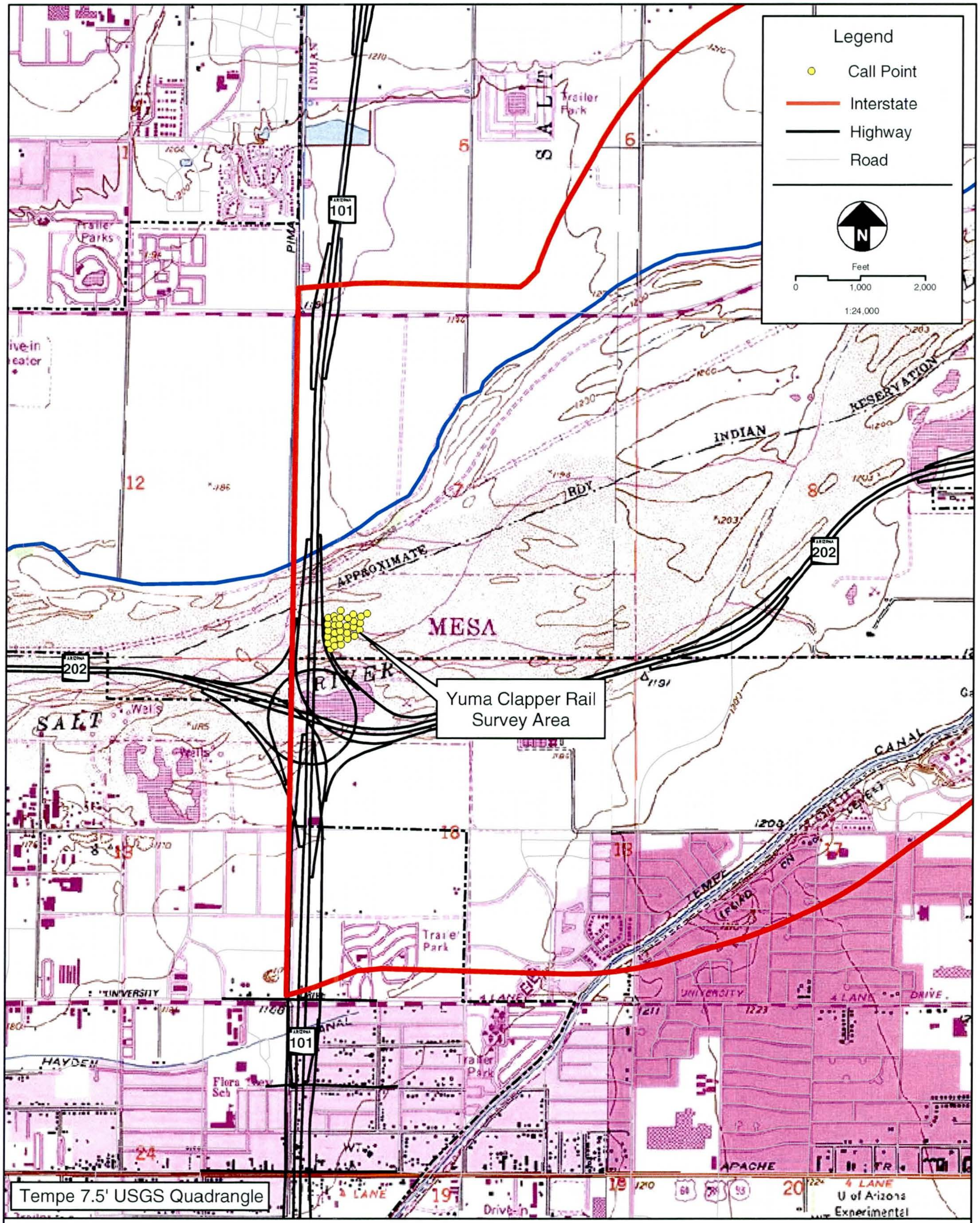


Mapped for:
U.S. Army Corps of Engineers

Mapped by:
Jones & Stokes

Figure 1
Vicinity Map
Va Shly'ay Akimel Project Study Area



Mapped for:
U.S. Army Corps of Engineers

Mapped by:
Jones & Stokes

Figure 2
Call Point Location Map
Va Shly'ay Akimel Project Study Area

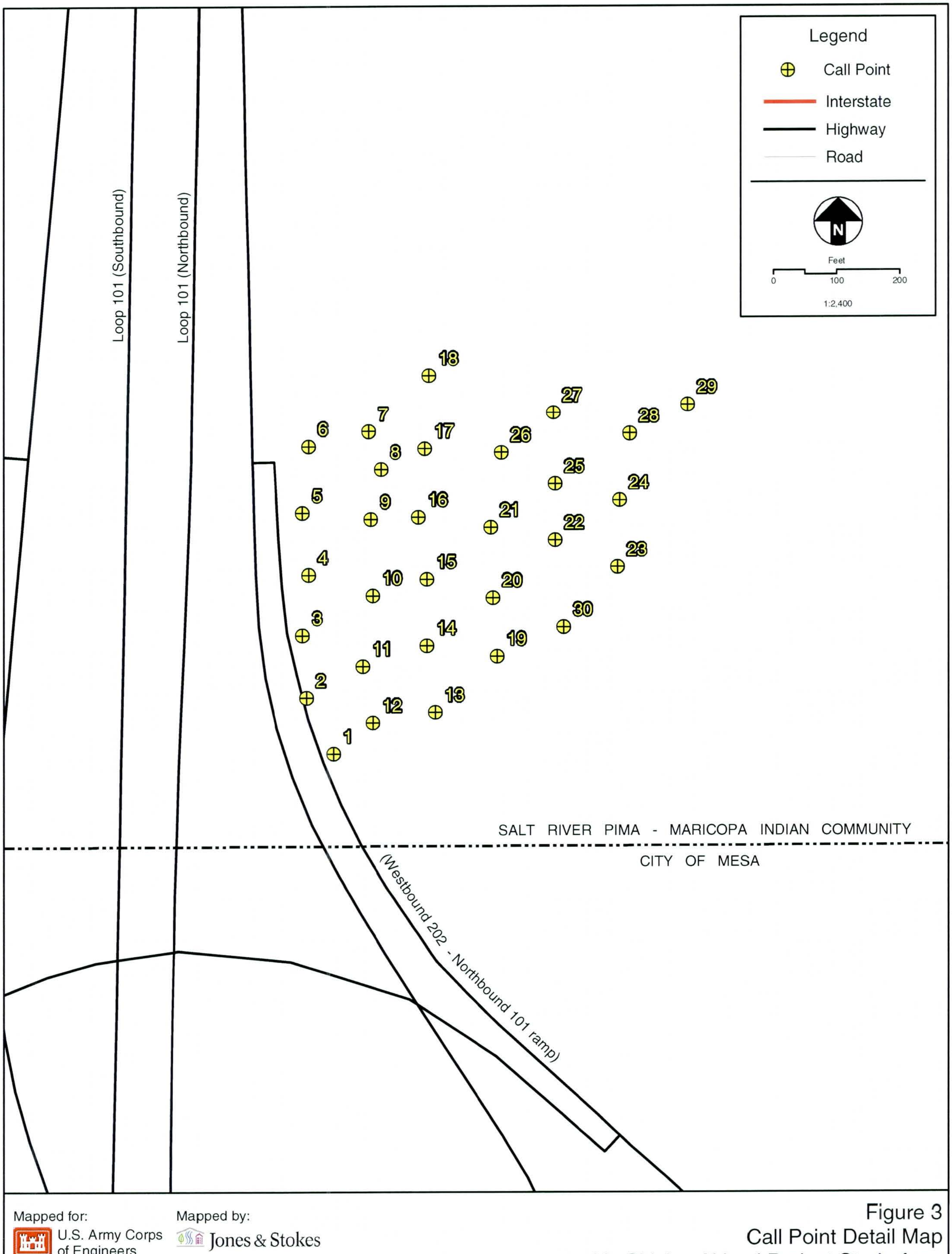


Figure 3
Call Point Detail Map
Va Shly'ay Akimel Project Study Area

Appendix J

Response to Comments Received on the Public Draft EIS

David Montiel testimony

"I'm not used to speaking in front of people. I have a real problem with this. Our people have been here for many, many years, and they own the mountain ranges throughout the Valley. And what happened was, we had settlers come in. And what happened, what -- the result is where we're at now. I'm speaking for my grandchildren. I'm speaking for my great grandfather. Encroachment has come on to us to the degree it is now. They are talking about putting Via de Ventura all the way to Gilbert Road. They are talking about extending or widening Gilbert. And we're talking about this now. How much more land does our -- do my grandchildren have to give up, my great-great-grandchildren? Sure, it's just a road here. But how many miles does that road take up on our reservation? How many miles will this take up from our people? You know, it sounds real good and, you know, I like it. I'd like to have it the way it was again. But how much do we have to give up for that? How much do we have to give up for all the land? It's just -- I don't understand. It sounds good. I'd like to have the river the way it was, but are we giving up our sovereignty? Are we giving up our policing? We don't have enough police to police these areas. Are we going to put fences up to limit people from going off of these areas and onto the reservation? You know what, I could probably talk here for a long time but I know I have so many minutes. Am I up?
(Moderator: No. You're still green.)
MR. MONTIEL: So I really think that it's a good thing that you guys are talking about this. But when I was talking to some of the elders I was sitting by, they were telling me that

RESPONSE:

Thank you for your comment. The U.S. Army Corps of Engineers (USACE) would at no time take possession of the land as part of the Va Shly'ay Akimel Ecosystem Restoration project. The USACE would only be on the project site during construction, and with written permission from the Salt River Pima-Maricopa Indian Community and the City of Mesa for Mesa lands. The Community would retain sole rights to the land, but would commit to maintaining the restored area, as outlined in the Operations and Maintenance manual.

The primary reason for the project is ecosystem restoration. The recreation component is only an ancillary benefit to the non-Federal sponsor(s), and the non-Federal sponsor(s) do not have to elect to have a recreation component.

saltcedar is one of the main things that we use because we don't have any large mesquites any more. We use that for our ceremonies, ceremonies that only our people know of. And they are really sacred ceremonies. When we go up to the river and we do our ceremonies up at Red Mountain, you know, that's something that we know about but we don't share with people. And that's what I have to say. But also the reason they closed the river to the outsiders is because the eagles were being affected, the eaglets. They weren't surviving because there was too many hikers up there. There was too many people that were from Mexico going over there and living back there and partying back there and killing back there, raping back there. Jurisdiction. We don't have the police power. I don't know how much was discussed before because this is my first meeting. And I just question this, you know. I see a military guy here. And, you know, everybody respects that. But at this point I can't really understand it.
PARTICIPANT: Are you for it?
MR. MONTIEL: Am I for it?
PARTICIPANT: Yes.
MR. MONTIEL: Not at this point.
PARTICIPANT: Tell them "yes" or "no."
MR. MONTIEL: Well, I just said it. And there's -- you know, like I said, encroachment is a big thing. A road that runs throughout the reservation is going to take lot of land, and it's going to open up the reservation to all kinds of people. And this could happen, you know, like, if you run from this river, there is no telling what it's going to bring in my eyes. It's a good thing. Don't get me wrong. It's a really good thing. But I don't think it is for myself and my mother and everybody I know."

Gary Owens testimony

"I'd like to speak too. I'm not afraid to say anything to people. I'd like to talk to them and tell them what I think. And as Mr. Montiel said, I'm not from this reservation but my grandchildren and my children are members here. And I want to make sure that they have land to live on, places to go on the reservation where they are not stepping over outsiders that are sleeping in the woods and doing things. This project that somebody thought up, you never did find out -- I never did find out who did it. Who thought it up? It says sponsors. Well, you named the mayor of Mesa but who in the Salt River Pima-Maricopa Indian Community was with him?
PARTICIPANT: Bobby Ramirez.
MR. OWENS: Was it a member of the Tribal Council?
COLONEL THOMPSON: It was the president.
MR. OWENS: The president. Who else? He decided for the Community; right? There you go. You've got a council that decides what's going to be good for the Community whether the Community wants it or not. You'll have a problem if you get this going through. And one of the things they mentioned was, if the Federal Government funds it, then it's open to the public. Once federal money is used for any project, no matter what it is, then the whole United States can come in on the land, not just in Arizona but from out of state, from all over. So think about it. Is that what you want? Non-Indians on the land? The fact is, they're already on it. You see them out there with their ATVs. They come out here and they dump their dogs and their cats. I don't know how many dogs and cats have come to my place because they come out and they dump them. They come out and they dump garbage. They come out and

RESPONSE:

Thank you for your comment. The implementation of the Va Shly'ay Akimel Ecosystem Restoration project would not require access to Community land by the general public unless there were recreational features funded by the Federal government. If there are no recreational features funded by the government, then access to the restoration project site may be restricted according to Community rules and regulations.

they steal the wood. They chop the trees down. So if you put up this project you have here, you're just opening it up. You're going to lose almost everything that you have. Another thing. What happened to the water 100 years ago or 80 years ago? Why didn't they just let the water keep running? No. They had to dam up the dams to get water to people who don't live along the river so that they could plant crops. But did they think of the Indian people that were living on the river? No. The State Legislature, all the non-Indians didn't care one hoot about the Indian people, and so they dammed up the river and it's dry as a bone. I have been here 40 years, and that river, the only time it flooded is when they let the water out of the dam because they were getting full. So how come all of a sudden you have to have a river running -- a river runs through it, so to speak? What's the big deal? What does it do for the Community? Ask that question. You know, Indians, think about that. What value is it to the Indian Community? The only -- it's -- the value is to the outside. Who supplies the water? The Community supplies the water. What does Mesa supply? An effluent plant further west. How many acres does the Community -- I mean, does Mesa give? 73 acres. And the Tribe has to give 4,023 acres. So who is it benefiting? It doesn't benefit the Tribe. It doesn't benefit the Community. It benefits those that live along the south side of the river so they can look down and see a pretty landscape down there. Right now there is no landscape. I'll be through in just a second. Okay. I see your time out. But I think it's something else other than beautifying, restoring. Just leave it alone. That's my opinion."

Virginia Loring testimony

"Good evening. I'm grateful to be here. First of all, I think that I would like all the Community members to stand. That includes our councilman Grinelda Gates. Look at the number that are here. And you want us to make a choice or you want to make a decision compared to the people that are here? I think that any time it involves Tribal land, I think that the whole Community needs to say. I think that a vote needs to be taken, councilman, councilwoman, because it does involve Tribal land. It's not just Lehi land. It's Tribal land. Another thing that I really -- I was concerned about is in the handout that was given, it says that in 25 years from now, Leon, Bob, 25 years from now if we decide that we no longer want this, do you know what's going to happen? It's going to take an act of Congress. Do you know how long an act of Congress takes? I'll be lucky to be alive to see that. And what if, along further down the way, we decide that we no longer have our casinos, we no longer have our enterprises, everything is passing us by, where is that money going to come from that we are supposed to foot for this? Also, Corps of Engineers, I commend you for your presentation that you have, everything that you've done, Bobby Ramirez. Really, it's excellent. But what concerns me is, why can't the Community do this? We have Salt River Sand and Rock. Why can't we do this? It's our Community. We have people that are very intelligent and can do that. Do you know that I'm going to contracting school to be a contractor simply because I don't want to be just a member sitting there? I want to do something in this Community. And we have people out there like that as well. Maybe they may be nonCommunity members but so is the Corps of Engineers.

RESPONSE:

Thank you for your comment.

But we already have people that are employed. I only have one statement left, and that comes from the council-approved mission statement. And I got this from the Au-Authm News. It's our local newspaper. And it says, "The Salt River Pima-Maricopa Indian Community projects sovereignty and promotes individual self-sufficiency. How much prouder should we be because we can do that? And those are my comments. Before I leave, I have one thing, and that is for all of you outside members from the outside community, Rusty Bowers, thank you for coming and being here, but I wish we would have had more of our Community members here. Thank you."

SRMG **Phoenix Cement Company.Salt River Sand & Rock**

Salt River Materials Group Aggregates .Construction .Fly Ash .Phoenix Cement

June 3, 2004

District Engineer
u.S. Army Corps of Engineers Los Angeles District
ATTN: CESPL-PD-RN
P.O. Box 532711
Los Angeles, Ca., 90053-2325

My name is Roger Smith Jr. and I am the President and Chief Executive Officer of the Salt River Materials Group, a business enterprise that is wholly owned by the Salt River Pima Maricopa Indian Community. The Materials Group consists of two divisional entities, Phoenix Cement Company and Salt River Sand and Rock Company. I am also a member of the Community.

In this letter, I have attempted to quantify some potential impacts that need to be addressed in considering whether or not the Salt River Materials Group can be totally supportive of the development of the Va Shly'ay Project in its current proposed form. We have concerns in the following areas: Financial impact on the Community's Enterprise, loss of control of the timing of the project's development, the mitigation of flood control issues as they relate to relieving flood issues and cultural landmarks, and the degree of revegetation and proposed park land development.

In terms of financial impact, (1) If we were to agree that all mining within the project boundary were to cease, with the exception of the area presently being performed at our Higley Plant Location, our operational costs would skyrocket. The

RESPONSE:

Thank you for your comment.

trucking costs that we would incur to supply the existing ready mixed concrete plants at Dobson and Beeline locations would be an additional $2.50 per ton. At a rate of approximately 3.5 million tons per year, the additional cost to keep our customers supplied would increase by $8.75 million dollars per year. This would, of course deplete the Higley site an increased rate and diminish our long-term presence as a factor in our synergistic sales efforts to also sell our cement and fly ash products.

(2) If we do not mine the channel between Gilbert Road and the GRUSP, we would be abandoning (assuming a 25 foot deep and 1100 foot wide channel) approximately 22.5 million tons. of aggregates. At a profit of approximately $2.00 per ton, the negative economic impact to the Community would approach $45 million.

(3) Our cement plant reserves are in excess of a 70-year supply, so it is necessary for us to maintain a strong aggregates position in the East Valley to complement our cement sales. The Community has just finished a $140 million modernization of the facility and the payback projections were rationalized by an increase in cement sales from 650,000 tons per year to 1.1 million tons. Cement sales have been the traditional "bread and butter" for the Community creating tens of millions of dollars to the Community annually. Fly ash, as a concrete additive has been a moneymaker as well, and long-term contracts that the company has with the power plants are also a consideration in these matters.

(4) Also, it should be noted that our industry employs between 75 and 100 Community Members on the sites located within the project boundary.

In terms of timing, the Army Corps plan to date has left little input from the Community in terms of the Project's build out. There seem to be little flexibility in each phase of the proposal as it relates to funding and construction. Conversely, the Materials Group has proposed a Mining and Reclamation Plan draft that accommodates the business unit for many years, while allowing a timeline as dictated by Tribal Leadership for riverbed restoration.

We have also addressed in our Plan the need for flood control measures including hard banking along stretches of the river to remove flood prone areas from the floodplain and protecting the cultural river island and the Lehi cemetery.

Finally, we feel that the development, or lack thereof, of lands for public use should be an exclusive decision for the Community Council.

We continue to try to be supportive of the project, and have met with the Corps on numerous occasions. Our discussions have included a mining plan that would include assuming the Rinker lease liabilities, addressing the design issues in the Mckellips road area, and cleaning up the Beeline pit issues west of Gilbert Road, over a twelve to fifteen year time frame.

We have proposed a channel to be mined between the Groundwater Recharge Underground Storage Project (GRUSP) and Gilbert Road (approximately 1100 feet wide and 25 feet deep as mentioned above). We further have proposed a time frame to refurbish and surrender these easterly properties to the project annually in *1'2* mile increments. Since this concession would include removing the aggregates and storing them for use at a much later date, we have proposed that we be compensated for the removal as part of the overall project contract. Our internal plans are to extract the materials as a business enterprise to create profits for the Community, while creating an environment that provides employment for the Community members, as well as minimizing potential flood damages. We certainly believe that we can also participate, through our plan, in the beautification of the river bottom by replanting natural type vegetation.

It is our goal to continue to work toward addressing and achieving desirable positive results for the Salt River Pima-Maricopa Indian Community.

Sincerely Yours,

Roger Smith, Jr.
President and Chief Executive Officer Salt River Materials Group

Carol Harris testimony

"Well, I'm a resident of Mesa right above the Lehi City, and I just wanted to say I support the project. I know I don't belong to the Indian Community and I respect their wishes and I have a high opinion of them. But I am a registered nurse and I believe that we need to have more places for recreation. We need to have more places for people to walk and ride their bikes and enjoy nature. Not only does it give our bodies what we need, but it also gives our minds and our spirits what we need to commune with nature. And I believe in the holistic approach to living, that we need to really work, each of us need to work to be healthy individuals. And I just think this would be another place where we could exercise and commune with nature. And I believe it will be a real positive impact on our whole community. Thank you."

RESPONSE:

Thank you for your comment.

Addie Garcia testimony

"My name is Addie Garcia. I just wanted to know, which of my presidents agreed to this project?
COLONEL THOMPSON: Okay. I have got that as a question. We're going to address that right at the end; all right?
MS. GARCIA: Okay. Out of this 98 percent of the Community members or the land, how much of it is allotted land? And if the people with the allotted land said it was okay for this project to go through, why aren't they here to support you, you know? I'm very disappointed that I don't see them. And, you know, it's -- for us, they said that we cannot even get a road through there. And I'm so surprised that they are going to let you do that. You know, it looks real nice, but, you know, we have a hard time. Our police have a hard time getting to this area. And I'll be very disappointed. I'm not for this because all we're asking for is a road and you're asking more, you know. And I'm just not for the project. Thank you."

RESPONSE:

Thank you for your comment. The real estate gross appraisal conducted by the Salt River Pima Maricopa Indian Community identified that the proposed alternative does not include allotted lands.

Carolyn Stacey testimony

"Good evening. My name is Carolyn Stacey. I'm not for this project. We have gone to some tours on how they improved it, how it's been improved in certain areas. I just want to say that I'm like David Montiel. My father has always said that when people dammed up the water, all our natural resources went down the drain and dried up, all the things that we lived off the land and used to survive all these many years, thousands of years. Now here comes this new project that you're thinking about that -- it is true that it's encroachment and I don't agree with it. It's just like me going into your backyard and making a shed or doing some -- pulling out your roses or something like that. That's what you're doing to us. You're invading our privacy. I'm sorry to say that, sir. But anyway, that's the way I feel. I have my great-great-grandchildren. I'm 63 years old. And if they just let that water flow freely, we'll have all these things replaced. Thank you."

RESPONSE:

Thank you for your comment. The U.S. Army Corps of Engineers (USACE) would at no time take possession of the land as part of the Va Shly'ay Akimel Ecosystem Restoration project. The USACE would only be on the project site during construction, and with written permission from the Salt River Pima-Maricopa Indian Community and the City of Mesa for Mesa lands. The Community would retain sole rights to the land, but would commit to maintaining the restored area, as outlined in the Operations and Maintenance manual.

June 03, 2004

District Engineer
U.S. Army Corps of Engineers
Los Angeles District
ATTN: CESPL-PD-RN
P.O. Box 532711
Los Angeles, CA 90053-2325

Comments of Mr. Hollis M. Chough
(Regarding Va Shly' Ay Akimel River Restoration project)
Recorded by Mr. Roger Smith
May 22, 2004

Good evening. My name is Hollis M. Chough, a full blood Maricopa Indian of Salt River Pima-Maricopa Indian Community. In my lifetime, I have, and my family and the Tribe, have been confronted with many issues that would better our land, better our community, that would better our lifetime stay on the Salt River Indian Reservation. It's been a long time since we had issues that come up before us that are very important. And usually, the issues are presented to us in a way that we either have to move with it or sit with it. I think we the Pimas and Maricopas of this community are mature enough to think some things out and take this issue and vote on it. I feel that it's an issue that has to be voted upon and the issues are the river restoration of the Salt River. The main purpose is to restore the river to its original condition with the wildlife, the vegetation, and so forth. It's a long ways to come yet, but these were the discussions that the group was involved in in discussions. We will present the discussions; the people that were involved in the discussions were Robert Aguilar, Herbert Chiago and Garnet Gates.

There was only the three of us and four of us, sometimes five of us that were involved in the discussions. The discussions were very hard because the Corps of Engineers were very adamant about getting this thing approved and moving with it as soon as possible. And we, the Indians, we say, "Wait a minute. What is in store for us? What do we profit from the whole project?" Now the profitability of the whole project centers around big money making kind of issue that comes forward before us, and that is our extraction of sand and rock at Salt River. That is our bread and butter. I think no tribe in the United States has a unique situation such as ours. We have our sand and rock located in the bed of Salt River. Salt River is used by many companies extracting land either in a regular contract form or stealing from us. We know that there's a lot of contractors who stole from us when we were talking about this some months back. It seems that the uncontrollable truckers were stealing from us, were stealing sand and rock, which we don't know, which we have no records of, and

RESPONSE:

Thank you for your comment. The U.S. Army Corps of Engineers (USACE) would at no time take possession of the land as part of the Va Shly'ay Akimel Ecosystem Restoration project. The USACE would only be on the project site during construction, and with written permission from the Salt River Pima-Maricopa Indian Community and the City of Mesa for Mesa lands. The Community would retain sole rights to the land, but would commit to maintaining the restored area, as outlined in the Operations and Maintenance manual.

eventually, when we get down to brass tacks of studying this thing and putting into written form, we would ask the questions: how many tons of sand and rock were not accounted for during the early discussions of this topic?

And as you notice, once the Tribe got into a situation where they had to tighten their belt to get things done the right way, they began to do profit and loss analysis of each company on our Reservation, and once that started, the truckers that were stealing from us, they quit hauling, you will notice. They quit hauling. I don't know how many tons or how much money or dollars and cents was stolen from us, but we stuck with it, and we raised the issue time and again, but not to the point where it was a real official comment.

We, the people of the committee are not experienced in any situation like this. Initially, it was the Tribal Council that wanted to approve the plan earlier in the year. They approved the plan, but the Tribe had no plans for how to implement this whole project. There was some talks about it but we were not a part of these discussions, we the committee, were not very well versed on it because Council or people that were assigned to do the study never contacted us or never met with us. It was always the Advisory Committee that was the aggressor to set up meetings and invite various department heads to discuss some things with the Tribe. When I talk about the Tribe, we're talking about 7200 community members, the committee members that were active in these discussions. We were active in discussions, certain things that you probably would like and probably won't like that is the general citizen, this committee, or the Reservation population.

Once you approve of this plan, the restoration plan, there are certain things that we need to know about. First thing, it has been our experience and understanding that other tribes in the mid-West have used the Corp of Engineers for their flood plain plan, their reservation dam reservoir plan, and the giving up of tribal land around the big lakes that they have. In the mid-West, those people they have a lot of plain lands that they wanted to develop and when the reservoir was built in the area there, some of you may know some of the dams that I'm talking about. Those dams were built with the tribal approval, but there are conditions to it that have never been fulfilled yet. And one of the things that have never been fulfilled is the payment of certain amount to the Tribe to rebuild and restore their community with whatever they need to do. It is a good thing to do that, restore the community. And it takes money, and Uncle Sam has that money. We need to take a look at it.

At first, when I understood the project, it was... as I understand it; the project was a $3 million project. We don't care how it's divided up, or who takes a share of that, that means the City and Corp and the Tribe, but we do know that the Tribe has to give quite a bit up, of tribal land, and that's the river, and we, as a whole, will also give up our own water to the outside communities, such as the growing City of Mesa, City of Tempe, and the various cities and towns that are going up all over the Valley. They need water, once they are set up, once they are completed, they will need water for fifteen, twenty, thirty years or maybe for one hundred years, and who has it? We have it. Salt River has it. It has a reservoir underground under the river, it is known as the Aquifer, and the water in those areas are saved for future use for our Reservation. We don't know this. As we really get into this matter, this issue will come up again. The question will be did the Tribe sell Aquifer water to outside cities? If they did, what are we getting in return? We need to know that. The other point is, how much did we get in terms of dollars and cents? We have never heard that expressed publicly by tribal planners or administrators of the Tribe.

On this Reservation, we talk about many projects, and this restoration project is one of them. As I said, this project is one of the projects that the Tribe has ongoing. What I can see as a layperson not involved in Tribal affairs is that some of the things I predicted to Mr. LaLonde, the Community Treasurer, are actually coming into play. And one of the things that I had fears about was that if the Tribe ever put a plan like the Tribal reorganization, it is entirely new to them, the people, that is, and they'll have a hard time understanding what the purpose is for. It has never been explained why we're doing it, why it has to be done. Instead, people are just told this is Tribal plan, and it scares them, and that throws them off. And when it's actually implemented, people don't want to get involved in it.

I guess a clear case is where we have various committees organized for specific purposes and those organizations or those committees have not actually done their job because members of the committee have not shown up for work, or committee discussions, so that's one problem we have. The other problem we have is, when it's actually implemented, it will cause quite a confusion because, as I see it, there has never been any training, nor workshops, nothing was ever done for the tribal members. That is for the committee; it was just thrown to them. "Here, do this." And they don't know how to do it. At least I know how to do it because I was involved in the state; City of Phoenix and City of Flagstaff general plan similar to what we're going through. And I know what we're going to go through eventually, and that is the lack of participation by the tribal employees. I knew that that would come about when tribal employees failed to show up for committee meetings, or show up for conferences, or even show up for work, because they are afraid to attend because they don't understand the general plan.

The general plan has never been discussed with the people, so therefore, we are in doubts about a lot of things, and so with that kind of background, the same thing holds true with the river restoration project. Our people may come through and they may not because they are not acquainted with it. And I mentioned this at one meeting one time that we need to be educated on this particular subject. It's a very, very deep subject, and it has to be explained by experienced people. Those experienced people also must know what they are talking about because it is a project that they have to have approved, and we've never had that. The Corp of Engineers has never said, "We have an experienced person who can explain this step-by-step if the committee wants it or if the people want it." Those things have never been offered to us.

My idea was, initially, I could see a flowering kind of riverbed, clean and so nice, like the City of Scottsdale river drainage, and that's what I wanted to see. Actually, when we got into it, we found out that was not so. It was something else that the Corps wanted. The Corps wanted quite a bit of land for the Reservation to give up. And it is quite a bit of land, in terms of dollars and cents; it goes into the thousands and millions of dollars that we will lose in years to come. And who will benefit from it?

Our neighboring towns, our neighboring cities, our neighboring communities. I am sure that once the labor or the Corps has authority over the riverbed, they will allow a lot of excavation by truckers and land developers, and they're going to allow that, and they will get the money, and where do we stand? The tribe is just giving the land away. I'm talking about sand and rock. That is our lifeblood of our Reservation. If we ever get rid of that, we won't have any dollars and cents. I'm looking at it from the standpoint of what the tribe has planned already, and that is the plans to build buildings here and there, and they have no land, and once they do that, they will need some dollars and cents. How are we going to get our money? The sand and rock business is one of the only things that is keeping the tribe alive by bringing income.

In closing, I wish to see the Salt River Restoration project become a reality or not depending on a community-wide vote. On the other hand we have approximately 7200 community members, if we don't get 15% of voter turnout from that to vote on this project that would be detrimental for the Tribe. Thank you for the opportunity to address my concerns in this public forum.

Sincerely,

Hollis M. Chough
10516 East Montecito Avenue
Scottsdale, Arizona 85256

Chris Higgins (email)

"I attended the public meeting on 6/3/2004 and have the following comments. I live in Tempe and have been interested for many years in the Salt River as it runs through the Phoenix Metro area, and have been excited by the various river improvement projects such as Tres Rios, Rio Salado, and Tempe Town Lake. While the restoration and beautification of the river is important to me, just as important are the future recreational opportunities that the above-mentioned project can offer to me and my family. When I heard about the Va Shly'ay Akimel project, I again was excited by the possible recreational opportunities the project would present. I had visions of being able to ride my bicycle along the river from Granite Reef Dam to Tres Rios! I did not realize that the river, for most of the Va Shly'ay Akimel project, is owned by SRPMIC, and was disappointed by comments made by members of the SRPMIC in the meeting, saying that they did not want the project, and certainly did not want 'outsiders' entering and enjoying 'their land'. As a non-Native American, and a non-member of the SRPMIC, I very much felt like an 'outsider' by the end of the meeting, and was glad to get out of there. As a result of the meeting, my hopes for recreational opportunities through the Va Shly'ay Akimel project are now very low, and I can't honestly say I support the project. My compliments to you, however, and your staff, on a professionally run and informative meeting. Please keep me on your mailing list."

RESPONSE:

Thank you for your comment. Your name will be added to the Final Environmental Impact Statement mailing list.

Tim Barnard Comments (email)

"Staff comments for the Va Shly'ay Akimel EIS are as follows:
Figure 3-10 – Consider including the updated Multiuse Path Master Plan Map in this document instead of the one originally included in the Parks & Recreation Master Plan. Staff can provide copy in Word format.
Figure 3-11 – It would be helpful if the trail connections into the Museum and Cultural Center were highlighted or labeled on the conceptual drawing.
P. 3-42 – Section 3.4.2.3 references the operation and maintenance costs for the trails. If this function falls to Mesa's Parks Maintenance staff, we would appreciate inclusion in the discussion of expectations and costs, in particular, the surface braided irrigation network seems to be a difficult and time consuming system to maintain.
P. 3-36 – Section 3.4.4.1 references a connection to Mesa's existing trail system along the Tempe Canal. Although the canal exists and can be used by the public, Mesa has not yet improved the pathway. It might be more accurate to say there will be a connection to Mesa's planned trail system along the Tempe Canal.
p. 3-46 – Regarding the recreation trail options, the City of Mesa's Community Services Department prefers the implementation of Option C as outline in Section 3.4.4.3.
We appreciate the opportunity to comment.

Tim Barnard, CPRP
Administrator, Community Services Department
City of Mesa

RESPONSE:

Thank you for your comment. Updated Multiuse Path Master Plan Map will be included in Final Environmental Impact Statement. Mesa's preferences have been noted.

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JOHN F. SULLIVAN
Associate General Manager
Water Group

June 21, 2004

VIA FACSCIMLE
And US MAIL

Colonel Alex Dornstauder
District Engineer
Los Angeles District
U.S. Army Corp of Engineers
ATTN: CESPL-PD-RN
P.O. Box 532711
Los Angeles, CA 90053-2325

RE: Salt River Project Comments on Draft Environmental Impact Statement (April 2004) Va Shly'ay Akimel Salt River Ecosystem Restoration Feasibility Study

Dear Colonel Alex Dornstauder:

On April 28, 2004, the United States Army Corps of Engineers (Corps) published a notice in the Federal Registry requesting public review of the Draft Environmental Impact Statement (EIS) for the Va Shly'ay Akimel Ecosystem Feasibility Study. The proposed action in the EIS includes the establishment of riparian habitat and restoration of river channel functions through a 14-mile reach of the Salt River located in Maricopa County Arizona.

The Salt River Project (SRP) operates dams upstream of the proposed project, operates water delivery structures to divert and distribute water from those dams in the vicinity of the proposed project, and operates the Granite Reef Underground Storage Facility (GRUSP) located within the study area. Additionally, SRP owns land parcels adjacent and near the project. SRP therefore has a keen interest in the construction and operation of the proposed project.

SRP is supportive of the proposed project goals and believes that the restoration of this portion of the Salt River will not only benefit the project participants but the Phoenix Metropolitan area as a whole. However, SRP does have concerns with some components c the proposed project. The purpose of this letter is to offer comments on these components And to request that the Corps meet with SRP and coordinate the proposed activities before completing the final EIS.

RESPONSE:

Thank you for your comment. The USACE will continue to coordinate with Salt River Project, should the project move into the design stage.

Project features currently require that irrigation water be diverted on the north bank of the Salt River. The SRPMIC and USACE assumed that SRPMIC waters may be redirected through the Hennessey Drain. If, after discussions with SRP, the Hennessey Drain does not have the capacity to convey irrigation waters to the vegetated areas along the north bank of the Salt River, Alternative O can be modified to no longer be dependent on Hennessey Drain. Evergreen, Tempe and Country Club drains are only used in the sense that the USACE anticipates diverting, or harvesting storm water runoff when available. There will be no additional water added to these drains.

Due to the groundwater hydrology, it is uncertain what, if any, contribution the recharge waters at the GRUSP site will have toward the newly planted vegetation survival. In addition, the project is designed such that vegetation around the GRUSP site will not be dependent on GRUSP waters.

A number of the project alternatives (F, N, E, and O), including the preferred alternative O, state that the Hennessy Drain would be used to deliver water to irrigate newly established vegetation and possibly wetlands. The proposed use of the Hennessy Drain raises some concerns. The Hennessy Drain is an integral part of a federal reclamation project and performs a critical operational need for the SRP's canal operations. The drain was designed solely for the purpose of discharging or removing excess waters from the South Canal.

The South Canal periodically and unpredictably experiences excess waters because of storm inflows or "upset conditions" in canal operations such as when water is returned to the canal from adjacent facilities such as Val Vista water treatment, RWCD pumping plant and South Con Hydrogenerating Plant. Delivering water through the Hennessy Drain to irrigate vegetation in the river bottom would diminish the drain's designed capacity to remove excess canal waters and could create potential flooding hazards farther down the South Canal. It was for this reason that a new and separate delivery structure was constructed immediately adjacent to the Hennessy Drain and used for deliveries to GRUSP.

Additionally, the wasteway into which the Hennessy Drain discharges is currently blocked by an erodible earthen "fuse plug" for the purpose of diverting water from the wasteway into the GRUSP delivery channel. At this time there is no additional capacity in the GRUSP delivery channel to accommodate irrigation deliveries to new cottonwood or mesquite plantings on the north side of the river.

A number of the proposed alternatives also discuss the use of the Evergreen, Tempe, and Country Club Drains to deliver water. SRP has concerns, which are similar to those listed above in reference to the Hennessy Drain, regarding the use of these drains to deliver water. In addition, SRP is concerned that these drains discharge without notice and may pose a public hazard particularly if there is an increase in recreational use of the river channel associated with the proposed project. The Corps should meet with SRP to, among other things, coordinate the proposed use of these structures to determine if it is possible to schedule and deliver the volume of water necessary to meet the project requirements.

In association with using the Hennessy Drain for deliveries, the preferred alternative, and others, calls for constructing wetlands at the Hennessy Drain outlet and protecting the wetlands with a berm of rock upstream to force flood flow releases away from the south bank of the river. Forcing flood flows to the north at this location might negatively impact the GRUSP delivery channel and basins. Impacts of these berms and any others on local facilities such as GRUSP should be explored an identified before moving forward with the project.

It is uncertain how vegetation outside of the GRUSP site would cause more GRUSP maintenance, but continued coordination with SRP would alleviate future problems.

No vegetation was planned near the Granite Reef Dam, only invasive plant eradication. Granite Reef leakage water is not a considered a reliable source and will not be used as a potential water source in the scope of this project.

Salt and Verde Rivers are considered sources only when the waters overtops Granite Reef Dam and flows into SRPMIC lands, during high flow conditions similar to the 1993 flood.

The Corps has been in direct coordination with the U.S. Fish and Wildlife Service throughout the Plan Formulation process, and will continue to coordinate through the design phase. Issues such as Safe Harbor Agreements and the inability to use Salt and Verde River waters will be resolved during that time. The data corrections provided will be included in the final document, and the Salt River Project will be added to the Final Environmental Impact Statement distribution list.

Many of these same alternatives, including the preferred alternative O, propose to establish vegetation near the GRUSP site and identify water being stored at the site as a potential water supply for the project. This proposal seems to imply that some of the water being recharged at GRUSP will be used to support mesquite and cottonwood restoration efforts. This is not consistent with the ADWR-permitted intent of GRUSP or with the understanding of the GRUSP participants (see list below) who provide the water being recharged at GRUSP.

If vegetation is planted near the GRUSP site and it utilizes the infiltrated water, the effectiveness of GRUSP as a storage site will be reduced and the volume of water and cost needed to store the intended amount of water will be increased. Additionally, the proposed irrigation of some of this vegetation and other newly established vegetation and wetlands might increase groundwater levels resulting in a reduction in GRUSP's storage capacity. It should be noted that while SRP operates the GRUSP facility, there are a number of other entities that participated in its construction and who have a vested interest in its operation. These participating entities include the City of Chandler, the Town of Gilbert, the City of Mesa, the City of Phoenix, the City of Scottsdale, and the City of Tempe.

Another concern that SRP has with establishing vegetation near GRUSP is that it may result in an increase in the need for maintenance activities, including the operation of monitoring wells, due to an increase in the rate of volunteer vegetative growth. The proposed establishment of vegetation near the GRUSP site will likely increase the number of visitors to the area and could result in an increase in operational expenses and pose a safety issue. Concerns regarding the impact of vegetation on maintenance activities and the effect of increased visitation also apply to the establishment of habitat near Granite Reef Dam. The Corps should also investigate whether the growth of vegetation immediately downstream of Granite Reef Dam could potentially increase flooding problems, due to reduction in channel flow velocities, or result in a reduction in the ability to pass flood flows over Granite Reef, due to pooling of water behind the downstream vegetation.

An additional concern associated with proposing to develop habitat near Granite Reef Dam is the reference to SRP water leaking from Granite Roof Dam (see Chapter 10). This should not be considered a potential water supply because SRP water supplies can only be used on SRP member lands. Moreover, this cannot be considered a reliable supply source because future modifications to Granite Reef Dam should be removed from the list of water sources proposed for the project.

Chapter 4 discusses the possibility that federally listed threatened or endangered species could potentially occur in the new habitat that is established by the project. Given that the Draft EIS recognizes the flooding potential on the Salt River, SRP recommends that the Corps pursue an incidental take statement to cover any threatened or endangered species that may occur in the habitat created by the project and which may be destroyed by future flooding. Additionally, SRP recommends that the Corps consider pursuing an incidental take statement to cover any threatened or endangered species that may occur on habitat that would be created through the use of the potential water supplies identified in the Draft EIS that are not owned or controlled by the project participants. Drain flows, water associated with the delivery and storage of water at GRUSP, and leakage water from Granite Reef Dam are examples of such supplies. Finally, the Corps should consider whether there is a need for incidental take protection in the event that habitat created by the project is eventually destroyed because water used to irrigate the habitat is reduced or eliminated entirely.

Appendix E, titled "Fish and Wildlife Coordination Act Documentation of the Draft EIS" contains a letter from Steven L. Spangle, Field Supervisor for the U.S. Fish and Wildlife Service. Contained within the letter is the following recommendation "Consider and evaluate opportunities to provide additional surface water to the project area directly from the Salt and Verde Rivers by coordinating with water users, managers, agencies, communities, Tribes, and/or other parties interested in riparian habitat improvement (for listed and non-listed animal species) on the lower Verde River below Bartlett Dam from flows more consistent with the natural hydrologic regime."

For a variety of reasons we do not believe the Corps should consider this as a source of supply for the project. These reasons include, but are not limited to: 1) significant impact on water rights and complex contracts with SRP shareholders, irrigation districts, Indian tribes, a mining company, and the City of Phoenix; 2) any operation to provide this water source would be contrary to the purpose of the Salt River Federal Reclamation Project; 3) limited frequency and duration of available flows caused by high variability of runoff; 4) high costs; and 5) limited benefit to riparian vegetation. For more detailed explanations of these reasons see the Final Environmental Impact Statement for the Roosevelt Habitat Conservation Plan Gila and Maricopa Counties, Arizona, December 2002.

Attached are a series of additional comments and observations regarding information contained in the Draft EIS.

Lastly, it should be noted that SRP was not initially provided a copy of the Draft EIS for review and is not listed in Chapter 11 as an entity that was provided a copy of the document. Please include SRP on any further correspondence regarding this project and address all correspondence on the matter to:

Mr.. David Roberts
Salt River Project
Mail Station PAB 11
P. O. Box 52025

We also recommend that before pursing a Final EIS, the Corps contact all potentially impacted parties such at the GRUSP participants previously mentioned. This would provide them with the opportunity to comment on the project and will help to ensure the project's success.

Given the potential impacts to SRP facilities, SRP recommends that the Corps coordinate their efforts with SRP before proceeding forward with a Final EIS. We appreciate the opportunity to comment on the Draft EIS. If you have any questions about these comments, please feel free to contact David Roberts at (602)-236-2343 or John Hetrick at (602)-236-5649.

Sincerely,

John F. Sullivan

John F. Sullivan

JFS/JH
Attachment

c: Marilyn Ethelbah, Salt River Pima Maricopa Indian Community
Gordon Haws, City of Mesa
Steven Spangle, U.S. Fish and Wildlife Service

LIST OF ADDITIONAL SRP COMMENTS REGARDING TECHNICAL ISSUES

1. Page 4-8. It is stated that SRP operates seven dams and storage reservoirs within the Salt River watershed. SRP does operate seven dams but only six have storage capacity. Granite Reef is a diversion dam and does not have storage capacity.

2. Page 4-8. Table 4.2-1 has a number of errors. The construction date listed for Mormon Flat Dam in Table 4.2-1 should be 1925, not 1938. Granite Reef Dam, which was completed in 1908, should be included with a storage volume of zero. The table should be modified to include these correct storage volumes; Bartlett 178,000 af, Horseshoe 109,000 af, Stewart Mountain 70,000 af, Mormon Flat 58,000 af, and Horse Mesa 245,000 af.

3. Page 4-8 and 4-9. It is stated that SRP releases water only for flood-control purposes to lower reservoir levels, either prior to winter rains or when the reservoirs are unexpectedly full. This is incorrect. SRP primarily releases water from reservoirs to meet shareholders water demands, but does release water for other purposes including minimum flow requirements and power generation.

4. Page 4-9. It is stated that dams upstream of the study area effectively delay flows by one month. This statement should be clarified. This is the case in normal years or years with minimal downstream releases. However, this is not the case in years with big flow events (1993) or very wet years (1983).

5. Figure 4.2-2. The data used to construct the graph appear to be incorrect, or they at least do not match SRP's data. SRP's data show a peak discharge in March with less in April. Additionally, a y-axis scale would be beneficial to help understand the information portrayed in the graph.

6. Page 4-12. The Buckhorn Mesa Project discharges storm water upstream of Granite Reef Diversion Dam, not downstream as stated.

7. Page 4-21. It is stated that minor flows are the results of controlled releases, while the major floods are caused by uncontrolled releases. All flood flows associated with dam releases are made via spillway gates and as such are controlled releases.

8. Page 4-70. Section 4.5.3.5 is titled the Southern Canal and the text below refers to the Southern Canal. The proper name for this canal is the South Canal.

USDA

United States
Department of
Agriculture

Marketing and
Regulatory
Programs

Animal and
Plant Health
Inspection
Service

Wildlife
Services

8836 N 23rd Ave.,
Suite 2
Phoenix, AZ 85021
(602) 870-2081
Fax (602) 870-2951

June 15, 2004

U.S. Army Corps of Engineers
Los Angeles District
Attn: Mr. Steve Dibble (CESPL-PD-RN)
P.O. Box 532711
Los Angeles, CA 90053-2325

Dear Mr. Dibble:

Thank you for the opportunity to review the Va Shly'ay Akimel (VSA) plans with regards to ensure that wildlife hazards for Falcon Field (FFZ). Wildlife Services appreciates your concern and continued commitment to aviation safety near FFZ.

The United States Department of Agriculture (USDA)–Animal and Plant Health Inspection Service (APHIS)–Wildlife Services (WS) program is authorized and directed to protect American agriculture and other resources from damage associated with wildlife. WS provides assistance to the aviation community to assess and manage wildlife hazards at airports. The primary statutory authority by which WS operates is the Animal Damage Control Act of March 2, 1931, as amended (7 United States Code (U.S.C.) 426-426c; 46 Stat. 1468). WS has the authority to manage migratory bird damage as specified in the U.S.C. In addition, the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988 (Public Law 100202) authorizes and directs the Secretary of Agriculture to cooperate with states, individuals, public and private agencies, organizations and institutions in the control of nuisance mammals and birds deemed injurious to the public. WS activities are conducted in cooperation with other federal, state and local agencies, and private organizations and individuals. Authority to conduct these activities on airports is typically granted to WS through contracts and agreements with airports and transportation authorities.

A Memorandum of Understanding (MOU) was established in April of 1989 between the United Stated Department of Transportation, Federal Aviation Administration (FAA) and WS. This MOU establishes a cooperative relationship between the FAA and WS for resolving animal hazards to aviation herein that benefits public safety. Wildlife recommendations and information provided is in accordance with the safety guidelines set forth by the FAA pertaining to air traffic safety in relation to FFZ and its users. An MOU was also established between the United States Department of Defense and WS. This MOU is to establish procedures for planning, scheduling and conducting animal damage control activities, on United States military installations within the United States and its territories. These MOU's established that WS has the wildlife damage management expertise and may provide technical and operational assistance (when funded by an airport or other entity) to alleviate wildlife hazards at airports.

RESPONSE:

Thank you for your comment. The preferred alternative, Alternative O, was modified to remove vegetation within the Critical Zone. This modification is reflected in the alternative description found in Chapter 3, of the Final Environmental Impact Statement. That description will show there are no wetlands within the Critical Zone, and that the constructed low flow channel is well outside of the Critical Zone.

The U.S. Army Corps of Engineers will take the enclosed plant list into consideration during the design phase and will continue to coordinate with your staff to alleviate the risk of wildlife hazards.

A Memorandum of Agreement (MOA) was established in July of 2003 between the FAA, US Air Force, US Army, US Environmental Protection Agency, US Fish and Wildlife Service and USDA. These federal agencies recognize the expertise of WS in addressing wildlife damage issues through a cooperative approach in assessing and managing wildlife hazards. This MOA establishes a cooperative agreement to coordinate missions to more effectively address existing and future environmental concerns that contribute to aircraft-wildlife strikes throughout the United States.

The threat to public safety from aircraft collisions with wildlife is increasing. Wildlife hazards at airports can result in loss of life, injury to passengers, crew, and people on the ground, and costly destruction and damage to aircraft, aircraft components, navigational aids, and airport facilities. Environmental losses from wildlife hazards include fuel dumping and loss of threatened and endangered wildlife species. Indirect impacts of wildlife hazards at airports are economic losses associated with modified flight schedules, closed runways, loss of flying time, passenger delays, and costs associated with emergency and repair procedures. Based on analysis of 13 years of wildlife strike data (1990-2002), the FAA estimates that the costs of wildlife strikes to the U.S. civil aviation industry is in excess of 364,626 hours/year of aircraft down time and $170.89 million/year in direct monetary losses and in associated costs. The risk, frequency, and potential severity of wildlife-aircraft collisions has increased, and will likely continue to increase due to three factors. 1) The trend toward more efficient and quieter 2-engined jet aircraft, and away from 3- and 4-engined aircraft, 2) Increasing population size and distribution of wildlife species that are especially hazardous to aircraft, and 3) Continued increase in air traffic.

Falcon Field Airport receives turbine-powered engine aircraft thereby qualifying within the 10,000 foot (3,048 meters) siting criteria described under the FAA Advisory Circular 150/5200-33, section 1-3b. The FAA Advisory Circular 150/5200-33 recommends separations when siting any wildlife attractant near aircraft movement areas. The distance between the wildlife attractant and the airport's aircraft movement areas, loading ramps, or aircraft parking areas should be 10,000 feet for airports serving turbine-powered aircraft. This area is referred to by WS as the Critical Zone.

A distance of five (5) statute miles (8,047 meters) is recommended for the approach or departure airspace if the wildlife attractant may cause hazardous wildlife movement into or across that airspace. This area, referred to by WS as the Expanded Critical Zone, contains the area five (5) statute miles off of each runway end. The Expanded Critical Zone reflects the boundaries defined by the FAA Advisory Circular 150/5200-33. Wildlife recommendations and information provided will be in accordance with the safety guidelines set forth by the FAA pertaining to air traffic safety.

Both the Critical Zone the Expanded Critical Zone should be designed and managed in a manner that will not support wildlife deemed hazardous to aviation. There is no distinction between the 10,000 foot area and the 5 mile approach and departure area in the AC 150/5200-33, Sections 1-3. A portion of the proposed VSA is in the Critical Zone. The boundaries of this survey were from the northwest area of the 4L runway and Taxiway E.

There are several characteristics which make birds more of a hazard for an airport environment. First is the overall population present in the environment. A flock of 500 blackbirds is more hazardous than a single individual of the same species. However, larger, dense birds present significant hazards even when found singly in the airport environment. Other characteristics such as flying behavior (i.e., soaring) or young and inexperienced birds also present a significant concern in the airport environment.

The purpose of the VSA plan is "to increase the diversity of native plants and animals as well as to sustain larger populations of key indicator species or more biologically desirable species". WS recommends USACE actively monitor the new habitat for wildlife hazards close to FFZ. If hazards do occur, the agencies will make every effort to undertake actions that will alleviate these hazards.

Flood irrigation should not be implemented within VSA. Standing water attracts waterfowl and large wading birds such as egrets, herons and can be a vector problem. Drip irrigation is recommended for this area. USACE should also ensure that wetlands are placed outside of the siting criteria.

Outside the Critical Zone, any ponds will be small, deep, steep sided, and irregular shaped which should help reduce the number and diversity of wildlife. No part of the will contain islands that provide excellent nesting areas for waterfowl. A Western grebe, an aquatic bird, was struck at FFZ in April, 1998 and caused substantial damage to a Bell 407, a large helicopter.

Page 4-36 states that low-flow channels "do not represent a significant value to wildlife, and are rare in the project." Low flow channels can be attractants for blackbirds such as red-winged blackbirds and yellow-headed blackbirds as well as wading birds and waterfowl. Low flow channels will need to be constructed with the greatest depth and steepest banks feasible to discourage the gathering of wading birds. The channel will need to be constructed with stabilized banks to minimize vegetative growth that could support birds considered hazardous to aviation. Vegetative growth that attracts hazardous wildlife should be cleared out on a regular basis.

Per an agreement dated March 29, 2001 between USACE and the FAA, within the Critical Zone of Phoenix International Airport, xeriscape landscaping will be utilized. WS expects that USACE would implement the same type of restrictions for FFZ. Other restrictions for that area should include no aquatic strand habitat within the

Critical Zone. Plants should not exceed 15 feet in height and active monitoring will be conducted for removal of any large trees. Wildlife Services recommends incorporating plants from the WS Recommended Plant List which offers landscaping options within the siting area of FFZ. Recommended trees within the aforementioned zone should be species native to southwestern deserts and must be maintained at a maximum of 15 feet (4.5 meters) in height to reduce the attractiveness to wildlife that conflict with airport safety. VSA should adopt a policy of complete eradication of non-native plant species, such as salt cedar and palm. The policy will also include active monitoring and removal of any large trees, such as cottonwoods, that start to grow as "volunteers".

Development of the VSA will change the land use around FFZ. Because major changes are expected through the creation of additional wildlife habitat, increased water availability, changes in wildlife patterns and movements, as well as species diversity and abundance, are likely to occur. Monitoring by a wildlife hazard biologist of wildlife in the area is recommended, since changing habitat may decrease habitat preference for one species but may increase its attractiveness to another. Monitoring will also be beneficial to determine if unforeseen wildlife attractants such as irrigation systems or structure design arise.

VSA representatives should continue to consult and or contract with a wildlife hazard biologist to ensure wildlife hazards do not occur. All plans and drafts should be presented to the FAA and the wildlife hazard biologist for review to make certain they are within the guidelines of the AC 150/5200-33. A wildlife hazard management plan should be compiled in order to manage wildlife hazards if or when they arise. Once the U.S. Army Corps of Engineers completes the project, the new project managers will have the wildlife hazard biologist and the management plan to help follow the guidelines established during the construction.

Thank you for the opportunity to comment on the VSA. WS looks forward to working with the U.S. Army Corps of Engineers in the spirit of the MOA. If you have any questions or wish to discuss any of these items further, please contact Mr. David Bergman, State Director, at (602)870-2081.

Sincerely,

Diane Witerboer

Diane Winterboer
Wildlife Biologist

Cc: David Bergman, WS, State Director
William Long, FAA Western Pacific Region
Ed Cleary, FAA Safety and Compliance
Gordon Haws, City of Mesa, Engineer Design
Mark Meyers, Falcon Field Airport Director

Attachments

USDA-Wildlife Services Recommended Plant List

The USDA-Wildlife Services recommends incorporating desert xeriscape within the critical zone (10,000 foot radius) of the airports in southern Arizona. Desert xeriscape should include plant species native to southwestern deserts and comprise a simple, uncluttered appearance (i.e., cacti, yuccas, dwarf varieties of desert trees, shrubs, ground cover and rocks). Trees should be open, fairly transparent and maintained at less than 15 ft in height to minimize roosting potential for doves, pigeons and blackbirds. Conversion of the airport environment to desert xeriscape should help reduce the potential for attracting wildlife considered hazardous to aviation operations. Although desert xeriscaping is the best option for airports located in arid environments, it should be noted that many of these desert plant species produce seed or bean pods which may attract birds or mammals for feeding opportunities. Seed and bean pods should be removed after they have dropped from the plant. Proper maintenance of the landscaped area should reduce the wildlife foraging potential.

TREES

Acacia berlandieri (Berlandier's acacia)
Acacia coulteri (Coulter's acacia)
Acacia crassifolia (Butterfly-leaf acacia)
Acacia cultriformis (Knife acacia)
Acacia farnesiana (Southwestern sweet acacia)
Acacia greggii (Catclaw acacia)
Acacia pennatula (Sierra Madre acacia, Feather acacia)
Acacia rigidula (Black-brush acacia)
Acacia smallii (Sweet acacia)
Acacia willardiana (Palo blanco)
Brongniartia alamosana (Alamos pea tree)
Bursera fagaroides (White bark tree)
Bursera hindsiana (Red elephant tree)
Bursera laxiflora (Torote prieto)
Bursera microphylla (Little-leaf bursera)
Caesalpinia platyloba (Palo Colorado)
Cercidium microphyllum (Foothills palo verde)
Cercidium sonorae (Hybrid Sonoran palo verde)
- Desert Museum Palo Verde (hybrid of *Parkinsonia aculeata, Cercidium floridium, and C. microphyllum)*
Cercis occidentalis (Western redbud)
Chilopsis linearis arcuata (Western desert willow)
Fraxinus greggii (Greg ash)
Fraxinus gooddingii (Goodding ash)
Lysiloma watsonii divaricatum (Rincon Mountains feather tree)
Olneya tesota (Ironwood tree) – keep trimmed to 15ft
Pithecellobium leucospermum (Palo pinto)
Prosopis glandulosa torreyana (Western honey mesquite) – keep trimmed to 15ft, clean up pods
Prosopis pubescens (Screwbean mesquite) – keep trimmed to 15ft , clean up pods
Prosopis velutina (Velvet mesquite) – keep trimmed to 15ft, clean up pods

USDA-Wildlife Services Recommended Plant List

Robinia neomexicana (New Mexico locust)
Tabebuia impetiginosa (Lavender trumpet tree) – keep trimmed to 15ft.
Thevetia thevetioides (Giant thevetia)
Ungnadia speciosa (Mexican buckeye)

SHRUBS

Abutilon palmeri (Sonoran flowering maple)
Acacia angustissima (Fern acacia, Hirta)
Acacia cochliacantha (Boat-spine acacia)
Acacia constricta (White-thorn acacia, Mescat acacia)
Aloysia wrightii (Wright's bee bush)
Ambrosia deltoidea (Bursage, Rabbit bush)
Ambrosia dumosa (White bursage, Burro weed)
Anisacanthus thurberi (Desert honeysuckle)
Asclepias linaria (Pineleaf milkweed)
Atriplex canescens (Four-wing saltbush)
Atriplex lentiformis breweri (Brewer's saltbush)
Atriplex polycarpa (Desert saltbush)
Baccharis sarothroides (Desert broom)
Berberis harrisoniana (Harrison barberry)
Caesalpinia gilliesii (Yellow bird of paradise)
Caesalpinia mexicana (Mexican bird of paradise)
Caesalpinia pulcherrima (Red bird of paradise)
Calliandra californica (Baja fairy duster)
Calliandra eriophylla (Fairy duster)
Chrysactinia mexicana (Domianita daisy)
Coccoloba goldmannii (Sonoran sea grape)
Condalia correllii (Mexican blue wood)
Cordia parvifolia (Little-leaf cordia)
Dalea bicolor argyrea (Silver dalea)
Dalea frutescens (Black dalea)
Dalea pulchra (Bush dalea)
Dalea wislizenii (Wislizenii's dalea)
Encelia farinosa (Brittle bush)
Ephedra viridis (Mormon tea)
Ericameria laricifolia (Turpentine bush)
Eysenhardtia orthocarpa (Kidneywood)
Jaquinia pungens (Jaquinia)
Jatropha cardiophylla (Limberbrush)
Justicia californica (Chuparosa)
Justicia candicans (Red Mexican honeysuckle)
Justicia spicigera (Mexican honeysuckle)
Lantana species (Trailing lavender, Desert lantana, Texas orange-flowered lantana)
Lantana velutina (White lantana)

USDA-Wildlife Services Recommended Plant List

Larrea divaricata tridentate (Creosote bush)
Leucophyllum candidum (Cenizo, Thunder cloud sage)
Leucophyllum frutescens (Texas sage)
Leucophyllum laevigatum (Chihuahuan sage)
Leucophyllum langmaniae (Cinnamon sage)
Pelisiphonia brachysiphon (Rock trumpet)
Penstemon barbatus (Scarlet penstemon)
Penstemon eatonii (Eaton's penstemon)
Penstemon parryi (Parry's penstemon)
Penstemon pseudospectabilis (Canyon penstemon)
Penstemon superbus (Superb penstemon)
Psilostrophe cooperi (Paper flower)
Rhus choriophylla (Chihuahuan leather-leaf sumac)
Rhus virens (Huachuca sumac)
Ruellia brittoniana 'Katie' (Mexican barrio ruellia
Ruellia californica (Sonoran desert ruellia)
Ruellia peninsularis (Baja ruellia)
Salvia chamaedryoides (Blue Chihuahuan sage)
Salvia clevelandii (Cleveland sage)
Salvia coccinea (Cherry red sage)
Salvia farinacea (Mealy cup sage)
Salvia greggii (Red Chihuahuan sage)
Senecio salignus (Willow groundsell)
Senna lindheimeriana (Lindheimer senna)
Simmondsia chinensis (Jojoba)
Sophora arizonica (Arizona mescal bean)
Sphaeralcea ambigua (Globe mallow)
Tagetes palmeri or *Tagetes lemmonii* (Mount Lemmon marigold)
Tecoma stans angustata (Narrow-leaf yellow bells)
Vallesia baileyana (Vallesia)
Viguiera deltoidea (Golden eye)

SUCCULENTS/CACTI

Agave americana (Century plant)
Agave colorata (Mescal ceniza)
Agave deserti (Desert agave)
Agave geminiflora (Twin-flowered agave)
Agave lechuguilla (Lechuguilla)
Agave lophantha (Holly avage)
Agave murpheyi (Murphy's agave)
Agave ocahui (Ocahui agave)
Agave palmeri (Palmer's agave)
Agave parryi huachucensis (Huachuca agave)
Agave parryi truncate (Gentry's agave)

USDA-Wildlife Services Recommended Plant List

Agave vilmoriniana (Octopus agave)
Aquilegia chrysantha (Golden columbine)
Asclepias subulata (Desert milkweed)
Carnegia gigantea (Saguaro cactus)
Dasylirion wheeleri (Desert spoon)
Echinocactus grusonii (Golden barrel cactus)
Echinocereus engelmannii (Hedgehog cactus)
Ferocactus cyclindraceus (Compass barrel cactus)
Ferocactus wislizenii (Fishhook barrel cactus)
Fouquieria splendens (Ocotillo)
Gaura lindheimeri (Pink gaura)
Hesperaloe funifera (Giant hesperaloe)
Hesperaloe nocturna (Night-blooming hesperaloe)
Hesperaloe parviflora (Red yucca)
Opuntia acanthocarpa (Buckhorn cholla)
Opuntia basilaris (Beaver tail prickly pear)
Opuntia ficus-indica (India fig)
Opuntia engelmannii (Engelmann's prickly pear)
Opuntia microdasys (Bunny ears)
Opuntia phaecantha (Sprawling Engelmann prickly pear)
Opuntia violacea v. santa-rita (Purple prickly pear)
Stenocereus thurberi (Organ pipe cactus)
Yucca baccata (Banana yucca)
Yucca glauca (Narrow-leaf yucca)
Yucca schidigera (Mojave yucca)
Yucca rigida (Blue yucca)

ACCENTS

Argemone platyceras (Prickly poppy)
Asclepias subulata (Desert milkweed)
Baileya multiradiata (Desert marigold)
Calliandra californica (Baja fairy duster)
Calliandra eriophylla (Fairy duster)
Dyssodia pentachaeta (Golden dyssodia)
Gaura lindheimeri (Pink gaura)
Hymenoxys acaulis (Angelita daisy)
Mascagnia lilacina (Lilac orchid vine)
Melampodium leucanthum (Blackfoot daisy)
Muhlenbergia capillaries (Pink mulhy)
Oenothera berlandieri (Mexican evening primrose)
Zexmenia hispida (Orange zexmenia)

GROUND COVER

USDA-Wildlife Services Recommended Plant List

Baccharis hybrid 'centennial' (Desert broom hybrid)
Dalea greggii (Trailing indigo bush)
Dyssodia pentachaeta (Golden dyssodia)
Lantana species (Trailing lavender, Desert lantana, Texas orange-flowered lantana)
Melampodium leucanthum (Blackfoot daisy)
Oenothera berlandieri (Mexican evening primrose)
Oenothera caespitosa (White primrose)
Oenothera stubbei (Saltillo primrose)
Stachys coccinea (Texas betony)
Verbena gooddingii (Goodding verbena)
Verbena rigida (Sandpaper verbena)
Zauschneria californica (Hummingbird trumpet bush)
Zinnia acerosa (Desert zinnia)
Zinnia grandiflora (Rocky Mountain zinnia)

Note: This plant list was designed to serve as a template for future landscaping projects within the 10,000 foot radius airports in southern Arizona. This is not a complete list of all plant species that may be acceptable within the critical zones. If other species are to be used within the 10,000 foot radius, they should first be approved by a Wildlife Services wildlife biologist. In addition, this plant list should be considered as continually evolving. As the scientific community continues to gain a better understanding of wildlife relationships with various habitats, individual plant species may be removed from or added to this list.

U.S. Department
of Transportation

**Federal Aviation
Administration**

Advisory Circular

Subject: HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS

Date: 5/1/97
Initiated by: AAS-310 and APP-600

AC No: 150/5200-33
Change:

1. **PURPOSE.** This advisory circular (AC) provides guidance on locating certain land uses having the potential to attract hazardous wildlife to or in the vicinity of public-use airports. It also provides guidance concerning the placement of new airport development projects (including airport construction, expansion, and renovation) pertaining to aircraft movement in the vicinity of hazardous wildlife attractants. Appendix 1 provides definitions of terms used in this AC.

2. **APPLICATION.** The standards, practices, and suggestions contained in this AC are recommended by the Federal Aviation Administration (FAA) for use by the operators and sponsors of all public-use airports. In addition, the standards, practices, and suggestions contained in this AC are recommended by the FAA as guidance for land use planners, operators, and developers of projects, facilities, and activities on or near airports.

3. **BACKGROUND.** Populations of many species of wildlife have increased markedly in the last few years. Some of these species are able to adapt to human-made environments, such as exist on and around airports. The increase in wildlife populations, the use of larger turbine engines, the increased use of twin-engine aircraft, and the increase in air-traffic, all combine to increase the risk, frequency, and potential severity of wildlife-aircraft collisions.

Most public-use airports have large tracts of open, unimproved land that are desirable for added margins of safety and noise mitigation. These areas can present potential hazards to aviation because they often attract hazardous wildlife. During the past century, wildlife-aircraft strikes have resulted in the loss of hundreds of lives world-wide, as well as billions of dollars worth of aircraft damage. Hazardous wildlife attractants near airports could jeopardize future airport expansion because of safety considerations.

DAVID L. BENNETT
Director, Office of Airport Safety and Standards

SECTION 1. HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS.

1-1. TYPES OF HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS. Human-made or natural areas, such as poorly-drained areas, retention ponds, roosting habitats on buildings, landscaping, putrescible-waste disposal operations, wastewater treatment plants, agricultural or aquacultural activities, surface mining, or wetlands, may be used by wildlife for escape, feeding, loafing, or reproduction. Wildlife use of areas within an airport's approach or departure airspace, aircraft movement areas, loading ramps, or aircraft parking areas may cause conditions hazardous to aircraft safety.

All species of wildlife can pose a threat to aircraft safety. However, some species are more commonly involved in aircraft strikes than others. Table 1 lists the wildlife groups commonly reported as being involved in damaging strikes to U.S. aircraft from 1993 to 1995.

Table 1. Wildlife Groups Involved in Damaging Strikes to Civilian Aircraft, USA, 1993-1995.

Wildlife Groups	**Percent involvement in reported damaging strikes**
Gulls	28
Waterfowl	28
Raptors	11
Doves	6
Vultures	5
Blackbirds-Starlings	5
Corvids	3
Wading birds	3
Deer	11
Canids	1

1-2. LAND USE PRACTICES. Land use practices that attract or sustain hazardous wildlife populations on or near airports can significantly increase the potential for wildlife-aircraft collisions. FAA recommends against land use practices, within the siting criteria stated in 1-3, that attract or sustain populations of hazardous wildlife within the vicinity of airports or cause movement of hazardous wildlife onto, into, or across the approach or departure airspace, aircraft movement area, loading ramps, or aircraft parking area of airports.

Airport operators, sponsors, planners, and land use developers should consider whether proposed land uses, including new airport development projects, would increase the wildlife hazard. Caution should be exercised to ensure that land use practices on or near airports do not enhance the attractiveness of the area to hazardous wildlife.

1-3. SITING CRITERIA. FAA recommends separations when siting any of the wildlife attractants mentioned in Section 2 or when planning new airport development projects to accommodate aircraft movement. The distance between an airport's aircraft movement areas, loading ramps, or aircraft parking areas and the wildlife attractant should be as follows:

a. Airports serving piston-powered aircraft. A distance of 5,000 feet is recommended.

b. Airports serving turbine-powered aircraft. A distance of 10,000 feet is recommended.

c. Approach or Departure airspace. A distance of 5 statute miles is recommended, if the wildlife attractant may cause hazardous wildlife movement into or across the approach or departure airspace.

SECTION 2. LAND USES THAT ARE INCOMPATIBLE WITH SAFE AIRPORT OPERATIONS.

2-1. GENERAL. The wildlife species and the size of the populations attracted to the airport environment are highly variable and may depend on several factors, including land-use practices on or near the airport. It is important to identify those land use practices in the airport area that attract hazardous wildlife. This section discusses land use practices known to threaten aviation safety.

2-2. PUTRESCIBLE-WASTE DISPOSAL OPERATIONS. Putrescible-waste disposal operations are known to attract large numbers of wildlife that are hazardous to aircraft. Because of this, these operations, when located within the separations identified in the sitting criteria in 1-3 are considered incompatible with safe airport operations.

FAA recommends against locating putrescible-waste disposal operations inside the separations identified in the siting criteria mentioned above. FAA also recommends against new airport development projects that would increase the number of aircraft operations or that would accommodate larger or faster aircraft, near putrescible-waste disposal operations located within the separations identified in the siting criteria in 1-3.

2-3. WASTEWATER TREATMENT FACILITIES. Wastewater treatment facilities and associated settling ponds often attract large numbers of wildlife that can pose a threat to aircraft safety when they are located on or near an airport.

a. New wastewater treatment facilities. FAA recommends against the construction of new wastewater treatment facilities or associated settling ponds within the separations identified in the siting criteria in 1-3. During the siting analysis for wastewater treatment facilities, the potential to attract hazardous wildlife should be considered if an airport is in the vicinity of a proposed site. Airport operators should voice their opposition to such sitings. In addition, they should consider the existence of wastewater treatment facilities when evaluating proposed sites for new airport development projects and avoid such sites when practicable.

b. Existing wastewater treatment facilities. FAA recommends correcting any wildlife hazards arising from existing wastewater treatment facilities located on or near airports without delay, using appropriate wildlife hazard mitigation techniques. Accordingly, measures to minimize hazardous wildlife attraction should be developed in consultation with a wildlife damage management biologist. FAA recommends that wastewater treatment facility operators incorporate appropriate wildlife hazard mitigation techniques into their operating practices. Airport operators also should encourage those operators to incorporate these mitigation techniques in their operating practices.

c. Artificial marshes. Waste-water treatment facilities may create artificial marshes and use submergent and emergent aquatic vegetation as natural filters. These artificial marshes may be used by some species of flocking birds, such as blackbirds and waterfowl, for breeding or roosting activities. FAA recommends against establishing artificial marshes within the separations identified in the siting criteria stated in 1-3.

d. Wastewater discharge and sludge disposal. FAA recommends against the discharge of wastewater or sludge on airport property. Regular spraying of wastewater or sludge disposal on unpaved areas may improve soil moisture and quality. The resultant turf growth requires more frequent mowing, which in turn may mutilate or flush insects or small animals and produce straw. The maimed or flushed organisms and the straw can attract hazardous wildlife and jeopardize aviation safety. In addition, the improved turf may attract grazing wildlife such as deer and geese.

Problems may also occur when discharges saturate unpaved airport areas. The resultant soft, muddy conditions can severely restrict or prevent emergency vehicles from reaching accident sites in a timely manner.

e. Underwater waste discharges. The underwater discharge of any food waste, e.g., fish processing offal, that could attract scavenging wildlife is not recommended within the separations identified in the siting criteria in 1-3.

2-4. WETLANDS.

a. Wetlands on or near Airports.

(1) Existing Airports. Normally, wetlands are attractive to many wildlife species. Airport operators with wetlands located on or nearby airport property should be alert to any wildlife use or habitat changes in these areas that could affect safe aircraft operations.

(2) Airport Development. When practicable, the FAA recommends siting new airports using the separations identified in the siting criteria in 1-3. Where alternative sites are not practicable or when expanding existing airports in or near wetlands, the wildlife hazards should be evaluated and minimized through a wildlife management plan prepared by a wildlife damage management biologist, in consultation with the U.S. Fish and Wildlife Service (USFWS) and the U.S. Army Corps of Engineers (COE).

NOTE: If questions exist as to whether or not an area would qualify as a wetland, contact the U.S. Army COE, the Natural Resource Conservation Service, or a wetland consultant certified to delineate wetlands.

b. Wetland mitigation. Mitigation may be necessary when unavoidable wetland disturbances result from new airport development projects. Wetland mitigation should be designed so it does not create a wildlife hazard.

(1) FAA recommends that wetland mitigation projects that may attract hazardous wildlife be sited outside of the separations identified in the siting criteria in 1-3. Wetland mitigation banks meeting these siting criteria offer an ecologically sound approach to mitigation in these situations.

(2) Exceptions to locating mitigation activities outside the separations identified in the siting criteria in 1-3 may be considered if the affected wetlands provide unique ecological functions, such as critical habitat for threatened or endangered species or ground water recharge. Such mitigation must be compatible with safe airport operations. Enhancing such mitigation areas to attract hazardous wildlife should be avoided. On-site mitigation plans may be reviewed by the FAA to determine compatibility with safe airport operations.

(3) Wetland mitigation projects that are needed to protect unique wetland functions (see 2-4.b.(2)), and that must be located in the siting criteria in 1-3 should be identified and evaluated by a wildlife damage management biologist before implementing the mitigation. A wildlife damage management plan should be developed to reduce the wildlife hazards.

NOTE: AC 150/5000-3, *Address List for Regional Airports Division and Airports District/Field Offices*, provides information on the location of these offices.

2-5. DREDGE SPOIL CONTAINMENT AREAS. FAA recommends against locating dredge spoil containment areas within the separations identified in the siting criteria in 1-3, if the spoil contains material that would attract hazardous wildlife.

SECTION 3. LAND USES THAT MAY BE COMPATIBLE WITH SAFE AIRPORT OPERATIONS.

3-1. GENERAL. Even though they may, under certain circumstances, attract hazardous wildlife, the land use practices discussed in this section have flexibility regarding their location or operation and may even be under the airport operator's or sponsor's control. In general, the FAA does not consider the activities discussed below as hazardous to aviation if there is no apparent attraction to hazardous wildlife, or wildlife hazard mitigation techniques are implemented to deal effectively with any wildlife hazard that may arise.

3-2. ENCLOSED WASTE FACILITIES. Enclosed trash transfer stations or enclosed waste handling facilities that receive garbage indoors; process it via compaction, incineration, or similar manner; and remove all residue by enclosed vehicles, generally would be compatible, from a wildlife perspective, with safe airport operations, provided they are not located on airport property or within the runway protection zone (RPZ). No putrescible-waste should be handled or stored outside at any time, for any reason, or in a partially enclosed structure accessible to hazardous wildlife.

Partially enclosed operations that accept putrescible-waste are considered to be incompatible with safe airport operations. FAA recommends these operations occur outside the separations identified in the siting criteria in 1-3.

3-3. RECYCLING CENTERS. Recycling centers that accept previously sorted, non-food items such as glass, newspaper, cardboard, or aluminum are, in most cases, not attractive to hazardous wildlife.

3-4. COMPOSTING OPERATIONS ON AIRPORTS. FAA recommends against locating composting operations on airports. However, when they are located on an airport, composting operations should not be located closer than the greater of the following distances: 1,200 feet from any aircraft movement area, loading ramp, or aircraft parking space; or the distance called for by airport design requirements. This spacing is intended to prevent material, personnel, or equipment from penetrating any Obstacle Free Area (OFA), Obstacle Free Zone (OFZ), Threshold Siting Surface (TSS), or Clearway (see AC 150/5300-13, *Airport Design*). On-airport disposal of compost by-products is not recommended for the reasons stated in 2-3.d.

a. Composition of material handled. Components of the compost should never include any municipal solid waste. Non-food waste such as leaves, lawn clippings, branches, and twigs generally are not considered a wildlife attractant. Sewage sludge, wood-chips, and similar material are not municipal solid wastes and may be used as compost bulking agents.

b. Monitoring on-airport composting operations. If composting operations are to be located on airport property, FAA recommends that the airport operator monitor composting operations to ensure that steam or thermal rise does not affect air traffic in any way. Discarded leaf disposal bags or other debris must not be allowed to blow onto any active airport area. Also, the airport operator should reserve the right to stop any operation that creates unsafe, undesirable, or incompatible conditions at the airport.

3-5. ASH DISPOSAL. Fly ash from resource recovery facilities that are fired by municipal solid waste, coal, or wood, is generally considered not to be a wildlife attractant because it contains no putrescible matter. FAA generally does not consider landfills accepting only fly ash to be wildlife attractants, if those landfills: are maintained in an orderly manner; admit no putrescible-waste of any kind; and are not co-located with other disposal operations.

Since varying degrees of waste consumption are associated with general incineration, FAA classifies the ash from general incinerators as a regular waste disposal by-product and, therefore, a hazardous wildlife attractant.

3-6. CONSTRUCTION AND DEMOLITION (C&D) DEBRIS LANDFILLS. C&D debris (Class IV) landfills have visual and operational characteristics similar to putrescible-waste disposal sites. When co-located with putrescible-waste disposal operations, the probability of hazardous wildlife attraction to C&D landfills increases because of the similarities between these disposal activities.

FAA generally does not consider C&D landfills to be hazardous wildlife attractants, if those landfills: are maintained in an orderly manner; admit no putrescible-waste of any kind; and are not co-located with other disposal operations.

3-7. WATER DETENTION OR RETENTION PONDS. The movement of storm water away from runways, taxiways, and aprons is a normal function on most airports and is necessary for safe aircraft operations. Detention ponds hold storm water for short periods, while retention ponds hold water indefinitely. Both types of ponds control runoff, protect water quality, and can attract hazardous wildlife. Retention ponds are more attractive to hazardous wildlife than detention ponds because they provide a more reliable water source.

To facilitate hazardous wildlife control, FAA recommends using steep-sided, narrow, linearly-shaped, rip-rap lined, water detention basins rather than retention basins. When possible, these ponds should be placed away from aircraft movement areas to minimize aircraft-wildlife interactions. All vegetation in or around detention or retention basins that provide food or cover for hazardous wildlife should be eliminated.

If soil conditions and other requirements allow, FAA encourages the use of underground storm water infiltration systems, such as French drains or buried rock fields, because they are less attractive to wildlife.

3-8. LANDSCAPING. Wildlife attraction to landscaping may vary by geographic location. FAA recommends that airport operators approach landscaping with caution and confine it to airport areas not associated with aircraft movements. All landscaping plans should be reviewed by a wildlife damage management biologist. Landscaped areas should be monitored on a continuing basis for the presence of hazardous wildlife. If hazardous wildlife is detected, corrective actions should be implemented immediately.

3-9. GOLF COURSES. Golf courses may be beneficial to airports because they provide open space that can be used for noise mitigation or by aircraft during an emergency. On-airport golf courses may also be a concurrent use that provides income to the airport.

Because of operational and monetary benefits, golf courses are often deemed compatible land uses on or near airports. However, waterfowl (especially Canada geese) and some species of gulls are attracted to the large, grassy areas and open water found on most golf courses. Because waterfowl and gulls occur throughout the U.S., FAA recommends that airport operators exercise caution and consult with a wildlife damage management biologist when considering proposals for golf course construction or expansion on or near airports. Golf courses should be monitored on a continuing basis for the presence of hazardous wildlife. If hazardous wildlife is detected, corrective actions should be implemented immediately.

3-10. AGRICULTURAL CROPS. As noted above, airport operators often promote revenue-generating activities to supplement an airport's financial viability. A common concurrent use is agricultural crop production. Such use may create potential hazards to aircraft by attracting wildlife. Any proposed on-airport agricultural operations should be reviewed by a wildlife damage management biologist. FAA generally does not object to agricultural crop production on airports when: wildlife hazards are not predicted; the guidelines for the airport areas specified in 3-10.a-f. are observed; and the agricultural operation is closely monitored by the airport operator or sponsor to ensure that hazardous wildlife are not attracted.

NOTE: If wildlife becomes a problem due to on-airport agricultural operations, FAA recommends undertaking the remedial actions described in 3-10.f.

a. **Agricultural activities adjacent to runways.** To ensure safe, efficient aircraft operations, FAA recommends that no agricultural activities be conducted in the Runway Safety Area (RSA), OFA, and the OFZ (see AC 150/5300-13).

b. **Agricultural activities in areas requiring minimum object clearances.** Restricting agricultural operations to areas outside the RSA, OFA, OFZ, and Runway Visibility Zone (RVZ) (see AC 150/5300-13) will normally provide the minimum object clearances required by FAA's airport design standards. FAA recommends that farming operations not be permitted within areas critical to the proper operation of localizers, glide slope indicators, or other visual or electronic navigational aids. Determinations of minimal areas that must be kept free of farming operations should be made on a case-by-case basis. If navigational aids are present, farm leases for on-airport agricultural activities should be coordinated with FAA's Airway Facilities Division, in accordance with FAA Order 6750.16, *Siting Criteria for Instrument Landing Systems.*

NOTE: Crop restriction lines conforming to the dimensions set forth in Table 2 will normally provide the minimum object clearance required by

FAA airport design standards. The presence of navigational aids may require expansion of the restricted area.

c. **Agricultural activities within an airport's approach areas.** The RSA, OFA, and OFZ all extend beyond the runway shoulder and into the approach area by varying distances. The OFA normally extends the farthest and is usually the controlling surface. However, for some runways, the TSS (see AC 150/5300-13, Appendix 2) may be more controlling than the OFA. The TSS may not be penetrated by any object. The minimum distances shown in Table 2 are intended to prevent penetration of the OFA, OFZ, or TSS by crops or farm machinery.

NOTE: Threshold Siting standards should not be confused with the approach areas described in Title 14, Code of Federal Regulations, Part 77, (14 CFR 77), *Objects Affecting Navigable Airspace*.

d. **Agricultural activities between intersecting runways.** FAA recommends that no agricultural activities be permitted within the RVZ. If the terrain is sufficiently below the runway elevation, some types of crops and equipment may be acceptable. Specific determinations of what is permissible in this area requires topographical data. For example, if the terrain within the RVZ is level with the runway ends, farm machinery or crops may interfere with a pilot's line-of-sight in the RVZ.

e. **Agricultural activities in areas adjacent to taxiways and aprons.** Farming activities should not be permitted within a taxiway's OFA. The outer portions of aprons are frequently used as a taxilane and farming operations should not be permitted within the OFA. Farming operations should not be permitted between runways and parallel taxiways.

f. **Remedial actions for problematic agricultural activities.** If a problem with hazardous wildlife develops, FAA recommends that a professional wildlife damage management biologist be contacted and an on-site inspection be conducted. The biologist should be requested to determine the source of the hazardous wildlife attraction and suggest remedial action. Regardless of the source of the attraction, prompt remedial actions to protect aviation safety are recommended. The remedial actions may range from choosing another crop or farming technique to complete termination of the agricultural operation.

Whenever on-airport agricultural operations are stopped due to wildlife hazards or annual harvest, FAA recommends plowing under all crop residue and harrowing the surface area smooth. This will reduce or eliminate the area's attractiveness to foraging wildlife. FAA recommends that this requirement be written into all on-airport farm use contracts and clearly understood by the lessee.

Table 2. Minimum Distances Between Certain Airport Features And Any On-Airport Agriculture Crops.

Aircraft Approach Category And Design Group [1]	Distance In Feet From Runway Centerline To Crop		Distance In Feet From Runway End To Crop		Distance In Feet From Centerline Of Taxiway To Crop	Distance In Feet From Edge Of Apron To Crop
	Visual & ≥ ¾ mile	< ¾ mile	Visual & ≥ ¾ mile	< ¾ mile		
Category A & B Aircraft						
Group I	200[2]	400	300[3]	600	45	40
Group II	250	400	400[3]	600	66	58
Group III	400	400	600	800	93	81
Group IV	400	400	1,000	1,000	130	113
Category C, D & E Aircraft						
Group I	530[3]	575[3]	1,000	1,000	45	40
Group II	530[3]	575[3]	1,000	1,000	66	58
Group III	530[3]	575[3]	1,000	1,000	93	81
Group IV	530[3]	575[3]	1,000	1,000	130	113
Group V	530[3]	575[3]	1,000	1,000	160	138
Group VI	530[3]	575[3]	1,000	1,000	193	167

1. Design Groups are based on wing span, and Category depends on approach speed of the aircraft.

Group I:	Wing span up to 49 ft.	Category A:	Speed less than 91 knots
Group II	Wing span 49ft. up to 78 ft.	Category B:	Speed 91 knots up to 120 knots
Group III:	Wing span 79 ft. up to 117 ft.	Category C:	Speed 121 knots up to 140 knots
Group IV:	Wing span 118 ft. up to 170 ft.	Category D:	Speed 141 knots up to 165 knots
Group V:	Wing span 171 ft. up to 213 ft.	Category E:	Speed 166 knots or more
Group VI:	Wing span 214 ft. up to 261 ft.		

2. If the runway will only serve small airplanes (12,500 lb. And under) in Design Group I, this dimension may be reduced to 125 feet; however, this dimension should be increased where necessary to accommodate visual navigational aids that may be installed. For example farming operations should not be allowed within 25 feet of a Precision Approach Path Indicator (PAPI) light box.

3. These dimensions reflect the TSS as defined in AC 150/5300-13, Appendix 2. The TSS cannot be penetrated by any object. Under these conditions, the TSS is more restrictive than the OFA, and the dimensions shown here are to prevent penetration of the TSS by crops and farm machinery.

APPENDIX 1. DEFINITIONS OF TERMS USED IN THIS ADVISORY CIRCULAR.

1. **GENERAL.** This appendix provides definitions of terms used throughout this AC.

a. Aircraft movement area. The runways, taxiways, and other areas of an airport which are used for taxiing or hover taxiing, air taxiing, takeoff, and landing of aircraft exclusive of loading ramps and aircraft parking areas.

b. Airport operator. The operator (private or public) or sponsor of a public use airport.

c. Approach or departure airspace. The airspace, within 5 statute miles of an airport, through which aircraft move during landing or takeoff.

d. Concurrent use. Aeronautical property used for compatible non-aviation purposes while at the same time serving the primary purpose for which it was acquired; and the use is clearly beneficial to the airport. The concurrent use should generate revenue to be used for airport purposes (see Order 5190.6A, *Airport Compliance Requirements*, sect. 5h).

e. Fly ash. The fine, sand-like residue resulting from the complete incineration of an organic fuel source. Fly ash typically results from the combustion of coal or waste used to operate a power generating plant.

f. Hazardous wildlife. Wildlife species that are commonly associated with wildlife-aircraft strike problems, are capable of causing structural damage to airport facilities, or act as attractants to other wildlife that pose a wildlife-aircraft strike hazard.

g. Piston-use airport. Any airport that would primarily serve FIXED-WING, piston-powered aircraft. Incidental use of the airport by turbine-powered, FIXED-WING aircraft would not affect this designation. However, such aircraft should not be based at the airport.

h. Public-use airport. Any publicly owned airport or a privately-owned airport used or intended to be used for public purposes.

i. Putrescible material. Rotting organic material.

j. Putrescible-waste disposal operation. Landfills, garbage dumps, underwater waste discharges, or similar facilities where activities include processing, burying, storing, or otherwise disposing of putrescible material, trash, and refuse.

k. Runway protection zone (RPZ). An area off the runway end to enhance the protection of people and property on the ground (see AC 150/5300-13). The dimensions of this zone vary with the design aircraft, type of operation, and visibility minimum.

l. Sewage sludge. The de-watered effluent resulting from secondary or tertiary treatment of municipal sewage and/or industrial wastes, including sewage sludge as referenced in U.S. EPA's *Effluent Guidelines and Standards*, 40 C.F.R. Part 401.

m. Shoulder. An area adjacent to the edge of paved runways, taxiways, or aprons providing a transition between the pavement and the adjacent surface, support for aircraft running off the pavement, enhanced drainage, and blast protection (see AC 150/5300-13).

n. Turbine-powered aircraft. Aircraft powered by turbine engines including turbojets and turboprops but excluding turbo-shaft rotary-wing aircraft.

o. Turbine-use airport. Any airport that ROUTINELY serves FIXED-WING turbine-powered aircraft.

p. Wastewater treatment facility. Any devices and/or systems used to store, treat, recycle, or reclaim municipal sewage or liquid industrial wastes, including Publicly Owned Treatment Works (POTW), as defined by Section 212 of the Federal Water Pollution Control Act (P.L. 92-500) as amended by the Clean Water Act of 1977 (P.L. 95-576) and the Water Quality Act of 1987 (P.L. 100-4). This definition includes any pretreatment involving the reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant properties in wastewater prior to or in lieu of discharging or otherwise introducing such pollutants into a POTW. (See 40 C.F. R. Section 403.3 (o), (p), & (q)).

q. Wildlife. Any wild animal, including without limitation any wild mammal, bird, reptile, fish, amphibian, mollusk, crustacean, arthropod, coelenterate, or other invertebrate, including any part, product, egg, or offspring there of (50 CFR 10.12, *Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants*). As used in this AC, WILDLIFE includes feral animals and domestic animals while out of the control of their owners (14 CFR 139.3, *Certification and Operations: Land Airports Serving CAB-Certificated Scheduled Air Carriers Operating Large Aircraft (Other Than Helicopters)*).

r. Wildlife attractants. Any human-made structure, land use practice, or human-made or natural geographic feature, that can attract or sustain hazardous wildlife within the landing or departure airspace, aircraft movement area, loading ramps, or aircraft parking areas of an airport. These attractants can include but are not limited to architectural features, landscaping, waste disposal sites, wastewater treatment facilities, agricultural or aquacultural activities, surface mining, or wetlands.

s. Wildlife hazard. A potential for a damaging aircraft collision with wildlife on or near an airport (14 CFR 139.3).

2. RESERVED.

United States Department of the Interior
OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
1111 Jackson Street, Suite 520
Oakland, CA 94607

June 17, 2004

ER 04/357

Ms. Sarah Laughlin, Environmental Coordinator
c/o District Engineer
U. S. Army Corps of Engineers
Los Angeles District
Attention: CESPL-PD-RN
P. O. Box 532711
Los Angeles, CA 90053-2325

Subject: Draft Environmental Impact Statement (DEIS) for the
Va Shly'ay Akimel Ecosystem Restoration Feasibility Study, Maricopa County, AZ

Dear Ms. Laughlin,

The U. S. Department of the Interior has reviewed the Draft Environmental Impact Statement (DEIS) for the Va Shly'ay Akimel Ecosystem Restoration Feasibility Study in Maricopa County, Arizona. The DEIS addresses foreseeable environmental impacts from measures being investigated to include habitat restoration, channel realignment, and sand and gravel mining quarry pit reshaping within and around the Salt River, Maricopa County, Arizona.

The U. S. Army Corps of Engineers (Corps), Salt River Pima-Maricopa Indian Community (SRPMIC), and the City of Mesa have cooperated in conducting this feasibility study. The Corps is the lead Federal agency for this study.

The purpose of the Va Shly'ay Akimel Ecosystem Restoration Study (Study) is to produce an available riparian ecosystem that will support native wildlife and vegetation, which will improve the overall ecological health of the river and return the project area to a less degraded, more natural condition. The Study resulted in a report recommending that Congress authorize a project for implementation by the Corps to address the problems and needs of the study area.

Six alternatives, including the "no action" alternative, are evaluated in the DEIS. In general, the primary difference among alternatives is the acreage of each vegetation type and the resulting water necessary to maintain the vegetation. Other differences are the inclusion or exclusion of structural features, such as river channelization and bank stabilization.

RESPONSE:

Thank you for your comment.

The USACE researched the concern regarding the withdrawn lands. A Department of Interior, Bureau of Reclamation memo dated January 20, 1956, revokes the withdrawn lands identified in the memo. Therefore, there are no Bureau of Reclamation withdrawn lands in Reach 6, 7, 8 or 9.

The environmental commitments section details the additional studies that may be required to address historical features found within the project site. These studies will not be undertaken until a future phase. The USACE is in the early stages of complying with Section 106 of the National Historic Preservation Act (36 CFR 800). As we go through this process, any required studies will completed and fully coordinated with the State Historic Preservation Officer, the SRPMIC, City of Mesa, interested public, Native American tribes, and Federal, state and local agencies. If a memorandum of agreement is required to address impacts to National register sites, the USACE would welcome the Bureau of Reclamation to be a concurring party to the document.

This study area includes a 14-mile reach of the Salt River within the SRPMIC and City of Mesa, and its upper banks. The SRPMIC and the City of Mesa identified the need for restoration of the riparian ecosystem and of the river channel functions.

General Comments
The U. S. Fish and Wildlife Service (Service) has participated in the planning process for this study with the Corps. The Service has participated in an alternative formulation and incremental benefits analysis, prepared a Draft Fish and Wildlife Coordination Act Report, and completed section 7 consultation under the Endangered Species Act. Any potential concerns pertaining to fish and wildlife resources were resolved thanks to early coordination on this project. As a result, the DEIS accurately reflects the Service planning assistance and recommendations. Accordingly, the Service has no comments on the DEIS.

There are Bureau of Reclamation (Reclamation) withdrawn lands for the Salt River Project (SRP) in Reaches 6, 7, 8, and 9 of the project area. These lands need to be identified, and impacts to them described, in the EIS.

There are some historic canals on the south side of the river within the project area that are or were part of the SRP system. These are not identified and described in the DEIS. There are also some historical features linked to the canals, some of which are mentioned in the DEIS. A discussion of the historic archaeology needs to be included in the final EIS. Some of the historic sites may be property of the Federal Government. More research needs to be documented in the Final EIS in this area to ascertain what is present in the project area and its ownership, its significance, and the need for mitigation.

Reclamation should be a concurring party to any cultural resource mitigation agreements. However, if impacts to the withdrawn lands prove to be a significant issue, then Reclamation should be a signatory to any future agreements rather than a concurring party.

For questions or further information concerning these Reclamation comments, please contact Mr. Jon Czaplicki at 602-216-3862 or jczaplicki@lc.usbr.gov.

Thank you for the opportunity to review and comment on this DEIS.

Sincerely,

Patricia Sanderson Port

Patricia Sanderson Port
Regional Environmental Officer

cc: Director, OEPC, D.C.
FWS, Albuquerque, NM
BOR, Boulder City, NV

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

June 24, 2004

Mr. Steve Dibble
U.S. Army Corps of Engineers
P.O. Box 532711
Los Angeles, CA 90053-2325

Subject: Draft Environmental Impact Statement (DEIS) for the Va Shly'ay Akimel Salt River Ecosystem Restoration Study, Maricopa County, Arizona (CEQ#040215)

Dear Mr. Dibble:

The Environmental Protection Agency (EPA) has reviewed the above referenced document pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508), and Section 309 of the Clean Air Act. Our detailed comments are enclosed.

The Corps of Engineers proposes to restore riparian habitat and provide passive recreation opportunities along the Salt River in Maricopa County. EPA supports the Corps, City of Mesa, and Salt River Pima Maricopa Indian Community in their efforts to increase native vegetation, and improve wildlife habitat and aquatic ecosystem function in this section of the Salt River.

Although we support the restoration effort, we have several concerns about impacts of the proposed actions due to a lack of information in the DEIS. As such, we have rated this DEIS as Environmental Concerns - Insufficient Information (EC-2). Please refer to the attached "Summary of Rating Definitions" for further details on EPA's rating system. In particular, EPA is concerned about the potential impacts from the construction and operation of the project's recreational facilities, impacts to water quality from the use of stormwater for irrigation, the effects of increased recreation on local traffic, and the potential cumulative impacts of the project.

We appreciate the opportunity to review this DEIS. When the Final EIS is released for public review, please send two copies to the address above (mail code: CMD-2). If you have any questions, please contact me or Shanna Draheim, the lead reviewer for this project. Shanna can be reached at (415) 972-3851 or draheim.shanna@epa.gov.

Sincerely,

Lisa B. Hanf, Manager
Federal Activities Office

Enclosures: EPA Summary Rating Sheet

RESPONSE:

Thank you for your comment. A final recreation plan had not yet been determined at the release of the draft Environmental Impact Statement. However, Recreation Option B has since been identified in the FEIS as the preferred recreation option. The FEIS contains a thorough discussion of the direct, indirect, and cumulative impacts associated with the alternatives analyzed in the document, including the 3 recreation options. Descriptions of any potential impacts and mitigation measures (if required) associated with construction and operation of the proposed recreational facilities are provided in the appropriate resource sections (e.g., Section 5.9 Transportation).

The FEIS (HWR-5) has been revised to state that the local sponsor will be responsible for implementing water quality improvement measures. Examples of additional measures that could be implemented to improve stormwater quality were also added to the FEIS discussion. As it is unknown what measures will be implemented, if any, it is speculative to analyze potential adverse affects or effectiveness of these measures.

Both the SRPMIC and the City of Mesa have existing stormwater monitoring plans in place as part of their permit requirements. Those same monitoring requirements will exist throughout the project construction. A reference to existing stormwater pollution permits currently held by the local sponsors have been added to the FEIS. This section also discusses the need to develop a stormwater monitoring plan if pollutant levels exceed allowable standards.

Environmental Impacts Associated with Construction of Recreation Facilities

The DEIS evaluates five action alternatives, and no-action for the Salt River restoration component of the project. In addition, the document identifies three alternatives for recreational improvements associated with the restoration; all of which include construction of trails and a cultural center. The DEIS indicates that the local sponsors will decide the final recreation components, and that only a portion of the costs of these facilities can be attributed to the federal project.

The Environmental Consequences chapter of the DEIS focuses on the impacts associated with construction and maintenance of the Salt River restoration. Except for a brief discussion of operational impacts on traffic and recreation, the DEIS does not assess the impacts associated with the proposed recreation facilities. Construction and operation of the recreational facilities could have significant short- and long-term environmental impacts, particularly on water, biological, and cultural resources. While the recreational components are primarily locally-sponsored, they are part of the overall Va Shly'ay Akimel project, and as such should be incorporated into the analysis of environmental impacts.

Recommendation: The Final EIS (FEIS) should include an analysis of the direct, indirect, and cumulative environmental impacts from all components of the proposed Va Shly'ay project, including the recreational facilities. If there are significant environmental impacts associated with construction and operation of the recreation facilities, appropriate mitigation should be identified.

Water Quality

Stormwater:

The DEIS states that irrigation for the proposed restoration will come from several sources including treated wastewater, agriculture return flows, and stormwater runoff. According to the document, stormwater runoff may contain high concentrations of pollutants during "first flush" events, which could adversely impact water quality and aquatic organisms. The DEIS states that the Corps will mitigate this potential impact by developing a stormwater quality sampling program to measure contaminant levels in stormwater used for irrigation. If concentrations exceed water quality standards, the Corps will identify other water sources or implement improvement measures such as stormwater detention basins. The document does not describe the components of the stormwater quality sampling plan (i.e., what parameters will be measured, when and where will sampling occur, how will results be reported). In addition, the DEIS does not discuss the potential environmental impacts associated with construction of water quality improvement measures such as detention basins.

Section 4.9 Transportation of the FEIS contains a thorough discussion of existing traffic levels and provides Average Daily Traffic (ADT) Volumes and Level of Service (LOS) designations for local roadways and arterial intersections. A discussion of estimated traffic associated with construction and recreational use is provided in Section 5.9 Transportation. Expected vehicle trips associated with recreational use were calculated based on the revised study prepared by the Va Shly' ay Akimel recreation technical committee. Because the majority of recreational use is expected to occur during off-peak commute hours (prime recreation time is defined as weekends and holidays) the project is not expected to adversely affect LOS (peak hour capacity) of any of the surrounding intersections.

The FEIS will include a discussion of potential cumulative impacts related to past and planned community growth as it relates to biological resources and habitat value.

Two copies of the FEIS will be sent to: US EPA, Region IX, 75 Hawthore Street (Mail code CDM-2), San Francisco, CA 94105-3901.

Recommendation: The FEIS should include additional details regarding the stormwater monitoring plan (e.g., water quality parameters, sampling intervals, potential sampling locations). A copy of the proposed stormwater quality sampling plan, if completed, should be included as an appendix. In addition, the FEIS should include a discussion regarding the potential environmental impacts associated with construction of detention basins or treatment swales, and the effectiveness of these measures in removing pollutants of concern.

Agriculture Irrigation Return Flow Water:

The DEIS states that agriculture return flows are of "relatively high quality and are suitable for use as irrigation for restoration plantings." However, the document does not identify or discuss what types of agriculture (e.g., crops, grazing) will be supplying the return flows, and what particular contaminants might be of concern. The quality of the return water is not quantified. Agriculture irrigation return flows, especially in arid regions, often contain high levels of contaminants such as selenium, salts, pesticides, nutrients and sediments. Return flows which have high levels of any of these contaminants might not be suitable for restoration of aquatic ecosystems.

Recommendation: The FEIS should identify the types of agricultural land use from which the project will receive return flows. The document should discuss the types and concentrations of contaminants found in the proposed sources of return flow, and evaluate the impacts on water quality and aquatic resources in the project area. If there are significant concentrations of pollutants in the agriculture return flows, the Corps should develop a water quality monitoring and mitigation plan similar to, or integrated with, the stormwater plan.

Traffic

Section 5.9 of the DEIS addresses the short- and long-term impacts of the project on regional traffic. The DEIS provides estimated recreationist trips (round trips) for winter and summer, and states that no impacts to traffic or circulation are anticipated. However, the document does not put the estimated number of vehicle trips into the context of local and regional traffic. Numerous intersections in the project area operate at level of service "E" and "F" (at or over capacity), and could be further impacted by an increase in recreational users.

Recommendation: The FEIS should discuss how projected vehicle trips compare to current traffic levels (e.g., what percentage of overall projected local traffic is attributed to the proposed project), and whether the project will cause a worsening in the level of service of any surrounding intersections.

Cumulative Impacts

While the DEIS provides a discussion of the cumulative impacts of the proposed project, it appears to limit the scope of that analysis to the four other restoration projects adjacent to Va Shly'ay on the Salt River. The document does not evaluate or discuss the cumulative impacts of other past, present or reasonably foreseeable projects in the study area. There is considerable ongoing and planned community growth (i.e., residential, commercial, and recreational developments) to the north and south of the Va Shly'ay project. The DEIS does not evaluate how the proposed project, in conjunction with these developments, might cumulatively impact resources of concern in the study area. In particular, there could potentially be cumulative impacts (beneficial and adverse) to air and water quality, wildlife, habitat, cultural resources, and traffic.

> *Recommendation:* The FEIS should expand the discussion of cumulative impacts to include other past, present, and reasonably foreseeable projects in the area which might impact the same resources as the Va Shly'ay project. This should include an analysis of cumulative impacts from past and planned community growth surrounding the project area.

SUMMARY OF EPA RATING DEFINITIONS

This rating system was developed as a means to summarize EPA's level of concern with a proposed action. The ratings are a combination of alphabetical categories for evaluation of the environmental impacts of the proposal and numerical categories for evaluation of the adequacy of the EIS.

ENVIRONMENTAL IMPACT OF THE ACTION

"LO" (Lack of Objections)

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

"EC" (Environmental Concerns)

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

"EO" (Environmental Objections)

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

"EU" (Environmentally Unsatisfactory)

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potentially unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the CEQ.

ADEQUACY OF THE IMPACT STATEMENT

Category 1" (Adequate)

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

"Category 2" (Insufficient Information)

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analysed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

"Category 3" (Inadequate)

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analysed in the draft EIS, which should be analysed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From EPA Manual 1640, "Policy and Procedures for the Review of Federal Actions Impacting the Environment."

U.S. Department of Homeland Security
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

FEMA

May 20, 2004

Ms. Ruth B. Villalobos
Office of the Chief, Planning Division
Environmental Resources Branch
U.S. Army Corps of Engineers
P.O. Box 532711
Los Angeles, CA 90053-2325

Re: Va Shly'ay Akimel Ecosystem Restoration Feasibility Study DEIS

Dear Ms. Villalobos:

This letter addresses impacts to the National Flood Insurance Program in response to your recent request for Agency input with respect to the Draft Environmental Impact Statement (DEIS) for the Va Shly'ay Akimel Ecosystem Restoration Feasibility Study and Salt River restoration project prepared by the Army Corps of Engineers and planned for development within the City of Mesa and Maricopa County, Arizona, as well as on lands of the Salt River Pima-Maricopa Indian Community (SRPMIC).

The City of Mesa and Maricopa County participate in the National Flood Insurance Program (NFIP), and have current Flood Insurance Rate Maps (FIRM) on file and available for review within their respective Engineering and Flood Control Departments. Any development within Mesa and Maricopa County must comply with the requirements of their respective floodplain management ordinances, which regulate development within the high risk Special Flood Hazard Area (SFHA) shown on the current FIRM, and must meet the minimum Federal requirements established in Volume 44 of the Code of Federal Regulations (44CFR). The NFIP floodplain management building requirements are described in Parts 59 through 65 of the Code.

As noted by the mitigation measures identified in Section Eight and in Table ES-1 of your report, there could be significant impacts (if unmitigated) which would change the 100-year water surface elevations for most of the alternatives presented, and a preliminary review of the current FIRM does indicate the likelihood of project encroachment within the SFHA.

Per Section 60.3 (b) of the Code of Federal Regulations, Local and County permits shall be required for all proposed construction and other development located within the SFHA (Zone A on the FIRM); and the final proposal should include base flood elevation data. The Section also describes flood-resistant design criteria and requirements for construction occurring within flood-prone areas.

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MAY 24 2004
PLANNING DIVISION

RESPONSE:

Thank you for your comment. Any development within Mesa and Maricopa County will follow compliance with the requirements of their respective floodplain management ordinances.

Selected NFIP definitions and floodplain management building requirements are summarized as follows:

- A determination of the Base Flood Elevation (BFE) must be performed prior to the start of development and indicated in the Proposal, which should demonstrate what impact the development would have on base flood levels.

- If implementation of the proposed project would result in any change of the existing BFE or floodplain delineation, the requirements for revising the FIRM must be implemented (44CFR § 65.12). These regulations include obtaining a Conditional Letter of Map Revision (CLOMR) from FEMA prior to the start of any development that will cause any rise within a floodway or that will alter or relocate a watercourse. If implementation of the project results in physical changes that increase or decrease the BFE, a request for a final Letter of Map Revision (LOMR) must be submitted within six months of the project's completion. To obtain copies of FEMA's Flood Map Revision Application Packages, please refer to the FEMA website at: http://www.fema.gov/mit/tsd/dl_mt-2.htm.

- The NFIP-participating communities (City of Mesa and Maricopa County) shall notify, in riverine situations, adjacent communities and the Arizona National Flood Insurance Program Coordinating Officer prior to any alteration or relocation of a watercourse, and submit copies of such notifications to the FEMA Administrator; and,

- Assure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained.

The full text of Volume 44, Code of Federal Regulations (44CFR) may be found on the Internet at: http://www.fema.gov/nfip/laws1.shtm

Please Note:

Many communities participating in the NFIP have adopted building requirements and regulations that are more restrictive or comprehensive than the minimum federal criteria set forth in CFR No.44 for purposes of floodplain management and regulation of development in the floodplain. Please contact the Maricopa County Principle Floodplain Coordinator at (602) 506-4874 for further information on local permitting requirements.

If you have any questions, or if you need further assistance, you may contact me by telephone at: (510) 627-7036, or by email at: clare.polansky@dhs.gov.

Sincerely,

Clare C. Polansky

Clare C. Polansky
Natural Hazards Program Specialist
National Flood Insurance Program

Cc: Sandro Amaglio, Environmental Officer, FEMA Region IX

Ted Collins
Principle Floodplain Coordinator
Maricopa County Flood Control District
2801 W. Durango
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(602) 506-4874

Gordon Haws
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Brian Cosson
Program Specialist, Flood Mitigation, Flood Warning
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Marilyn Ethelbah
Cultural & Environmental Services Office
Salt River Pima-Maricopa Indian Community
10005 E. Osborne Road
Scottsdale, CA 85256

MARTIN H. YOUNG
2601 E McKellips Rd #2022
Mesa, AZ 85213
(480) 835-7505
saltrivernative@msn.com

April 8, 2004

RE: Salt River Restoration Project

I would like to thank you in advance for listening to my concerns.

I am speaking as a community member and an employee of Salt River Materials Group. After a long absence I have come back to make my home and become apart of this Community.

I gained employment at Salt River Sand & Rock, and felt secure in my future as an employee of a Tribal enterprise, contributing to the prosperity of our Tribe. All of a sudden I'm going thru a merger of Salt River Sand & Rock and Phoenix Cement. Which cast doubt for my future, because of changes that were under way. As I weathered through that storm and was seeing daylight at the end of the tunnel, I was blind-sided by news of the possibility of the Dobson plant as well as others might be shut down due to the restoration project. I have no problems with the project as far as the idea, my mother, aunts and uncles used to tell me stories of the trees, water and fishing along the Salt River when they were young.

I'm worried for my future and that of my family. I have worked at SRMG for seven years and I'm now forty years old. I now have benefits I've never had, such as health insurance, vacation, retirement not to mention a future. I not only enjoy what I'm doing, I also get a sense of contributing not only to the Community but also to society.

It was my understanding that Tribal enterprises were not only to create income for the Tribe but also to create jobs for our Community members as well as native peoples.

Please address what provisions will be made to keep Salt River Community members gainfully employed, without having to start over at entry level jobs with none of the benefits we have worked so many years for.

Sincerely,

Martin H. Young

LEIH PUBLIC MTG 8 APR 04

RESPONSE:

Thank you for your comment. Any loss or gains in employment as a result of the project is the local responsibility.