

PASEO DE LAS IGLESIAS

Restoring Cultural and Natural Resources
in the Context of the Sonoran Desert Conservation Plan

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I. BACKGROUND

This paper expands on the Conceptual Plan originally forwarded by Pima County in April of 1998 for a cultural and riparian restoration project called Paseo de las Iglesias. Since that time the Board of Supervisors has launched one of the largest conservation initiatives in the country. The Sonoran Desert Conservation Plan identifies the Paseo de las Iglesias project as one which Pima County intends to pursue.

This background paper describes Paseo de las Iglesias from three perspectives:

- (1) First, Paseo de las Iglesias is explained in the context of elements of the Sonoran Desert Conservation Plan;
- (2) Next, the project is portrayed in the practical context of traveling from San Agustin to San Xavier through a historical and cultural perspective, as the project's title promises; and
- (3) Finally, Paseo de las Iglesias is placed in the context of the inter-nation and inter-governmental cooperation that will be necessary to make the project a reality.

The Basic Features of the Paseo de las Iglesias Project

Paseo de las Iglesias (Walk of the Churches) is the name of the plan to restore the Santa Cruz River between San Xavier and the Convento site at the base of Sentinel Peak. The plan provides:

- ▶ Major riparian restoration opportunities along the Santa Cruz River which will benefit plant and animal communities;
- ▶ Preservation of the numerous prehistoric, historic, and cultural sites along the riverbank;
- ▶ Potential recharge opportunities for Central Arizona Project Water and other water sources;
- ▶ Native farming restoration opportunities on and adjacent to the Tohono O'odham Nation, San Xavier District; and
- ▶ Completion of missing trail links along the Santa Cruz River Park. The Juan Bautista de Anza National Trail, along the traditional route of the Camino Real, closely follows the western edge of the river.

II. PASEO IN THE CONTEXT OF SONORAN DESERT CONSERVATION PLAN

A. CULTURAL AND HISTORIC PRESERVATION

1. DEFINING THE CULTURAL AND HISTORIC PRESERVATION ELEMENT

Overview of Elements of the Sonoran Desert Conservation Concept Plan:

On October 27, 1998, the Board launched a major conservation planning effort -- the Sonoran Desert Conservation Plan -- that will: (1) define urban form and prevent urban sprawl through the protection of natural and cultural resources; (2) provide the basis of a natural resource protection and environmental element of the Comprehensive Plan; (3) lead to the recovery of the endangered cactus ferruginous pygmy-owl and stabilize the ecosystem and plant communities which support multiple species and thereby prevent future listings; and (4) lead to issuance of a Section 10 permit under the Endangered Species Act for a regional multi-species conservation plan that is one of the largest, if not the largest, in the United States.

The Sonoran Desert Conservation effort will create a model of how the Endangered Species Act can realize its potential for the protection of multiple species, and at the same time avoid the potential economic crisis and community disruption that a listing can cause. During the next eighteen months to two years, Pima County will focus on identifying and preserving six major categories of land areas that will form the natural resource component of Pima County's Comprehensive Plan:

- | | |
|---------------------------------------|--|
| 1. Ranch Conservation | 4. Mountain Park Expansion |
| 2. Historic and Cultural Preservation | 5. Establishment of Biological Corridors |
| 3. Riparian Restoration | 6. Critical and Sensitive Habitat Protection |

The Historic and Cultural Preservation Element:

Pima County is rich in history, culture, regional character, and diversity, all of which contribute greatly to our collective cultural heritage and community identity. This heritage may be viewed as a mosaic of its ethnic diversity, archaeological past, history, architecture, technology, art, and traditions that is expressed in archaeological and historic sites and districts, buildings, structures, and objects significant to Pima County's cultural and economic history.

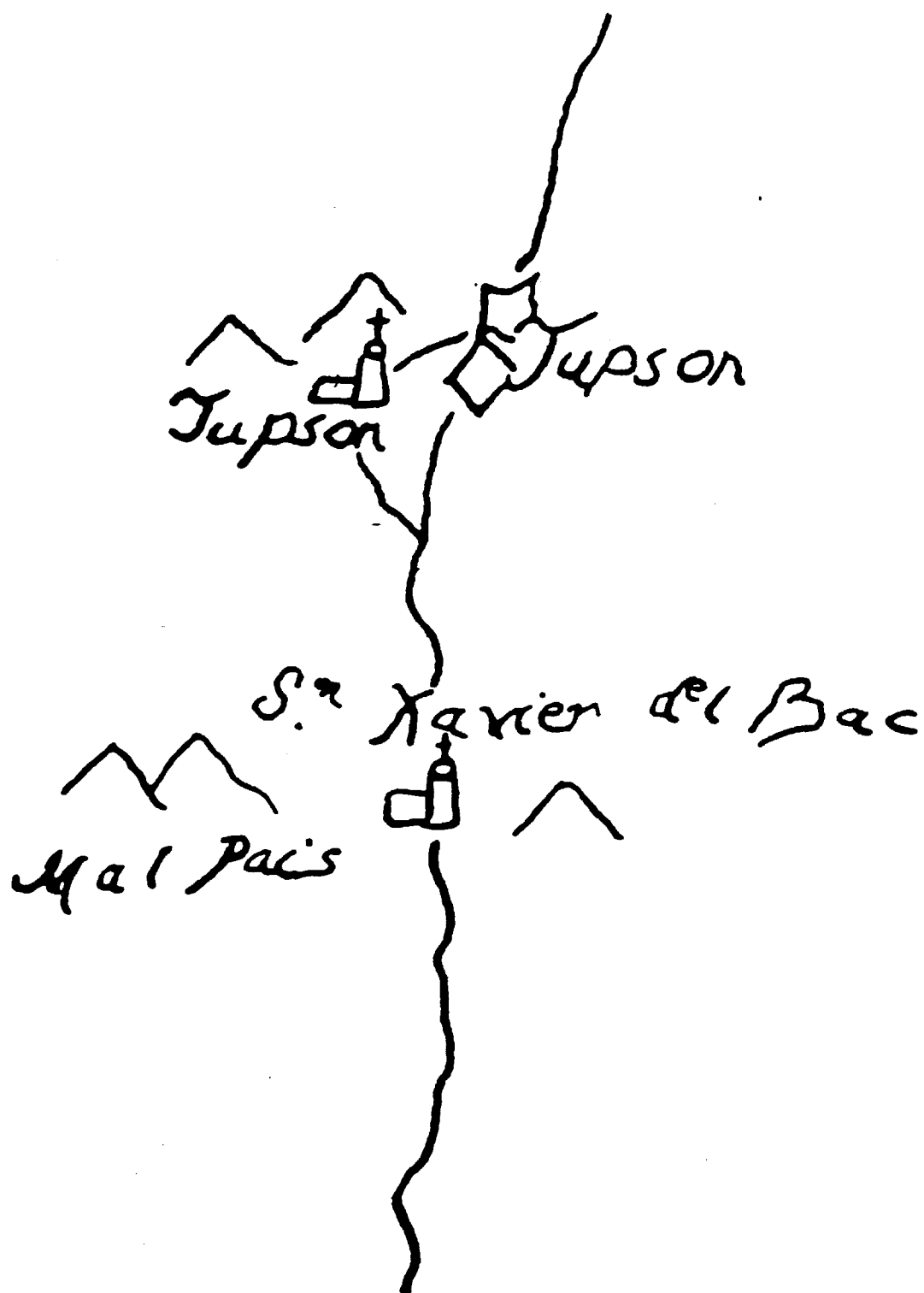
In fact, Pima County has a long and complex multi-cultural heritage, beginning about 10,000 B.C., which has left us a rich legacy of cultural and historic sites and buildings, many of which qualify for listing on the National Register of Historic Places. However, urban development has unfortunately destroyed most of the prehistoric Hohokam villages, the early Piman villages and Spanish Colonial and historic period sites along the Santa Cruz River that were visited by Fr. Kino, settled by early Spanish missionaries and soldiers of the 17th and 18th centuries, and later occupied by American pioneers. Further intensive development and urban sprawl both north and south along the Santa Cruz continue to threaten these non-renewable cultural resources.

2. MISSION SAN AGUSTIN

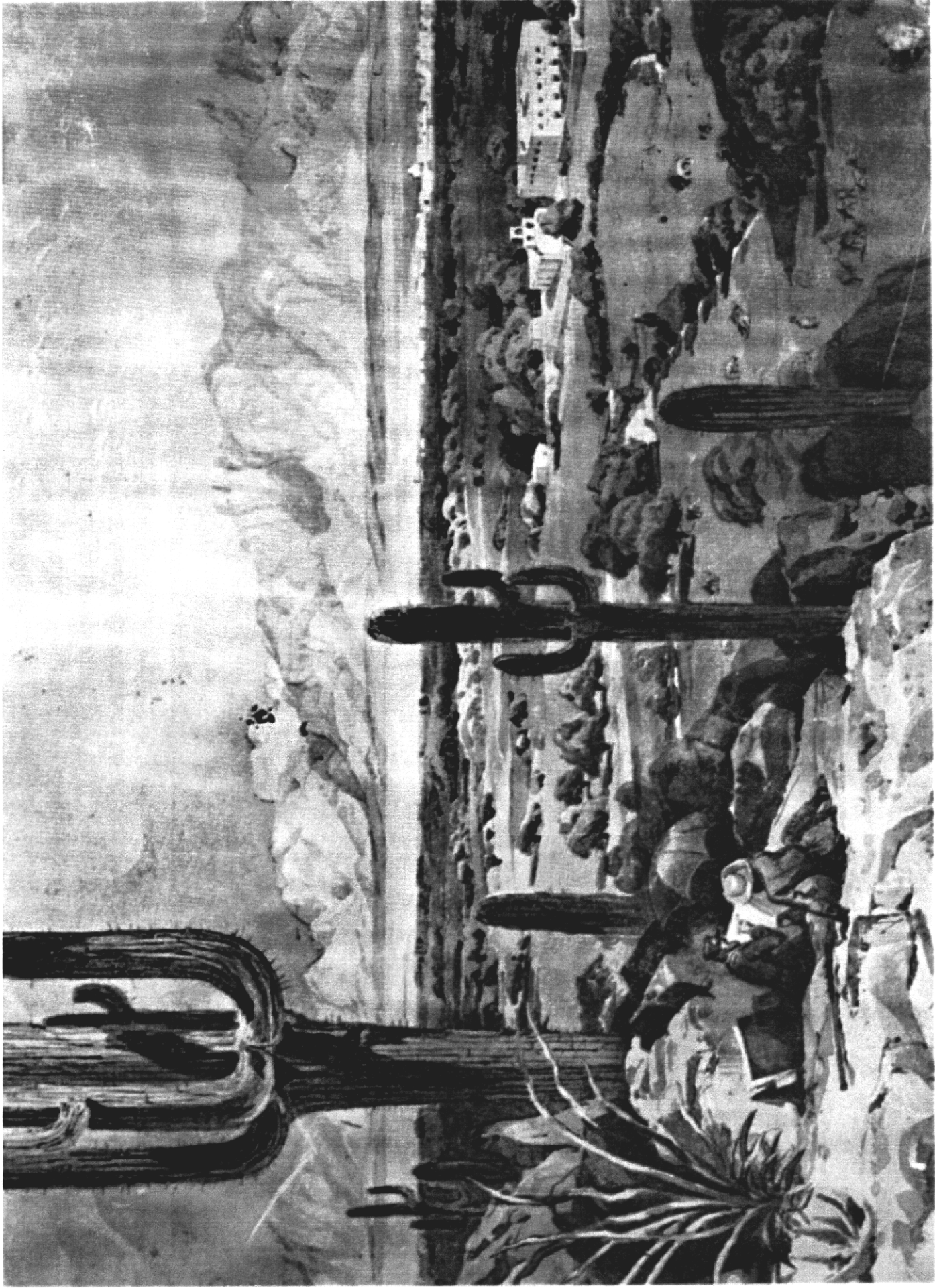
The "Birthplace of Tucson" at the base of "A" Mountain has been occupied since prehistoric times and has irreplaceable significance as the site of Tucson's origins. First noted by Father Kino in the 1690s and named San Cosme de Tucson, this was the site of an historic Piman village known as "stjukshon," which gave Tucson its name. On this site, Fr. Kino envisioned a European style community on the Spanish mission frontier, in which the church protected by the military and aided by civilian authorities, would teach the native Pima population skills in agriculture, animal husbandry, and various crafts, convert them to Christianity and rely on the services of the Indians for the protection of the newly claimed Spanish territory, and eventually make them taxpaying citizens of the Spanish empire. This was largely accomplished over the next 100 years by Fr. Garcés and his successors and the Spanish military, who established the Mission San Agustín del Tucson and the Tucson Presidio across the river during the late 1700s. Archaeological ruins of the San Agustín Mission, Convento, Mission Gardens and extensive canal system remain, as well as prehistoric features. The site has been determined eligible for the National Register of Historic Places, and a public park commemorating the historic beginnings of Tucson is planned.

3. WARNER'S MILL

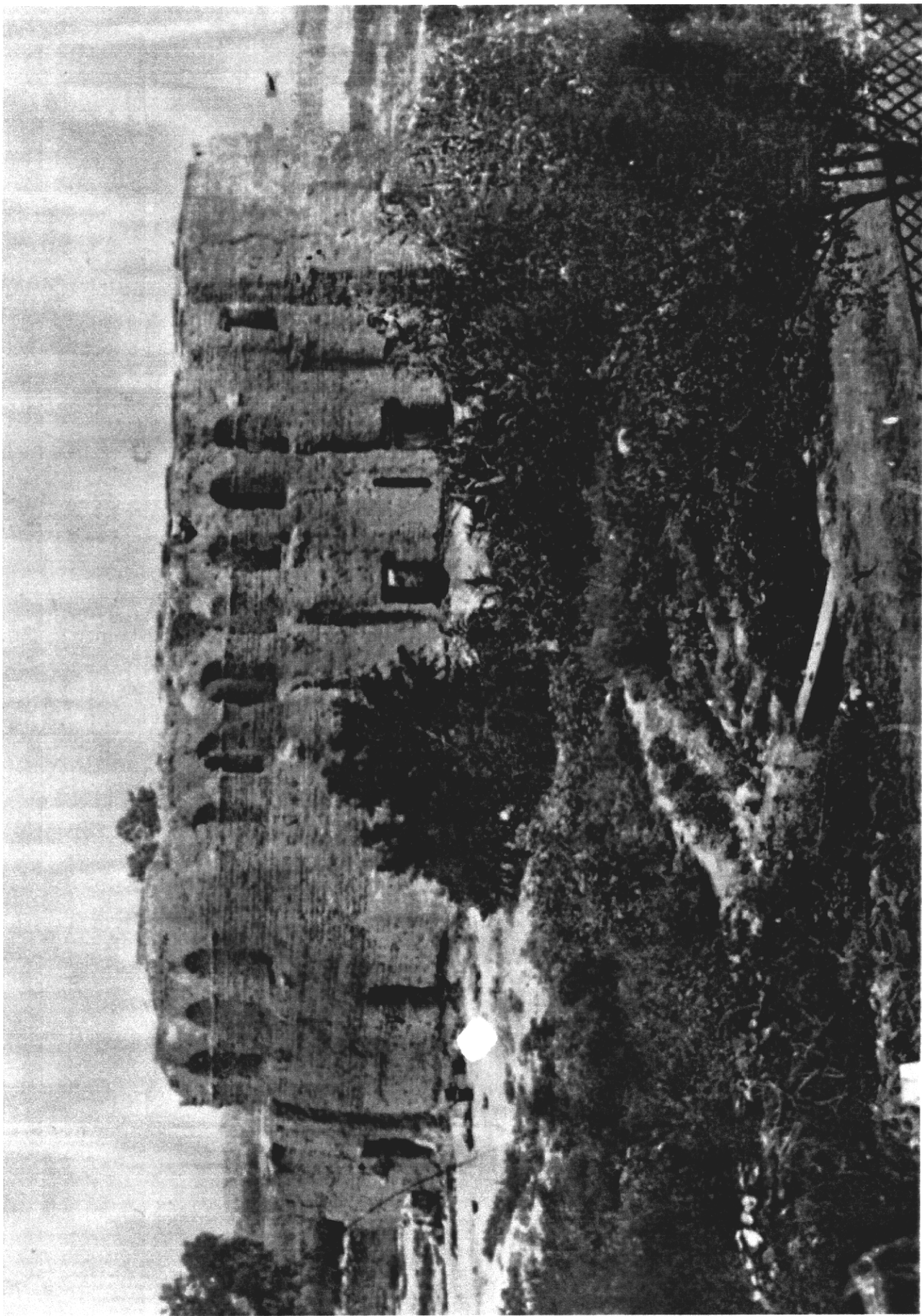
One of Tucson's enterprising pioneers, Solomon Warner in 1874 directed the construction of a residence and stone flour mill at the base of Sentinel Peak. He was given permission by Bishop Salpointe to construct a canal across the Mission San Agustín gardens and mission to carry water to power his mill wheel. In addition to the mill and canal, a 50 acre lake was created by building an earthen dam at the confluence of the Santa Cruz River and the West Branch to create a reliable and consistent source of water for the mill. The mill was a two story flour mill, the first story built of volcanic boulders from Sentinel Peak and the second story built of adobe. Damming the river may have benefitted Warner's mill, but caused a less reliable source of water for farmers downstream who were dependent on the tail race waters. At least one pioneer recalls that "when the farmers needed water very badly they would wait until there was a thunder storm and then would blast an opening in Warner's dam so as to get more water on their crops. People thought [the dynamite blast] was a blast of thunder." Despite this water thievery, the mill operated from 1874 to about 1890 when floods finally destroyed the lake and mill race. It was used subsequently as a residence. When abandoned about 1930, it became a home for transients. The owner, tired of evicting the homeless, blew the mill up with dynamite. The first floor stone walls still stand just to the west of Mission Road, and the Historical Commission has placed a sign to commemorate the ruins. Solomon Warner's adobe house is still occupied as a residence.



Detail of Geronimo de la Rocha's 1780 map of Pimeria Alta. The Tucson Presidio (1775) and Mission San Agustín on the east and west banks of the river was the northernmost outpost of Colonial New Spain. Mission San Xavier is located some nine miles to the South.



Photograph by Edward Ronstadt of a sketch taken from Sentinel Peak (A Mountain) by John R. Bartlett, July 14, 1852. The buildings in the foreground are of the mission visita of San Agustin del Tucson.



The earliest known photograph of the Mission San Agustín convento building from around 1880. (Arizona Historical Society)

4. ANZA NATIONAL TRAIL

The Juan Bautista de Anza National Historic Trail commemorates the route taken by Anza in 1775-76, when he led a group of some 250 colonists and 1200 head of livestock from Sonora Mexico to establish a presidio and mission for Spain at San Francisco bay. Congress legislated the trail as a component of the National Trails System in August 1990 (Public Law 101-365) based on the determination by the National Park Service that the trail met the criteria of the National Trails System Act.

The legislated trail extends from Nogales, Arizona to San Francisco, California, a distance of 1200 miles. As defined in the National Trails System Act, national trails are "extended trails which follow as closely as possible and practicable the original trails or routes of travel of national historical significance."

Such trails have as their purpose "the identification and protection of the historic route and its historic remnants and artifacts for public use and enjoyment."

Furthermore, the National Trails System Act requires the provision of public access to historic site and trail segments as part of the certification process, and it requires, as well, the protection of sites from changes that will diminish the historic integrity of the trail.

National trails are established and managed through the cooperative efforts of the National Park Service, state and local governments, private landowners, and cooperating groups. The Anza National Trail traverses 20 counties, 5 in Arizona and 15 in California.

There are approximately 60 miles of trail in Pima County following the route of the Spanish Camino Real along the west bank of the Santa Cruz River, with six campsites at Canoa, Llano Grande (just south of Sahuarita), San Xavier del Bac, Tucquison (near downtown), Llano del Azotado (at the site of Los Morteros), and Oitipars (near the Pinal County line at the confluence of Los Robles Wash and Santa Cruz River.) The route was located along the upper floodplain where the terrain was relatively flat and not heavily vegetated.

Today, the route is located to the west of I-19 in the Green Valley area and between Silverbell Road and the river north of Tucson. Acquisition and interpretation is planned for public access and enjoyment of approximately 60 miles of the Anza National Trail and six campsite locations along the Santa Cruz River.

5. TUMAMOC HILL

Preservation of Tumamoc Hill is planned to protect this National Historic Landmark and to protect its natural and cultural values. There appears to be significant public and institutional consensus that preservation of this landmark as undisturbed natural open space is critical to maintaining Tucson's identity and historical qualities. The Tumamoc Hill complex also represents the largest acreage within the City limits that is committed to use as open space. There are resident populations of deer, javelina, foxes, bobcats, and other animals that are provided with habitat diversity, which is critical to maintain wildlife populations.

In addition to its natural values, the subject parcel has significant cultural values. The Hohokam made extensive use of the parcel as dry-farming fields that contain more than 1000 rock piles, contour terraces, check dams, and bordered gardens as well as numerous processing sites that contain stone tools and ceramics. This agricultural complex appears to be associated with the "trincheras" habitation and defensive constructions on top of Tumamoc Hill and the village known as the St. Mary's Hospital site. These habitation areas together with the agricultural fields and close proximity to other Hohokam villages at the base of Sentinel Peak comprise a prehistoric cultural landscape. This landscape includes a comprehensive view of a prehistoric settlement system -- its villages, water source, agricultural fields, hunting areas, food processing sites, trail networks, and possible defensive retreat. Preservation of these cultural values is consistent with the existing research uses of the parcel, which began in 1903.

Soon after the Carnegie Institution of Washington, D.C. was incorporated in 1901, its advisory board for botany suggested that it should establish a desert botanical laboratory. Tumamoc Hill was chosen in 1903 as the Carnegie Desert Laboratory site because it had the richest and most diversified vegetation in any area of the desert Southwest and Sonora. The scientific name of the giant saguaro, Carnegiea gigantea, is a permanent memorial to the research conducted by the Carnegie Desert Laboratory staff. Tumamoc Hill and its research area of approximately 869 acres has been managed by three different institutions -- the Carnegie Institution from 1901-1937, the U.S. Forest Service from 1940-1960, and the University of Arizona from 1960 to the present. In the 1950s, researchers from the University of Arizona located and began to monitor the desert study plots established about 1907 by the Carnegie Institute. Today, current University research activity on Tumamoc Hill relates to study of paleo-ecology of the greater Southwest, in addition to continuing desert ecosystems research by the US Geological Survey and others. In recognition of its important contribution to research and education, Tumamoc Hill has received the following acknowledgments:

- National Historic Landmark - 1976
- National Environmental Study Site - 1976
- Arizona State Natural Area - 1981

6. VALENCIA HOHOKAM SITE

Through acquisition and interpretation, this significant Hohokam ballcourt community in the southern Tucson Basin along the Santa Cruz River could be preserved and protected for future public appreciation. This site represents some 500 years of Hohokam occupation, and there is evidence for earlier Archaic settlement here as well. The Valencia site is listed on the National Register of Historic Places, and creation of the Valencia Site Archaeological Park is planned. Previous research conducted in the vicinity of the Valencia site suggests a long history of human occupation along this reach of the Santa Cruz River. The most intensive use of this area was by the Hohokam, and it is probable that from the Pioneer period at least through the Sedentary period, from about A.D. 700 to 1200, it was an attractive location for these farming peoples. The large Valencia site with its central plaza and ballcourt ringed by several hundred houses was probably the principal focus of settlement for most of this period of five centuries or so, and the appearance of smaller sites to the north of it toward the latter end of its occupation represents an organizational shift to a community composed of several small, scattered settlements rather than one large village. Currently owned by the Arizona State Land Department, it is fortuitous that this significant Hohokam site remains undisturbed and undeveloped. It is one of the last remaining large prehistoric village sites along the Santa Cruz River in the greater Tucson area.

7. SILVER LAKE AND HOTEL

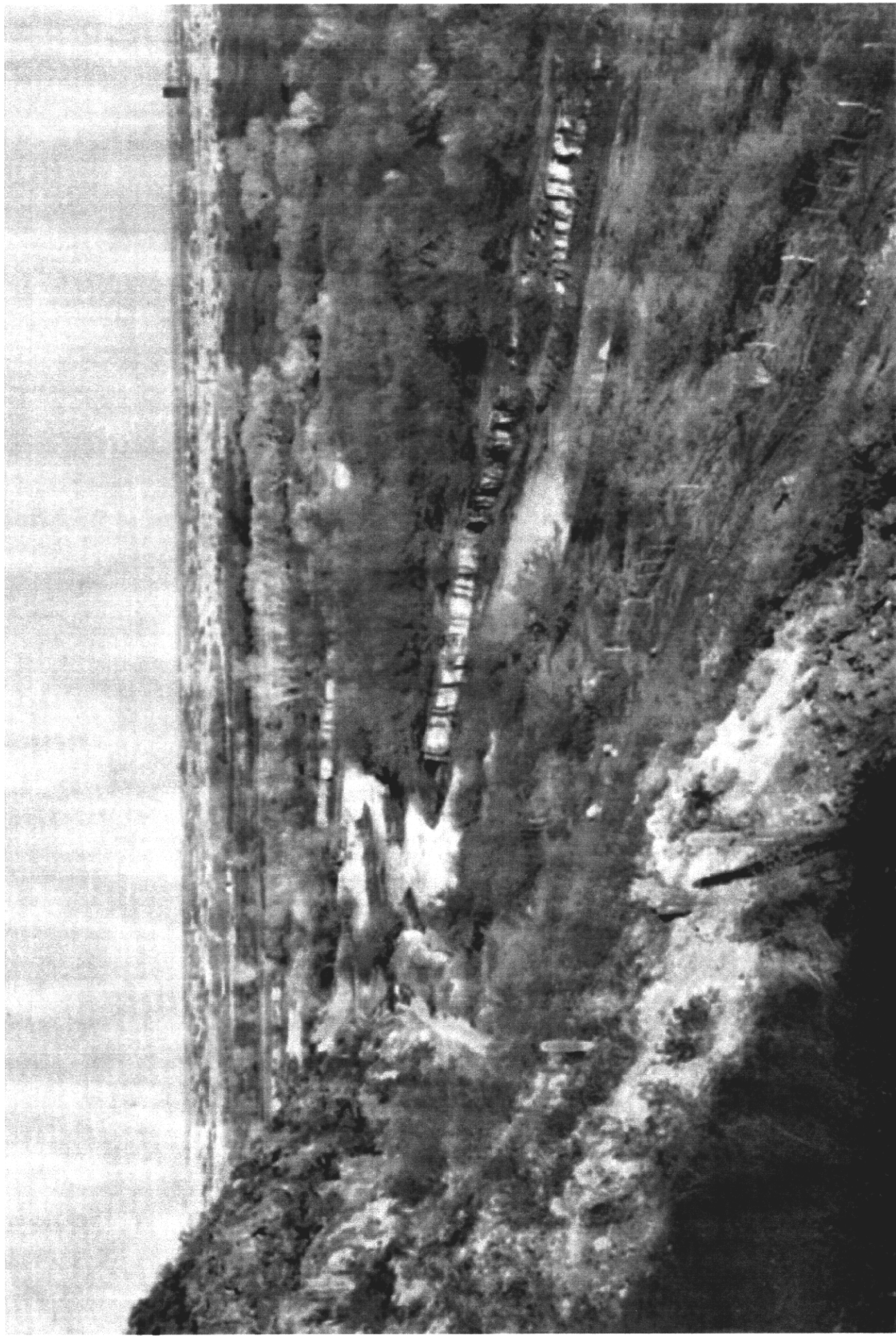
Before the construction of Warner's Lake in 1874, Silver Lake was constructed in 1856, following the Gadsden Purchase to provide a reliable source of water for Rowlett's Mill, which was later confiscated and burned by Union troops during the Civil War. Following the war, the Pioneer Mill was built on the lake located south of Tucson where 29th St. today crosses the Santa Cruz. Just to the west the historic route of the Camino Real became a route of increasing commerce as freighters from Mexico and Tubac brought their goods to Tucson, and Tucson farmers and craftsmen sold their wares to buyers to the south. Along this route of commerce, Silver Lake in 1881 became the first respectable place for "swimming baths" in Arizona, and it had the only race track, built as a one mile straight-away along Cottonwood Lane. The Silver Lake Hotel became a place of respectable resort with "a row of commodious bath houses for bathers, a stout rope across a portion of the lake for the convenience of persons learning to swim," and they had a two-story hotel, pavilion, and a grove for picnickers right next to the racetrack. As quickly as it had grown into a place of respectable resort, the Silver Lake complex with its gambling, saloon, and its changing patronage by freighters and the "soiled doves of Gay Alley," soon became a place of questionable resort. Silver Lake and its hotel were washed away in the torrential floods of the 1890s. Today, nothing remains of the Silver Lake hotel complex except the race track along Cottonwood Lane.

8. SAN XAVIER MISSION

San Xavier Mission, first established by Father Kino in the 1690s, is today a National Historic Landmark. There is no other historic property in Pima County that is so visible and so defining of our community's identity and sense of place as the current Mission dating to 1797. Located on the San Xavier District of the Tohono O'odham Nation, we are at once reminded of our community's collective multi-cultural heritage. Efforts to restore the priceless interior artwork and exterior architectural features of this world-class historic property are currently underway by the Patronato San Xavier with overwhelming support from the citizens of Pima County. As noted by Dr. Bernard. L. Fontana:

In the past as in the present and, hopefully in the future, Mission San Xavier del Bac will stand as a common meeting ground in which all racial, ethnic, social, economic, and other differences are laid aside in shared appreciation of an extraordinarily beautiful and awe-inspiring place. It is the inspired gift of the region's O'odham, Spanish, and Mexican forebears to their descendants and to the rest of us who are able to appreciate its wonder. The least we can do is to preserve the tradition."

The immediate environment of the mission has changed little since the Jesuits and Franciscans first established San Xavier, although the river no longer flows and cottonwood trees and willows are a photographic memory. Unique among missions established to serve a Native American people, San Xavier has continuously served the O'odham for whom it was built. Few of the Spanish missions left in the United States today still are used by the Indians for whom they were built. San Xavier today remains a focal place for the San Xavier District of the Tohono O'odham Nation.



View from Sentinel Peak looking downstream across the confluence of the West Branch and the Santa Cruz River, 1904.
(Arizona Historical Society)

B. RIPARIAN RESTORATION

1. DEFINING THE RIPARIAN RESTORATION ELEMENT

Historical accounts of Tucson indicate that the Santa Cruz River flowed year-round at San Xavier del Bac and near downtown Tucson. Near the former confluence of the Santa Cruz and the West Branch, there was a natural Cienega/wetlands that was impounded for irrigation and later more fully developed into Warner's Lake in 1874 which covered some 50 acres.

The river flow was carried downstream in series of acequias dating from the Spanish period. Rillito Creek and portions of Tanque Verde Creek, Sabino Creek, and Pantano Wash were also perennial. Beavers swam in Tanque Verde Creek. High water tables along parts of the Santa Cruz River, Tanque Verde Creek, Canada del Oro Wash, and Agua Caliente Wash supported extensive riparian forests of mesquite, cottonwood, and willow.

The Santa Cruz River was broad and shallow until floods in 1887. The ensuing incision of the floodplain caused a lowering of the water table and serious channel bank erosion. Even then, the river flowed, until it finally disappeared due to groundwater pumping in the late 1930's and 1940's.

Groundwater pumping, floodplain development, and habitat loss due to erosion have significantly altered the biologically rich and diverse riparian corridors of eastern Pima County. For example, the Santa Cruz River lost at least six species of native fish, including the federally endangered Gila topminnow and desert pupfish. The endangered Huachuca water umbel, which grew at the base of Sentinel Peak, was also lost.

Today, there are new opportunities to recreate our watercourses as a gathering place for people and wildlife. Pima County now actively promotes protection and restoration of our river corridors and floodplains. Key techniques to accomplish this include floodprone land acquisition to prevent future development, and restoring the aquifers that once supported free-flowing streams. Opportunities exist to reintroduce CAP and reclaimed water to the Santa Cruz River.

In these areas and others, restoration efforts can target retirement of wells or surface water diversions through substitution of renewable water sources or conservation measures. For example, Tucson's use of CAP water for municipal purposes would allow wells along the Santa Cruz River to be placed on standby. Reducing or eliminating livestock and off-road vehicle impacts, deliberate plantings of native trees, shrubs and grasses, and erosion control measures are other techniques Pima County is using to restore other riparian areas.

The watercourses in the Tucson area today serve as an important community commons and vital recreational links. Pima County is creating a regional, multi-use trail system along the major washes. The river park system will link the business and residential areas with parks, sports fields, and restored riparian zones along a continuous trail network.



Santa Cruz River eroding Sam Hughes' diversion ditch in October 1889. Sentinel Peak at right. Note broad, flat flood plain up-stream of the headcut. (Arizona Historical Society)

2. EROSION / FLOOD CONTROL

Several miles of the reach of the Santa Cruz River within the Paseo de las Iglesias planning boundary have already received soil cement bank stabilization. Three segments will require flood protection or some type of flood control consideration. Those segments are Valencia to Irvington Roads, Ajo Way to 29th Street, and Tohono O'odham Nation boundary to Valencia. Flood control activities and actions on the Ajo to 29th reach of the Santa Cruz River are unknown at this time and will be influenced by City of Tucson decisions as to the most appropriate uses for the property in question.

Regarding the reach from Irvington to Valencia, certain bank stabilization improvements have been approved by the voters in the bond issue of May, 1997. This section of the Santa Cruz River is characterized by steep incised banks that contain 100 year flood flows, but are highly susceptible to erosion by the sinuous channel. The flood control strategy for this reach of the Santa Cruz River will be to preserve flood storage areas by retaining high channel banks and sinuous geometry while investigating a broad range of methods to control bank erosion, including vegetative methods.

The final reach of the Santa Cruz River that requires flood control attention is that section of the Santa Cruz River from Valencia Road to the San Xavier District of the Tohono O'odham Nation boundary. This reach of the Santa Cruz River is characterized by significant sand and gravel activity. The flood control strategy for this reach of the Santa Cruz River is to acquire the property owned by San Xavier Rock and Materials, allowing continued sand and gravel extraction over the life of the facility, which is estimated not to exceed five years. The continued sand and gravel extraction would maximize the benefit of the property as a flood storage and possibly groundwater recharge facility.

In addition, if groundwater recharge was undertaken using a renewable water supply such as Central Arizona Project water, it is possible that water-based recreation could also be planned at this location. Presently the property contains a number of gravel pits which could provide a storage volume in excess of 910 acre feet. It is possible that with continued control, sand and gravel excavation in the area over the next five years, the amount of volume for a lake, natural flood storage, or recharge could be increased significantly.

Additional Considerations: Throughout the length of Paseo de las Iglesias from approximately Los Reales Road to Mission Lane, the 100 year flood peak on the Santa Cruz River can be contained within the existing channel. Some erosion hazards exist throughout the length from Los Reales to Irvington, and then again from Ajo Way to 29th Street. Economic losses from these hazards may be insufficient to justify a traditional positive cost benefit for flood control. Pima County staff is now investigating the possibility of flood control benefits associated with the reach of the Santa Cruz bank stabilization originally constructed by the Flood Control District through Rio Nuevo.

The original bank stabilization was constructed when the discharge value of the Santa Cruz River was thought to be approximately 28,000 to 30,000 cubic feet of water per second. Today this amount has been revised upward primarily due to the flood event of October 1983. Benefits may accrue to this section of the Santa Cruz River via Santa Cruz River widening and / or flood control storage improvements along the planned reach of Paseo de las Iglesias.

As a point of comparison, the historic river was broad and shallow and not at all channelized until floods in 1887 caused today's downcutting. At the former confluence of the Santa Cruz and the West Branch, there was a natural Cienega/wetlands that was developed into a lake to impound water sometime during the Spanish/Mexican period and later more fully developed into Warner's Lake in 1874 which covered some 50 acres. The river was carried downstream in series of acequias dating from the Spanish period, and there was not a single channel. Restoration of the channel bottom floodplain to more closely resemble its historic form is the desired flood control strategy within the existing channel bank and construction of increased flood storage improvements whenever possible.

3. CAP SURFACE FLOW / RECHARGE / WETLANDS AT VALENCIA

A centerpiece of the Santa Cruz River restoration project as proposed by Pima County is development of water-based lakes and wetlands on property immediately adjacent to the San Xavier District of the Tohono O'odham Indian Nation. Because Pima County does not have a direct access to any renewable water supply, either CAP water or effluent, the County is completely dependent upon others regarding development of the water element of the project. Given the proximity of the property to the San Xavier District of the Tohono O'odham Nation and the Santa Cruz River, it is possible to form a cooperative relationship with the District to manage this component of the project for the County if water resources were made available.

The benefits of multiple basin recharge and/or permanent water at this location are considerable for environmental enhancement and water based recreation. In addition, with a significant water volume stored at this location, it is possible to periodically release waters to saturate and irrigate established vegetation along and within the Santa Cruz channel, thereby re-establishing much of the Santa Cruz River historical riparian environment. Without this project, the existing wetlands and cottonwoods will cease to flourish when the gravel pit operation ceases. The existing ponds were created for the purpose of washing the gravel. They are maintained by groundwater pumping, and have naturally revegetated with cattails, cottonwoods, and willows.



Santa Cruz River near Los Reales Road. One of two wetlands at the San Xavier gravel operation. The wetland is used to store water for washing gravel. (U.S. Army Corps of Engineers)

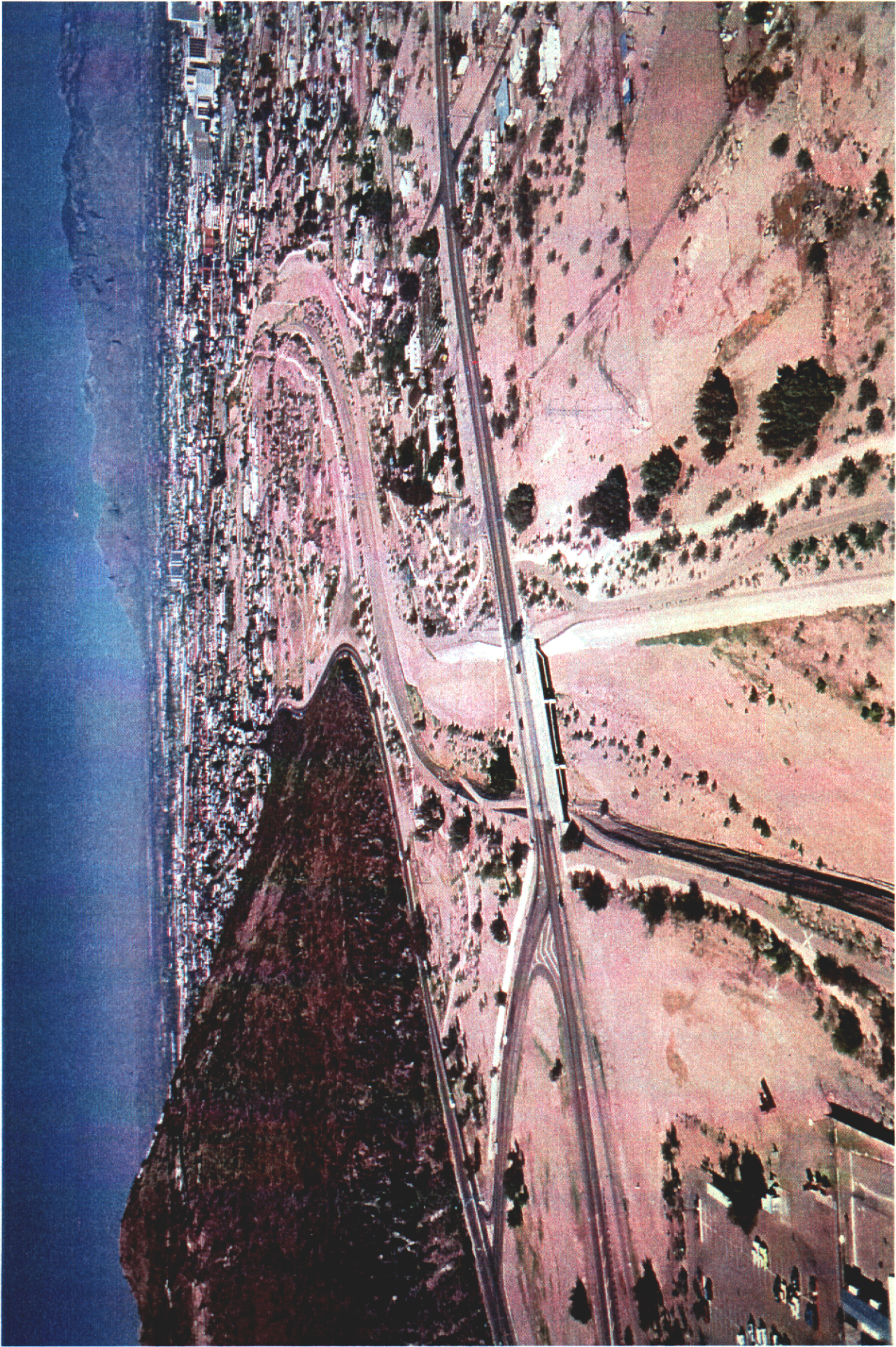
4. RESTORATION OF NATIVE VEGETATION

If 2000 acre-feet of water were available for vegetation, it would support approximately 500 acres of mixed cottonwood-willow forest and mesquite woodland. The significance of 500 acres of these two globally endangered forest types is enormous from a biological standpoint. These forests are important for many species of migratory birds, and still other species of birds and mammals which would live in there year-round. If such occurs, the restored riparian habitat would be one of the most significant purposeful riparian restorations in southern Arizona. By comparison, the U. S. Geological Survey estimated riparian vegetation down a sixteen mile reach of Ina Roads wastewater treatment facilities amounted to some 300 acres and had a consumptive use of less than 900 acre-feet per year. The lower amount of water use occurs because the acreage of mature cottonwood or mesquite woodland was only a small percentage of the total acreage of vegetation in 1990.

Riparian vegetation can be established in several ways. One way is to raise the water table or discharge water directly to the channel and allow the vegetation to restore itself. This method has several advantages: no cost for plant materials, reduced costs for maintenance, a high likelihood of success from a biological standpoint, and natural disturbance processes in the form of flooding, which would maintain the forests in a variety of successional states. One disadvantage is the amount of water needed to produce the conditions favorable for natural regeneration and maintenance greatly exceeds what is needed for the plants themselves. Therefore, this method works best when economic advantages are derived from the discharge of water. Previous examples of where riparian vegetation has been restored in this manner have been in the context of recharge projects, gravel washing, or disposal of effluent or agricultural runoff, or in association with high profile recreational features.

The other model of establishing native vegetation would be to plant and irrigate the vegetation much as one would in a park or home landscaping project. The advantages include lower total water needs, and an improved ability to direct what type of vegetation will grow in any given location. The disadvantages are the costs for plant materials, irrigation infrastructure, the need for perpetual maintenance, and lack of natural flooding. These types of projects are generally not considered sustainable and hence are not considered restoration from a biological standpoint. However, this option may be appropriate where landfills are present or where flooding is absent.

Opportunities also exist to establish the native grasslands and saltbush-wolfberry scrub which were more common along the periphery of low-desert floodplains prior to agricultural development. Grasslands and saltbush-wolfberry scrub support an entirely different wildlife community, and would require no supplemental water once established. Areas that would be most suitable for this type of restoration would be outside the incised channel on fine-textured soils. Grassland vegetation would help control runoff and erosion along the tributaries of the Santa Cruz River.



Santa Cruz River looking North (downstream) across 22nd St. bridge. Sentinel Peak on left, downtown Tucson on right.
(U.S. Army Corps of Engineers)

5. CONNECTION OF TRAILS / TRIBUTARIES

Over 23 miles of river parks have been constructed along the Santa Cruz River, Rillito Creek and Tucson Diversion Channel within the present urban area. These parks are used by thousands of people each week to relax and exercise.

The channel bottoms offer one of the few locations for horse use in a growing urban area. Riparian vegetation will be encouraged to regrow in the channel bottom, making the watercourse an important future biological corridor linking open space and public lands.

6. TUCSON AJO DETENTION BASIN ENVIRONMENTAL RESTORATION

The Tucson/Ajo Detention Basin Environmental Restoration Project is a major project which ties to Paseo de las Iglesias through the Julian Wash and will create 27 acres of wetlands and riparian habitat to a 120-acre flood control basin. The project will also extend the Tucson Diversion Channel, or Julian Wash River Park. In the final phase, the wetlands will be surrounded by an 18-hole golf course.

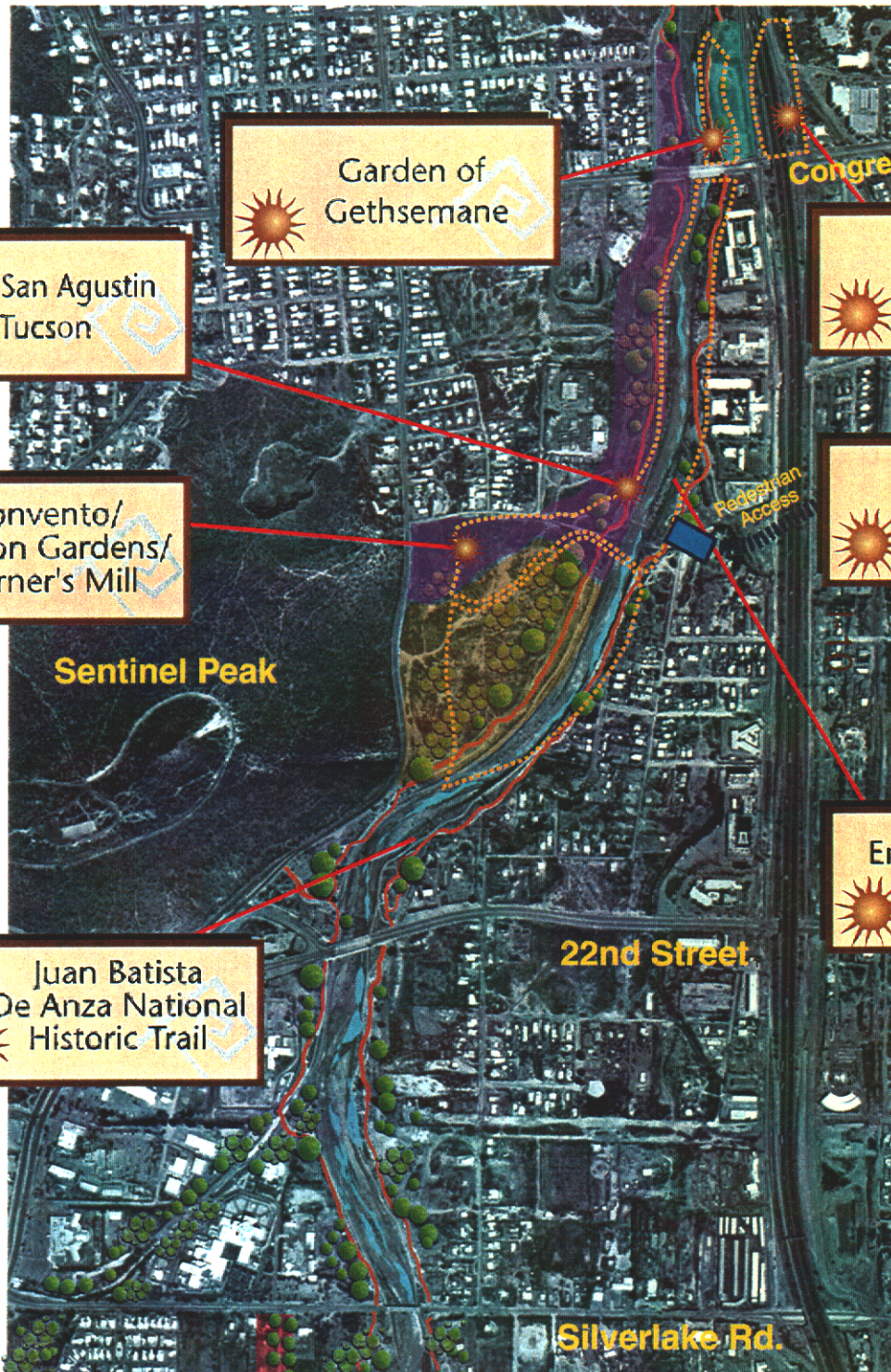
The Tucson/Ajo Detention Basin is located just north of Ajo Way and west of Country Club Road. The basin partially surrounds Sam Lena Park. The Kino Sports Complex has been developed to the south and is the winter home of the Arizona Diamondbacks and the Chicago White Sox. A state-of-the-art stadium, Tucson Electric Park, opened in 1998.

Now, Pima County, in cooperation with the United States Army Corps of Engineers, is bringing another phase of this project to fruition with the restoration of the Tucson/Ajo Detention Basin. The project will capture normally lost urban storm water within the project water features and will use this water for turf irrigation, thereby becoming an important water conservation project.

Paseo de las Iglesias



Proposed Santa Cruz Riverpark
San Agustín Mission to Silverlake



Mission San Agustín
de Tucson

Garden of
Gethsemane

Downtown
Gateway
Water Feature

Convento/
Mission Gardens/
Warner's Mill

St. Augustine
Cathedral

Sentinel Peak

Enhanced Acequia
Gathering Park

Juan Batista
De Anza National
Historic Trail

22nd Street

Silverlake Rd.

7. ENDANGERED AND SENSITIVE SPECIES

Within Pima County, the federal government recognizes eighteen species as threatened or endangered. Of these, at least five stand to benefit directly from efforts to restore the Santa Cruz River:

- | | |
|-------------------------|-----------------------------------|
| 1. Desert Pupfish | 4. Cactus Ferruginous Pygmy-Owl |
| 2. Gila Top minnow | 5. Southwestern Willow Flycatcher |
| 3. Huachuca Water umbel | |

These species formerly occurred in the Tucson Basin and have been lost due to the decline of the water table along the Santa Cruz River, which eliminated perennial flow and habitat for these species. The progressive demise of native fish in the Santa Cruz is reflected in the table below, which is based on the 1986 Site Specific Water Quality Criteria Study for the Santa Cruz River [Key: "O" = occurrence; "PO" = probable occurrence; "E" = extirpated.]

NATIVE FISH	1851-1854	1874	1893	1904	1937-1939	1950-1970	1985
Agosia chrysogaster (Dace)	O	O	O	O	O	E	E
Cyprinodon macularius (Pupfish)	PO	PO	PO	E	E	E	E
Catostomus clarkii (Sucker)	O	PO	O	O	E	E	E
Catostomus insignis (Sucker)	O	PO	O	O	E	E	E
Gila robusta (Chub)	O	PO	O	O	E	E	E
Poeciliopsis occidentalis (Top minnow)	O	O	O	O	E	E	E

Unlisted species that would benefit from restoration projects include the Western Yellow-billed Cuckoo, the Gila Chub, Desert Sucker, Sonoran Sucker, and Long-fin Dace. The first two species are likely to be listed by the federal government. Obviously, for fish and endangered plants, water lies at the heart of their recovery potential. In fact, an estimated 60 percent of Arizona's wildlife species depend on riparian areas for survival. The availability of CAP and effluent water presents an opportunity for re-establishing populations of these species along the Santa Cruz river system through direct use or through groundwater recharge.

III. PASEO DE LAS IGLESIAS IN CONTEXT OF TRAVELING FROM CHURCH TO CHURCH

Juan Mateo Manje, on an expedition with Padre Kino in 1699, made an entry in his journal expressing his thoughts about the pueblos at San Xavier and San Agustín and the river, the Rio Santa Maria de Soamca, now the Rio Santa Cruz.

... a mission can be established with two pueblos of more than 2000; for which there are sufficient lands for planting, all of which are watered by fine canals, and large and extensive plains of beautiful meadows or savannas with many pastures It is in my opinion the best site in all of Pimeria. Two independent towns could be formed ... along a level route beneath shady and leafy cottonwoods. It would be a form of recreation ... to visit while having the pleasure of going from one town to the other while enjoying the crystal clear water of the springs midway between the two.

Between the two missions, a distance of about eight miles, various travelers and missionaries noted that the river flowed nearly perennially from springs just upstream of San Xavier and at the base of Sentinel Peak, near San Agustín, which provided additional flow farther downstream. If we are to trust these historical accounts, the flow of the Santa Cruz River prior to 1890 was at the very least dependable, if not truly perennial, from San Xavier Mission to the confluence of the Rillito River.

Consequently, there is little doubt that the availability and reliability of water and fertile bottomlands along this reach of the river became the focus for human settlement dating from prehistoric times to the present. Much has changed in 300 years since Manje's journal account, yet the river and its missions retain their history as well as the potential once again to be a verdant and peaceful place.

The following summaries provide (1) specific information for the potential to recreate and interpret the cultural and environmental history of the Paseo de las Iglesias, and (2) to summarize proposed development of the river park corridor today, with particular attention paid to water resource issues.

A. SAN AGUSTIN MISSION TO SILVERLAKE

1. CULTURAL AND ENVIRONMENTAL HISTORY RESTORATION OPPORTUNITIES

- ▶ Archaeological excavations in the vicinity of Sentinel Peak indicate a substantial Archaic settlement of the **Clearwater Site** practicing maize cultivation at 1000 B.C. Considered the **Birthplace of Tucson**, there is evidence of virtually continuous occupation here through the prehistoric period to the first explorations by Father Kino in the 1690s who called the Piman settlement San Cosme del Tucson after the Piman place name of "stjuckshon." Later known as **San Agustín del Tucson**, or El Pueblito, this village and its mission community became a visita of San Xavier del Bac in the latter part of the 18th century.
- ▶ The **Tucson Presidio** was established in 1775 to the east terrace across the river from the mission where ample water, good farmland, and timber would provide for a Spanish and later Mexican military garrison. The modern **St. Augustine Cathedral** and the **Santa Cruz Church** carry the traditions of Tucson's early patron saint and its river.

- ▶ Also at the base of Sentinel Peak, just north of the confluence of the West Branch of the Santa Cruz and the Santa Cruz River, Solomon Warner built an earthen dam creating a 50 acre lake in order to insure a reliable source of water to run his flour mill located just west of Mission Lane. **Warner's Mill and Lake** completed in 1874 captured the water from the natural springs emanating from the base of Sentinel Peak. By the late 1880s, Warner's lake and Silver Lake and the Silver Lake Hotel complex were destroyed by floods and subsequent downcutting of the river channel.
- ▶ With increased demand for water in the growing community and a lowered watertable, in 1913 the **Tucson Farms Company Cross-cut Canal and Reservoir** was constructed just upstream of the confluence of the West Branch and the Santa Cruz River and created today's confluence point near 22nd Street. The old course of the West Branch was filled in, but floods damaged the Cross-cut, and it was finally destroyed in 1940 and abandoned.

2. RIPARIAN RESTORATION AND WATER RESOURCE OPPORTUNITIES

There is bank protection from Silverlake Road to Congress (both banks). The river park is constructed within and adjacent to the 100-year floodplain. The riparian restoration of the river near the "Convento Site" has been constrained by the 'A' Mountain landfill.

However, it would be possible to re-create the Mission garden setting that existed near the Convento through landscape irrigation techniques, and to re-establish grassland and desert scrub vegetation in existing disturbed areas. This section of the river connects to the Tucson Mountain Park via Sentinel Peak and Tumamoc Hill, and therefore has value as a wildlife corridor.

Paseo de las Iglesias



Proposed Santa Cruz Riverpark
Silverlake to Ajo Way



North

West Branch Santa Cruz
River Conservation/
Link to Tucson Mt Park
and Kennedy Park



Silverlake Rd

Silverlake Resort
Historic Site



Cottonwood Ln

Santa Cruz Irrigation
District Restoration
Cottonwood Path



Julian Wash

Yaqui Park & Ceremonial Center/
Link to Tucson Diversion Channel
River Park & County Ajo
Detention Environmental
Restoration Project



Ajo Way

St. John's
Catholic Church



B. SILVERLAKE ROAD TO AJO WAY

1. CULTURAL AND ENVIRONMENTAL HISTORY RESTORATION OPPORTUNITIES

- ▶ Before the construction of Warner's mill and lake, **Silver Lake** was constructed in 1856 following the Gadsden Purchase to provide a reliable source of water for **Rowlett's Mill**, which was confiscated and burned by Union troops during the Civil War.
- ▶ Following the war the **Pioneer Mill** was built on the lake, and the **Silver Lake Hotel** and Tucson's first **racetrack** along Cottonwood Lane were built first as a respectable resort and later a place of "questionable resort." All this would wash away in the floods of 1891.
- ▶ South of Silverlake, prehistoric Hohokam peoples had established a large village known as the **Julian Wash Site** that was occupied for several hundred years near the confluence of Julian Wash and the Santa Cruz River. Much of this site on the terrace above the floodplain remains intact and provides excellent potential for interpretation.
- ▶ Relatively recent immigrants to the area, Yaqui Indians fled their native Mexico in the late 1800s fleeing the persecution of the Mexican government and settled in Tucson in this and other areas, bringing with them their unique ceremonials and traditions and further enriching our cultural fabric and diversity.

2. RIPARIAN RESTORATION AND WATER RESOURCE OPPORTUNITIES

- ▶ The unprotected reach between Silverlake Road and Ajo Way is expected to remain as is during next several years. The 1997 Bond Election approved funding for the Santa Cruz River Community Park (a sports field complex) along the east bank of the Santa Cruz River, north of Ajo. Public lands adjacent to the river may also be useful for community gardening projects. Two landfills pose constraints to development.
- The District's river park master plan identified a multi-purpose trail along the reach which connects to Julian Wash as a high priority recreational and transportation feature for the community.
- An extensive grassy terrace within the west half of the channel slopes westward, away from the low-flow channel. If riparian vegetation were encouraged in this location, it would reduce the potential for erosion during floods. Without such a measure, the western bank will be more susceptible to erosion when flows rise over the terrace.
- To the extent possible, storm water harvesting techniques should be considered on the tributaries, to reduce the headward erosion of the tributaries and provide supplemental water for riparian growth.

Paseo de las Iglesias



Proposed Santa Cruz Riverpark
Ajo Way to South of Irvington



St. John's
Catholic Church

Santa Cruz
River Extension

Cottonwood/Willow
Habitat
Restoration

C. AJO WAY TO VALENCIA ROAD

1. CULTURAL AND ENVIRONMENTAL HISTORY RESTORATION OPPORTUNITIES

- ▶ The lands between the West Branch and the Santa Cruz River undoubtedly provided some of the best lands for cultivation both prehistorically and historically. Commenting on the area between the San Xavier and Tucson settlements, Father Kino notes in 1697 that numerous fields were irrigated with canals suggesting that perennial flow could be directed across the floodplain with minimal effort.

The fields and lands for sowing were so extensive and supplied with so many irrigation ditches running along the ground that the father visitor said they were sufficient for another city like Mexico.

- ▶ Large prehistoric communities, specifically the **West Branch Community** and the **Dakota Wash Site** on the west bank of the West Branch and the **Valencia Site** on the east bank of the Santa Cruz River, certainly took advantage of this large expanse of arable lands. Moreover, recent research indicates significant Archaic settlement north of the Valencia Site, as well as evidence for early maize agriculture. This area now known as the Midvale Farms development once provided a significant agricultural economy in prehistoric and historic times.
- ▶ Although urbanization continues to impact the West Branch Community and the agricultural fields between the West Branch and the Santa Cruz River, bond funds have been identified for the acquisition and interpretation of the Valencia Site on the east side of the river. An opportunity exists here as well for a Native American cultural center and museum facility.
- ▶ City of Tucson lands adjacent to the river provide the opportunity for riverpark development and interpretation of this important Hohokam village.

2. RIPARIAN RESTORATION AND WATER RESOURCE OPPORTUNITIES

Ajo Way to Irvington Road

- Erosion protection has already been constructed in this reach.
- The Santa Cruz River Park runs from Irvington to Ajo. This reach is known as Paseo de los Arboles. This project encompasses a one-mile long section of the Santa Cruz River Park and is divided into six groves. Each grove has 100 native trees that have been planted through public support. The El Paseo de los Arboles project enables citizens to have a tree planted for any occasion and names placed on a uniquely designed tile wall adjacent to each grove. This reach of the Santa Cruz River Park is the first to be fully landscaped with private funding.
- Remediated water from the adjacent TCE-stripping facility could be discharged in this channel reach or otherwise made available for landscape irrigation.

Irvington Road to Valencia Road

- Riparian restoration opportunities supporting Cottonwood-Willow growth would be created through periodic releases of water.
- Although the 100-year flow is contained within existing high banks, the banks are highly susceptible to erosion during large flows.
- Using a combination of recently authorized bonds and matching funding from benefitting property owners, the District will construct bank stabilization along the banks. A thorough alternatives analysis and geomorphic study are needed to determine how erosion control can best be provided.
- The existing floodplain width and channel sinuosity will be retained by the erosion protection project to preserve flood storage areas, assure adequate flood-carrying capacity and minimize the need to excavate or fill along the alignment. The bank protection can also serve to decrease headward erosion on the tributaries to the Santa Cruz River.
- Ponds to detain storm water from some of the tributaries behind the bank protection will be considered, where right-of-way and soils constraints permit.
- In certain reaches, the top of the soil-cement embankment will be at the 50-year flood level or below to permit riverpark trails to be located below the top of the bank. This will visually isolate the paths from adjacent development, similar to the design of the Rio Nuevo reach of the Santa Cruz riverpark.
- A terrace adjacent to channel could be used for a demonstration of Hohokam floodwater farming techniques adjacent to the archeological site north of Valencia Road. The farm project would utilize tributary flows for the water source, potentially augmented by CAP or reclaimed water, and indigenous crops such as corn, beans and squash. A "charco" or floodwater retention pond, could also be constructed on the terrace.
- Mission Manor (El Vado) Wash possesses significant wildlife habitat and should remain substantially unmodified by development of the Hohokam village site.
- The high, erodible channel banks contain many voids that are the result of soil piping. The voids can be valuable to certain bird and bat species. Wildlife surveys should be performed to examine the significance of these features as part of the alternatives analysis for bank stabilization. Low flow stabilization or fence-jetties could be used to preserve these features while still providing erosion protection.
- Measures are needed to reduce headward erosion of the tributaries.

Paseo de las Iglesias



Proposed Santa Cruz Riverpark
South of Irvington to Valencia Road



Cottonwood/Willow
Habitat
Restoration

Mission Park

Hohokam
Archaeological
Interpretive Site

Paseo de las Iglesias



Proposed Santa Cruz Riverpark
Valencia Road to Mission San Xavier



Periodic Releases to Establish
& Irrigate Riverpark Corridor
to Congress

Wetlands at
Valencia

Farmland
Rehabilitation
Project

Reservation Boundary

Native Seed
Traditional Flood
Irrigation Farming

Mission
San Xavier

Martinez Hill

CAP Surface Flow Option
from Pima Mine to Feed
Recharge Lake



D. VALENCIA ROAD TO SAN XAVIER

1. CULTURAL AND ENVIRONMENTAL HISTORY RESTORATION OPPORTUNITIES

- ▶ Recharge in the San Xavier gravel pits could provide multifaceted benefits to the community in restoring not only ground water but in restoring some of the historical natural environment. Bureau of Reclamation efforts to stabilize the riverbank and rehabilitate some of the traditional O'odham farmlands provides an additional opportunity for demonstration traditional floodwater and ditch irrigation farming.
- ▶ Cooperation and involvement of the San Xavier District of the Tohono O'odham Nation is critical to the successful extension of this project onto the Reservation and its destination of **Mission San Xavier del Bac**, first established in the 1690s by Fr. Kino to serve the Piman village of Bac.
- ▶ There is an additional important opportunity for the O'odham Nation and Pima County in the establishment and interpretation of the 1775 **Juan Bautista de Anza National Historic Trail**, which has been nominated to be designated a Millennium Trail, and which follows along the traditional route of the **Camino Real**.

2. RIPARIAN RESTORATION AND WATER RESOURCE OPPORTUNITIES

The area between Valencia and Los Reales roads is currently dominated by aggregate mining. The useful life of the mine will end in approximately five years. Afterwards, the area owned by San Xavier Rock and Sand could be rehabilitated to provide other useful community functions such as recharge and storage of CAP water, recreation areas, and wildlife habitat.

- The existing gravel pits have an above-ground storage volume in excess of 910 acre-feet. If the purpose were above-ground storage for water-based recreation or supply reliability, the gravel pits would be enlarged and possibly lined with finer-textured compacted soils or clay to prevent seepage losses.
- The deepest pits may occasionally fill with recently recharged water following streamflow events (T. Hendricks, personal communication). The presumed mechanism would be transient saturation of the coarse material overlying a clayey layer at 40 to 55 feet below land surface. This suggests that if shallower basins are used for recharge, the perched water table will form and rise into the channel. Possible benefits could include the restoration of a flowing stream in the Santa Cruz River and creation of a "hydraulic dam" underground to lift water levels in San Xavier District.
- The depth to the regional aquifer is about 112 to 118 feet (Scott Rogers, personal communication). The hydrologic connection between the aquifer(s) below the gravel pits and the TCE-contaminated perched aquifer to the east must be investigated to determine feasibility of recharge.
- Mayor and Council voted March 17, 1998 to proceed with planning an extension of the raw CAP distribution system to Valencia Road at the Santa Cruz River. The pipeline could be used to recharge CAP water. If water recharged in this area reaches the regional aquifer, it could be recovered by existing wells.

New wells could be constructed to pump from a perched aquifer, if one forms. The difference in total dissolved solids between CAP water and ambient groundwater in the area is much less than in the central well field.

- A lake has been created by directing tributary flow from Santa Clara Wash into one of the pits and pumping groundwater into the basin. Cottonwoods and willows have established in this area without assistance from the pit operator. Without federal assistance, the vegetation will die when the gravel mine is abandoned. Wildlife observation and picnicking would be the primary recreational activity suitable for this area. Depending on water quality, water levels and vegetation management, the lake could also be suitable for swimming and non-motorized boating. Future bank protection should protect this lake from erosion, but allow occasional overtopping of the embankment by flood flows from the main channel of the Santa Cruz River. Flows from Hughes Wash should continue to be diverted due to potential water quality concerns.
- Gravel pits which are isolated from 100-year flooding and properly landscaped could become attractive urban fisheries if supplied by CAP water. However, game fisheries might be incompatible with establishment of native fish habitat. Fishing features would have to be isolated from flooding by a levee to prevent release of fish or removal of habitat during flood events. Non-motorized boating could be compatible with fishing and CAP storage. The State Lake Improvement Fund, the Heritage Program, and the Arizona Water Protection Fund are possible sources which could help to finance recreational development.
- Many native fish, as well as the Huachuca water umbel, need a flowing river to survive, not merely ponds. Conceptually, an off-channel headwater source which discharges to a channel that would be subjected to occasional flood scouring would be ideal.
- Erosion protection would be needed to protect the land and associated facilities as well as the El Paso Natural Gas pipeline and Interstate Highway 19. Bureau of Reclamation has stabilized the channel banks south of Los Reales Road to protect the San Xavier District of the Tohono O'odham Nation.

San Xavier District

The San Xavier District has initiated several projects to examine alternatives for riparian restoration and recreational features. The first project uses Arizona Water Protection funding to study the feasibility of such projects at various locations within the District, including within the Santa Cruz River arroyo. The District's staff will be presenting the alternatives to the community within the next year for feedback. If the community accepts one of the alternatives, the project will proceed to design and construction. A separate project will involve planting native trees such as cottonwood and mesquite behind the newly constructed bank stabilization just north of the San Xavier Road bridge on the Santa Cruz River. This project is funded through Bureau of Reclamation using SAWRSA funds. The source of water would be CAP water. A third project, already completed, involved discharging excess CAP water from the City of Tucson's reservoir into two tributary arroyos of the Santa Cruz River. This project was funded by U. S. Bureau of Reclamation, and involved constructing "blow-off" valves and energy dissipation structures.

PART IV: PASEO DE LAS IGLESIAS IN CONTEXT OF INTERGOVERNMENTAL COOPERATION

A. INTRODUCTION

The concepts described in the previous sections regarding Paseo de las Iglesias are achievable. However, they can only be achieved through a great deal of intergovernmental cooperation. Pima County has invited the Tohono O'odham Nation Indian Nation to participate as a major partner in both the Sonoran Desert Conservation Plan and the Paseo de las Iglesias project, along with these federal and state entities that have also expressed interest in developing the larger Sonoran Desert Conservation Plan.

FEDERAL ENTITIES

- United States Department of Agriculture, Forest Service
- United States Department of Defense, Air Force, Ranges and Airspace
- United States Department of Defense, Army Corps of Engineers
- United States Department of the Interior, Bureau of Land Management
- United States Department of the Interior, Bureau of Reclamation
- United States Department of the Interior, National Parks Service
- United States Department of the Interior, Office of the Secretary
- United States Department of the Interior, U.S. Fish and Wildlife Service
- United States Department of the Interior, U.S. Geological Survey

STATE ENTITIES

- Arizona Dept of Environmental Quality
- Arizona Dept of Water Resources
- Arizona Water Banking Authority
- Arizona Game and Fish Department
- Arizona State Land Department
- CAWCD

B. FUNDING AND RELATIONSHIPS FOR CULTURAL & HISTORIC PRESERVATION

Historic and Cultural Preservation

- 1997 General Obligation Bonds

Mission San Agustín	\$500,000
Anza National Trail and Campsites	\$750,000
Tumamoc Hill	\$500,000
Valencia Site	\$900,000

- Arizona Heritage Fund Historic Preservation Grants - The Heritage Fund Historic Preservation Grants program administered by Arizona State Parks and the State Historic Preservation Office offer \$1.7 million annually in competitive grants for a variety of historic preservation activities. Eligible projects include acquisition/easements, building assessment reports, stabilization, rehabilitation, reconstruction, archaeological park development, education and preservation program development, interpretation, maintenance, and nominations to the National Register of Historic Places. Other Heritage Fund grant programs such as the Trails Heritage Fund, for example, could assist in the development of public heritage sites such as the Juan Bautista de Anza National Trail.
- Arizona State Land Department - With the recent passage of the Arizona Preserve Initiative (API), State Trust Lands that are environmentally and culturally sensitive may be reclassified for "conservation" purposes, provided they meet certain criteria. Following reclassification approval, the applicant has up to eight years to raise sufficient funds to either lease or purchase the reclassified lands. Tumamoc Hill is an example of an API reclassification, and another is the Valencia Site, which will be preserved and interpreted as an archaeological park. Fortunately, where open space is preserved, historic and cultural sites are also preserved, and it is anticipated that other open space acquisitions will achieve historic preservation objectives as well.
- Federal Assistance - Federal funding sources for elements of this plan will typically provide some source of funding for the inventory and treatment of archaeological, historical, and cultural sites associated with the project. Funding for historic preservation, interpretation, and education is often available when these sites are incorporated into project planning and development. Potential sources of Federal funding for project related historic preservation efforts include the United States Army Corps of Engineers and the Bureau of Reclamation.

C. FUNDING AND RELATIONSHIPS FOR RIPARIAN RESTORATION

Riparian Restoration

- 1997 General Obligation Bonds

Santa Cruz Flood Control and River Park Irvington to Valencia	\$4,200,000
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Santa Cruz River Community Park	\$850,000
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- State Assistance

Two State grant programs are also likely to provide significant funding: the Heritage Program and the Arizona Water Protection Fund.

The Heritage Fund was established in 1990 with monies from the State lottery. Sixty percent of the monies must be spent on the identification, acquisition, protection and management of sensitive areas for wildlife. The Arizona Game and Fish Department administers the program, and can provide technical assistance as well as funding.

The Arizona Water Protection Fund was established in 1994 specifically to restore and protect rivers and riparian areas. One advantage of the AWPf is that funds can be used to purchase water, in addition to being used for planning, design and construction. AWPf has granted over \$600,000 to the San Xavier District for riparian restoration on the Santa Cruz River or its tributaries.

State funding discussions have occurred regarding the Rio Salado Project in Phoenix, which is a Salt River redevelopment project. Similar funding, if made for Rio Salado, should also be made for watercourse redevelopment within Pima County, primarily the Santa Cruz River Paseo de las Iglesias project from Congress to Valencia Road.

The Central Arizona Water Conservation District operates the Central Arizona Project in Arizona. In addition, Central Arizona Groundwater Replenishment District also operates the recharge program and, finally, the State Water Banking Authority is charged with recharging and storing Central Arizona Project water.

The introduction of Central Arizona Project water into riverine corridors to re-establish the environmental benefits of traditional riparian vegetation as well as recharge the underground aquifer, are actions that may be consistent with the goals of each of these State agencies. Therefore, they could also play a vital role in riparian restoration.

- Federal Assistance

Corps of Engineers - The Corps of Engineers has been the primary Federal cooperative agency with Pima County regarding riparian or environmental restoration projects associated with Corps of Engineers flood control projects in Pima County. Significant additional funding opportunities will exist for participation with Pima County, primarily the Ajo Detention Basin and Environmental Restoration Project, the Paseo de las Iglesias Santa Cruz River Project, Tucson Arroyo/Arroyo Chico, and the Rillito/Swan Wetlands Ecosystem Restoration Project. To date, approximately \$6 million of Federal funds have been committed to the study and/or actual project development for Corps sponsored environmental restoration or riparian restoration projects. The Water Resources Development Act of 1998 now pending in Congress, which would fund the Corps of Engineers Challenge 21 Program, provides excellent opportunities for funding the four environmental restoration projects of Paseo de las Iglesias, Ajo Detention Basin and Environmental Restoration, Tucson Arroyo/Arroyo Chico, and Rillito/Swan Wetlands Ecosystem Restoration, totaling approximately \$55 million.

Bureau of Reclamation - Given the primary desire to reintroduce dependable water sources into riverine corridors, the Bureau of Reclamation, the Federal agency that developed the Central Arizona Project, may be instrumental in providing surface waters to reintroduce into riverine environments. It is hoped that the Bureau of Reclamation will play an important role in providing surface waters for the Paseo de las Iglesias Project. Reclamation is an environmental enhancement program. The program emphasizes actions which have a high probability of promoting the full recovery of functional habitats. Examples of restoration activities funded include placing water back into a stream, controlling over-grazing, and restricting off-road vehicle impacts. The local sponsor must be willing to assume at least 50% of the capital costs, and the project must be linked to some feature of the CAP.

Other Federal Programs - The United States Fish and Wildlife Service and the United States Natural Resource Conservation Service also provide funding for riparian restoration work. The Land and Water Conservation Fund can be used to acquire land or water rights for conservation purposes. Since 1965, the LWCF has collected revenues from Federal off-shore oil leases for the purpose of protecting natural and cultural resources. Appropriation of these funds slowed to a trickle in the early 1980s, and the \$11 billion that has accumulated in the fund is presently being used for deficit reduction. However, a national effort is presently underway to restart the disbursement of these funds, and a portion may eventually become available to Pima County for land acquisition through the State of Arizona.

- Multi-Species Conservation Planning Intergovernmental Cooperative Agreement - The County has begun initial planning on a multi-species habitat conservation plan to comply with the Endangered Species Act. This habitat conservation planning process will include multiple species that are threatened or endangered and will likely result in strategies to establish riparian and biological corridors that can be used as pathways for endangered or threatened species, including migration to and from larger publicly conserved habitats. All local governmental entities within Pima County will be asked to participate in a regional conservation planning initiative, as well as the Tribes within the regional planning area of the Pima County boundaries and federal and state entities that have expressed an interest as described above.
- ▶ Public/Private Partnerships - The Santa Cruz River Alliance (SCRA) is a newly formed, citizen-based, non-profit organization with the mission to promote ecological restoration and conservation of the natural and cultural resources of the Santa Cruz River and its watershed. The SCRA plans to achieve its mission by serving as a link among citizens, government agencies, non-governmental organizations, and industry, in the effort to improve the quality of the human and natural environment. They plan to seek grants to fund restoration and other activities.

The Nature Conservancy provides expertise and funding for key projects. They already hold conservation easements along Sabino Creek and the San Pedro River, and have attracted several private donations for management of Bingham Cienega on behalf of Pima County. Volunteers with the Nature Conservancy and many local community groups have already been and will continue to be instrumental in stream restoration projects.