

**DRAFT**



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# MEMORANDUM

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Date: December 15, 1999

To: The Honorable Chair and Members  
Pima County Board of Supervisors

From: C.H. Huckelberry  
County Administrator 

Re: **Environmental Restoration in Pima County in Cooperation with the U.S. Army Corps of Engineers**

On December 14, 1999, Dr. Joseph Westphal, Assistant Secretary of the Army for Civil Works, and Congressman Ed Pastor visited Pima County to review progress and implementation on a number of Corps of Engineers/Flood Control District environmental enhancement projects. These projects begin to form the basis for the riparian restoration and protection element of the Sonoran Desert Conservation Plan. The federal resources of the Corps of Engineers are considerable and will greatly assist in implementing the riparian restoration and protection element of the Conservation Plan. While the Corps continues to be thought of as primarily a structural flood control organization, more and more of the projects sponsored by the Corps and those particular to Pima County are for environmental purposes.

The attached discussion paper entitled *Environmental Restoration in Pima County in Cooperation with the U.S. Army Corps of Engineers*, brings together and updates prior analyses of the Riparian Restoration Element of the Sonoran Desert Conservation Plan to include not only the considerations of the Endangered Species Act as administered and enforced by the United States Fish and Wildlife Service, but also the Clean Water Act, as administered by the United States Army Corps of Engineers.

As the lead local entity overseeing the development of the Plan, Pima County supports and promotes a regional Riparian Restoration policy which moves toward an ecosystem baseline that requires our basin to be in balance, and eventually results in some level of recovery of natural functions within riverine systems.

This report defines the scope of environmental and legal issues. It also describes a few of the riparian restoration projects underway between Pima County and the Army Corps, including: Paseo de las Iglesias; the Rillito River Habitat Restoration; and the Ajo Detention Basin. Finally, the report describes a method for further integrating efforts to address environmental and regulatory issues.

The Honorable Pima County Board of Supervisors  
**Environmental Restoration in Pima County in Cooperation with the U.S. Army Corps of  
Engineers**

December 15, 1999

Page 2

On November 16, 1999, a letter was forwarded to request a meeting with the District Engineer of the Los Angeles District to discuss a cooperative effort between Pima County Government and the Army Corps of Engineers to address the issues that were raised as part of the October 1999 United States District Court Order enjoining the Corps from authorizing certain Nationwide Permits under Section 404 of the Clean Water Act until a regionally based programmatic environmental impact statement is prepared. The letter stated that since Pima County is developing a regional multi-species habitat conservation plan, the Sonoran Desert Conservation Plan, we have a long-range interest in the programmatic assessment and in the consultation ordered by the District Court between the Army Corps of Engineers and the United States Fish and Wildlife Service. Because we have conducted a great deal of work with the local science community and are in the process of requesting proposals from biologists to conduct a regional biological evaluation, the existing habitat conservation planning process could serve to assist the Army Corps of Engineers as it assesses cumulative impacts of the Section 404 permit program on the endangered cactus ferruginous pygmy-owl.

CHH/jj

Attachment

# ENVIRONMENTAL RESTORATION IN PIMA COUNTY

## Restoring Riparian Resources in the Context of the Sonoran Desert Conservation Plan

### **PART I: Riparian Restoration -- Understanding the Scope of the Problem**

A.	Biological Impact of Degraded Riparian Systems . . . . .	2
	1. Defining the Sonoran Desert Conservation Plan & Riparian Restoration Element	2
	2. Decline in the Riparian Systems . . . . .	5
	3. Problem of Impact to Species. . . . .	7
B.	Legal Impact of Degraded Riparian Systems . . . . .	13
	1. Endangered Species Act . . . . .	13
	2. Clean Water Act . . . . .	14
	3. Federal Reserved Right . . . . .	17
C.	The Relation of Water Budgets to Habitat Types and Species Protection under the Sonoran Desert Conservation Plan . . . . .	19

### **PART II: Army Corps Projects -- Building Blocks of a Riparian Restoration Solution . . . . 26**

A.	Paseo de las Iglesias . . . . .	26
	1. Project Description . . . . .	26
	2. Scope of Restoration . . . . .	26
	3. Walk of the Churches . . . . .	30
	a) San Agustin Mission to Silverlake . . . . .	30
	b) Silverlake to Ajo Way . . . . .	32
	c) Ajo Way to Valencia Road . . . . .	34
	d) Valencia Road to San Xavier Mission . . . . .	38
B.	Rillito River Habitat Restoration . . . . .	41
	1. Project Description . . . . .	41
	2. Scope of Restoration . . . . .	41
C.	Ajo Detention Basin . . . . .	43
	1. Project Description . . . . .	43
	2. Scope of Restoration . . . . .	43

### **PART III: Integration in Both Planning and Regulatory Approaches . . . . . 46**

	Enhancing the Scope of Riparian Restoration through Future Pima County - Army Corps of Engineers Cooperative Efforts: Special Area Management Planning . . . . .	46
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## **PART I: Riparian Restoration -- Understanding the Scope of the Problem**

This discussion paper brings together and updates prior analysis of the Riparian Restoration Element of the Sonoran Desert Conservation Plan to include not only the considerations of the Endangered Species Act as administered and enforced by the United States Fish and Wildlife Service, but also the Clean Water Act, as administered by the United States Army Corps of Engineers. The Sonoran Desert Conservation Plan offers the community the opportunity to consider Riparian Restoration policy from a comprehensive, integrated, regional perspective, rather than a narrow or interest based perspective. As the lead local entity overseeing the development of the Plan, Pima County supports and promotes a regional Riparian Restoration policy which moves toward an ecosystem baseline that requires our basin to be in balance, and eventually results in some level of recovery of natural functions within riverine systems. Recent court cases have indicated the need for integrated planning among federal entities, and between the federal and local partners. Accordingly, this paper defines the scope of environmental and legal issues, describes a few riparian restoration projects underway between Pima County and the Army Corps, and describes a method for further integrating efforts to address environmental and regulatory issues.

### **A. Biological Impact of Degraded Riparian Systems**

#### **1. Defining the Sonoran Desert Conservation Plan and the Riparian Restoration Element**

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 serve as an example 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. Pima County is planning to identify and preserve 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 |

In exchange for a long term conservation commitment, the business interests within the region will receive greater economic certainty and ability to plan, a streamlined regulatory process, and relief from the threat of potential criminal and civil liability under Section 9 of the Endangered Species Act for the "take" of an endangered animal.

a) Riparian Habitat Protection Under the Sonoran Desert Conservation Plan. The Sonoran Desert Conservation Plan is divided into subareas based on watershed and riparian features.

1) The San Pedro planning unit, which includes Buehman Canyon and the San Pedro River in the vicinity of Redington.

2) The Cienega-Rincon watershed planning unit, which includes the Empire-Cienega Ranch and proposed National Conservation Area, as well as the Vail and Rocking K communities.

3) The Upper Santa Cruz planning unit, which extends north from the Santa Cruz county line to Martinez Hill. It includes Green Valley, Sahuarita, Amado and the Santa Rita Experimental Ranch.

4) The Middle Santa Cruz planning unit, which encompasses the Santa Cruz River from Martinez Hill north to the confluence of the Canada del Oro Wash. The unit includes the foothills of the Tucson and Catalina Mountains, and the Tanque Verde Creek.

5) The Tortolita Fan planning unit, which includes all the watersheds that drain the Tortolitas, as well as the communities of Tortolita, Catalina, Oro Valley and portions of Marana along the Santa Cruz River.

6) The Avra-Altar planning unit, which includes all of the Avra or Brawley Wash, as well as portions of north-ward flowing watersheds near the Silverbell Mountains, and southward-flowing watersheds near Sasabe. This planning unit will be broken into two subunits, recognizing that the Altar Valley ranches have organized their own watershed association.

7) The Tohono O'odham planning unit, which includes the Aguirre and Santa Rosa Valleys, and the San Simon watershed.

8) Western Pima County's planning unit, which includes four separate watersheds: the Midway, Childs Valley, San Cristobal and Rio Sonoyta.

The watershed / riparian link to subareas enhances the ecosystem basis of the conservation plan. It is also clear, as elements of the Plan are studied, that the riparian connection is among the most critical. In the recently updated report on *Determining Vulnerable Species*, a number of sensitive species and a disproportionate number of extirpated native species were found to be dependent on aquatic habitat which is now lost. Likewise, the technical report issued on *Preserving Cultural and Historic Resources* found a strong correlation between existing cultural sites and riparian areas.

Each subarea will have a plan, drafted in concept form, and finalized as the biological, cultural and economic assessments are completed. These plans, when viewed together, will provide preserve alternatives that will constitute Pima County's conservation plan.



b) Role of Water Resources in the Sonoran Desert Conservation Plan -- The County has made a commitment to pursue a high conservation standard since the reach of the Sonoran Desert Conservation Plan is extensive. However, under any standard that seeks to comply with the Endangered Species Act, the Plan will have to include significant riparian restoration in order to prevent the decline and extinction of some of our imperiled riparian-dependent species, given the largely decimated status of the riparian ecosystem. Because there is an over-representation of riparian-dependent extirpated and imperiled species, which we have lost along with most of our perennial streams and the associated ground-water dependent riparian habitat, some significant amount of riparian restoration will be required if the Plan is to be meaningful. An inventory of some of the results of water resource utilization during the past one hundred years includes: (1) the loss of most perennial stream flow in Pima County; (2) the dramatic decline in the water table due to ground water pumping and the continued overdraft of this resource; and (3) the loss of 85 to 95% of quality riparian habitat during the last century, which negatively impacts the 60 to 75% of Arizona's resident wildlife population that depends on riparian habitat during some part of its life cycle. Given the status of the riparian ecosystem, the jurisdictions throughout the region face the realistic prospect that some level of restoration is likely to be a condition of the Section 10 permit issued under the Endangered Species Act.

## **2. Decline in Riparian Systems**

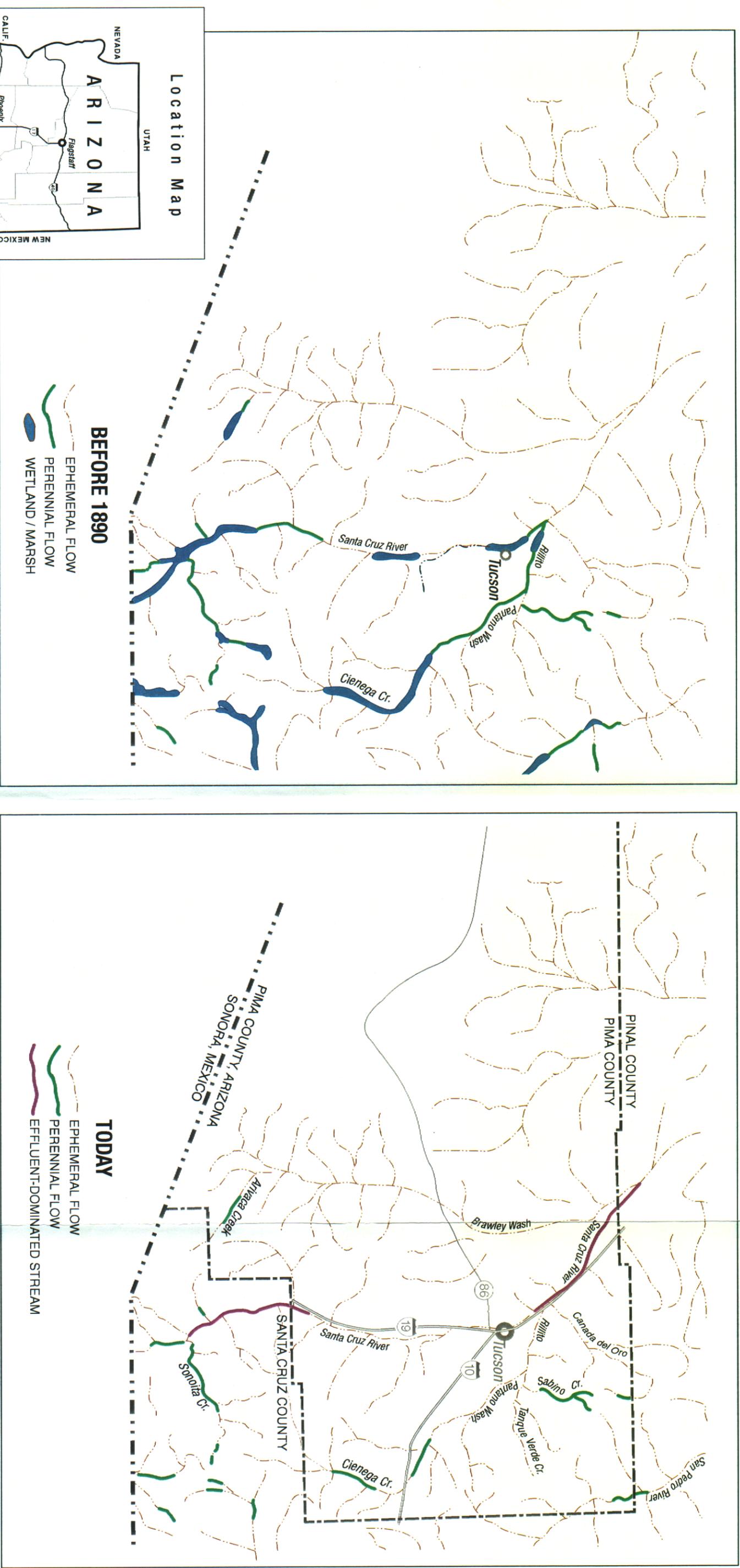
a) Current Riparian Status and the Implications for Conservation Planning. The water law and policy that developed over the past century failed to describe physical conditions, and failed to prescribe a long term resource protection policy. As the map on the next page shows, we have -- since 1890 -- completely eliminated the presence of cienegas and riverine marshes, and largely eliminated perennial flows from the Santa Cruz Valley in Eastern Pima County. In the space of 100 years, we have lost most of our aquatic and semiaquatic habitats.

b) Decline of the Santa Cruz River. Historical accounts of Tucson indicate that the Santa Cruz River flowed year-round at San Xavier del Bac and near downtown Tucson. Near present-day Silverlake Road, there was a natural cienega/wetlands that was impounded for irrigation and later more fully developed into Warner's Lake in 1883 which covered some 50 acres. The river flow was carried downstream in series of acequias dating from the Spanish period to irrigate farmfields. The Santa Cruz River was broad and shallow until floods in 1887 caused the river to incise Sam Hughes' water diversion channel. 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, wood-cutting and habitat loss due to erosion have significantly altered the biologically rich Santa Cruz River. For example, the 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. The mesquite bosque (Spanish for a closed-canopy woodland) at Martinez Hill died when the water table dropped due to municipal groundwater pumping. More recently, the riparian vegetation along the West Branch Santa Cruz River has been diminished through urban development and channelization. Garbage was dumped into the pits in the river. Many of the incised channel banks are now lined with soil-cement bank stabilization to prevent erosion.

# SANTA CRUZ VALLEYS AND SAN PEDRO RIVER, ARIZONA

## Comparison of Aquatic and Semi-aquatic Habitats before 1890 and Today

(after Hendrickson and Minckley, 1984)



c) Decline of the Rillito River and Tangu Verde Creek. Hydrologist G.E.P. Smith (1910) provides the following account of changes in a portion of the Tucson Basin in a report entitled, *Ground Water Supply and Irrigation in the Rillito Valley*:

*"The oldest known effort at settlement in the Rillito Valley was that of an Arkansas pioneer who cleared a small area of bottom land just east of Fort Lowell in 1858. The entire valley was at that time unbroken forest, principally of mesquite, with a good growth of grama and other grasses between the trees. The river course was indefinite, a continuous grove of tall cottonwood, ash, willow, and walnut trees with underbrush and sacaton and galleta grass, and it was further obstructed by beaver dams.*

*In the fall of 1872, the U.S. Army post was moved from the military plaza in Tucson to the junction of Pantano Wash and the Rillito. There was a great demand for hay and the grass was cutoff with hoes to supply the post on large contracts. A few years of such cropping sufficed to kill it. Cattle were brought into the country during the seventies and roamed the valley and hills, destroying the root grasses and wearing trails which later became rivulets in time of rain, increasing the runoff of water to the river. New and unusual flood cut out a wide channel, washed the big cottonwoods away, and exposed the white sand. The amount of total runoff from the land must have increased very greatly, and yet meanwhile the permanency of the small surface flow in the river was decreased. The general affect [sic] of settlement was to increase the magnitude and severity of the floods and, also, the length of the totally dry seasons. In the Pantano, the first real flood to reach the Rillito occurred in 1881, but it was much spread out over the valley and not until in the 90s was the present deep broad wash with vertical banks eroded."*

Since Smith's 1910 remarks, the Rillito (Spanish for "creek") has become an ephemeral stream, the stream channel has widened considerably, and urbanization has encroached the floodplain. While the Rillito was once home to pygmy-owls, this is no longer the case.

### **3. Problem of Impact to Species**

a) Decline of Species and the Interface of the Endangered Species Act -- Arizona's water law and water policy direction of the past 100 years has resulted in: (1) the loss of most perennial stream flow; (2) the dramatic decline in the water table due to ground water pumping and the continued overdraft of this resource; and (3) the loss of 85 to 95% of quality riparian habitat during the last century, which negatively impacts the 60 to 75% of Arizona's resident wildlife population that depends on riparian habitat during some part of its life cycle. Groundwater pumping, floodplain development, and habitat loss due to erosion have significantly altered the biologically rich and diverse riparian corridors of Eastern Pima County. The losses are profound, but there are still many opportunities to recreate our watercourses as a gathering place for people and wildlife. This will be a major task of the Sonoran Desert Conservation Plan.

Within Pima County, the federal government recognizes eighteen species as threatened or endangered. Of these, at least five have been endangered by depletion of the water tables in Pima County: (1) Desert Pupfish; (2) Gila Topminnow; (3) Huachuca Water Umbel; (4) Cactus Ferruginous Pygmy-Owl; and (5) Southwestern Willow Flycatcher.

Other species dependent on riparian areas that might be listed as endangered soon include (1) the Western Yellow-billed Cuckoo, (2) the Sonoyta Mud Turtle, (3) the Chiracahua Leopard Frog, and (4) the Gila Chub.

In November of 1999 a report by the Science Technical Advisory Team entitled *Determining Vulnerable Species in Pima County* identified more than 80 additional species of concern, and described aquatic habitat and wetlands as a target habitat for conservation under the Sonoran Desert Conservation Plan.

The federal Endangered Species Act of 1973 is discussed in greater detail below. For purposes of assessing the impact of the loss of water resources and riparian habitat, it is sufficient to say that once a riparian/aquatic dependent animal is listed as endangered, the prohibition on "take"<sup>1</sup> of the listed animal under Section 9 of the Endangered Species Act, if enforced, will prevent water utilization practices which can hurt, harm or harass the animal, or significantly alter its habitat.

b) Impact to the Pygmy-Owl -- Depletion of water tables and the loss of riparian habitat has impacted cactus ferruginous pygmy-owl habitat. Most of the major documents describing the pygmy-owl connect it to its riparian habitat based origins. On March 10, 1997, the pygmy-owl was listed as endangered. There were only 12 known individuals, making the listing one of the most difficult in the United States. The Federal Register states that the "pygmy-owl occurs in a variety of subtropical, scrub, and woodland communities, including riverbottom woodlands."

Following the listing, Russell Duncan and Lisa Harris conducted a study of *The Ferruginous Pygmy-owl in Arizona: Historical Context, 1972-1998*. Citing Roy Johnson et al, the study found in part that "the range contraction [of the pygmy-owl in Arizona] is the result of numerous direct and indirect human-related impacts including dam construction for diversion and flood control purposes beginning in the early 1900s; conversion of both riparian and upland (non-riparian) desertscrub habitats to croplands; urban development; lowering of groundwater tables for urban and agricultural uses; and other causes." Confirming that water is a necessary component of owl habitat is an 1898 article by George Breninger. The article states that "among the growth of cottonwood that fringes the Gila and Salt rivers of Arizona this Owl is of common occurrence." As water resources were extended from the rivers through irrigation canals, the owls followed the water, or in the words of the author, "this Owl has gradually worked its way from the natural growth of timber bordering the rivers to that bordering the banks of irrigating canals."

One hundred years later in advising local landowners about survey protocol and take guidance, the United States Fish and Wildlife Service included riparian vegetation such as cottonwoods, willows, and mesquites growing along watercourses within the scope of the guidelines.

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<sup>1</sup> "Take" is a term from the Endangered Species Act which means harass, harm, pursue, hunt, shoot, wound, kill, trap, collect or attempt to do any of these acts in relation to a listed species. Under the Endangered Species Act, "take" is a violation of federal law.

In 1999, 731,712 acres of riverine habitat and upland habitat across Pima, Pinal, Maricopa and Cochise Counties were designated as critical habitat for the pygmy-owl. Critical habitat is defined in the U.S. Code as: "the specific areas within a geographic area occupied by the species at the time of listing ... on which are found physical or biological features essential to the conservation of the species and which may require special management considerations or protection; and specific areas outside the geographic area occupied by the species at the time it is listed ... upon a determination of the Secretary that such areas are essential for the conservation of the species." In addressing pygmy-owl conservation and recovery initiatives, the Sonoran Desert Conservation Plan will have to prescribe a riparian protection and restoration strategy. Pygmy-owl compliance issues make such strategies a more immediate matter for the community, but the same can be said for conservation and recovery initiatives of all listed and imperiled animals in Pima County that rely on riparian habitat.

c) Impact on Listed Species and Species of Concern -- There are 24 plants and animals in Pima County that are listed or under consideration for federal protection. More than 80 additional species are considered vulnerable by the Science Technical Advisory Team. The charts below describe the status of obligate riparian species and aquatic habitat species.

#### OBLIGATE RIPARIAN SPECIES

SCIENTIFIC NAME	COMMON NAME	STATUS IN PIMA COUNTY (Federal or SDCP)*
<i>Empidonax trailii extimus</i>	Southwestern Willow Flycatcher	Endangered
<i>Coccyzus americanus occidentalis</i>	Western Yellow-billed Cuckoo	Petitioned Endangered
<i>Dalea tentaculoides</i>	Gentry Indigobush	Extirpated
<i>Pipilo aberti</i>	Abert's Towhee	Status 1
<i>Melospiza melodia</i>	Songsparrow (subspecies)	Status 1
<i>Sorex arizonae</i>	Arizona Shrew	Status 2
<i>Peromyscus merriami</i>	Merriam's Mouse (Mesquite Mouse)	Status 2
<i>Lasiurus borealis</i>	Red Bat	Status 2
<i>Cnemidophorus burti stictogrammus</i>	Giant Spotted Whiptail Lizard	Status 2
<i>Thamnophis eques</i>	Mexican Garter Snake	Status 2
<i>Choeronycteris mexicana</i>	Mexican Long-tongued Bat	Status 3
<i>Buteo nitidus</i>	Grey Hawk	Status 3
<i>Buteo albonotatus</i>	Zone-tailed Hawk	Status 3
<i>Caprimulgus ridgewayi</i>	Buff-collared Nightjar	Status 3

Trogon	Trogon	Status 3
Senticolis triaspis	Green Rat Snake	Status 3
Capsicum annuum var. Glabriusculum	Chiltepin	Status 4

### AQUATIC HABITAT SPECIES

SCIENTIFIC NAME	COMMON NAME	STATUS IN PIMA COUNTY (Federal or SDCP)*
<i>Kinosternon sonoriense longifemorale</i>	Sonoyta Mud Turtle	Candidate
<i>Rana chiricahuensis</i>	Chiricahua Leopard Frog	Candidate
<i>Cyprinodon macularius</i>	Desert Pupfish	Endangered
<i>Poeciliopsis occidentalis occidentalis</i>	Gila Topminnow	Endangered
<i>Gila intermedia</i>	Gila Chub	Candidate
<i>Lilaeopsis schaffneriana</i> spp. <i>recurva</i>	Huachuca Water Umbel	Endangered
<i>Castor canadensis</i>	Beaver	Extirpated
<i>Ondatra zibethicus</i>	Muskrat	Extirpated
<i>Rana tarahumarae</i>	Tarahumara Frog	Extirpated
<i>Catostomus insignis</i>	Sonoran Sucker	Extirpated
<i>Catostomus clarki</i>	Desert Sucker	Extirpated
<i>Rhinichthys oculus</i>	Speckled Dace	Extirpated
<i>Speyeria nokomus caerulescens</i>	Blue Silverspot Butterfly	Extirpated
<i>Anodonta californensis</i>	California Floater (clam)	Extirpated
<i>Tryonia protea</i>	Desert Tryonia	Extirpated
<i>Tryonia quitobaquita</i>	Quitobaquito Tryonia	Status 1
<i>Zaitzevia parvula</i>	Santa Rita Water Beetle	Status 1
<i>Argia sabino</i>	Sabino Creek Damselfly	Status 1
<i>Rana yavapaiensis</i>	Lowland Leopard Frog	Status 2

**\*Legend**

Petitioned-- Species petitioned to be federally listed

Extirpated --Species believed to have been extirpated from Pima County

Status 1 --Species in jeopardy in Pima County and for whom habitat in Pima County is critical for their existence

Status 2 --Species in jeopardy in Pima County and whose numbers are generally declining throughout their range

Status 3 --Species in jeopardy in Pima County, but are not at risk overall

Status 4 --Species considered for conservation because of their ecological or social importance to the community

d) Impact on Extirpated Species. A dozen species that are not federally listed have been extirpated in Pima County. A disproportionate number of these missing natives to the area were dependent on aquatic habitat that is now lost. These species formerly occurred in the Tucson Basin and have been lost due to the decline of the water table along the Santa Cruz and its tributaries, which eliminated perennial flow and habitat for these species and others.

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<sup>2</sup>

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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

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The illustration on the next page describes the depth to water in Eastern Pima County, with some areas showing a depth of 700 feet below ground. The chart also shows the elevation change between 1940 and 1995.

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<sup>2</sup> "O" = occurrence; "PO" = probable occurrence; E = extirpated.



## **B. Legal Impact of Degraded Riparian Systems**

### **1. Endangered Species Act**

a) Purpose of the Act -- The findings and purposes sections of the Endangered Species Act demonstrate Congressional intent to incorporate a conservation ethic into economic growth and development. The findings state in part: "The Congress finds and declares that: (1) various species of fish, wildlife, and plants in the United States have been rendered extinct as a consequence of economic growth and development untempered by adequate concern and conservation; (2) other species of fish, wildlife, and plants have been so depleted in numbers that they are in danger of or threatened with extinction; (3) these species of fish, wildlife, and plants are of esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people." The purposes of the Endangered Species Act, which Pima County adopted in Resolution 1998-250 signed on December 3, 1998 with the Secretary of the Interior, states in part that: "The purposes of this Act are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved [and] to provide a program for the conservation of such endangered species and threatened species...." Local water resource decisions have in the past, and can continue to undermine the basic purposes of the Endangered Species Act.

b) Role of the Prohibition on Significant Impact on Habitat -- Section 9 of the Endangered Species Act describes prohibited acts. It states in part that: "with respect to any endangered species or fish or wildlife ... it is unlawful for any person subject to the jurisdiction of the United States to ... take any such species within the United States or the territorial sea of the United States." Take is a term from the Endangered Species Act which means harass, harm, pursue, hunt, shoot, wound, kill, trap, collect or attempt to do any of these acts in relation to a listed species. Supreme Court case law has extended the definition of take to apply to acts which significantly alter the habitat of a listed animal. Like land use decisions that have a level of impact on habitat, local water resource decisions, given the state of the riparian ecosystems and the status of species dependent on systems that are so highly degraded, could face challenges going forward based on violation of the prohibition of take under the Endangered Species Act and its case law.

c) Meaningful Restoration under the Sonoran Desert Conservation Plan -- Section 10 of the Endangered Species Act allows the Secretary of the Interior to permit take that is prohibited under Section 9, if it is incidental to otherwise lawful activity, and if "the applicant ... submits to the Secretary a conservation plan that specifies -- (i) the impact which will likely result from such taking; (ii) what steps the applicant will take to minimize and mitigate such impacts, and the funding that will be available to implement such steps; (iii) what alternative actions to such taking the applicant considered and the reasons why such alternatives are not being utilized; and (iv) such other measures that the Secretary may require as being necessary or appropriate for purposes of the plan." Again, similar to the situation which applies to land use decisions that have a level of impact on habitat, certain local water resource decisions, given the state of the riparian ecosystems and the status of species dependent on systems that are so highly degraded, will need to be permitted under Section 10 of the Endangered Species Act, and therefore will need to be defined under the terms of a habitat conservation plan.

## 2. Clean Water Act

a) Recent Army Corps Nation Wide Permit (404) Injunction -- Wash Protection -- In October of 1999, in the case of *Defenders of Wildlife v. Lt. General Ballard / United States Army Corps of Engineers*, a United States District Court Order (1) enjoined the Army Corps of Engineers "from any further authorization under Nation Wide Permits 13, 14, and 26, until the [Corps] conducts a regionally based, programmatic impact analysis," and (2) the Corps was further ordered to "engage in Section 7 consultation with the Fish and Wildlife Service regarding the effect of its Nation Wide Permit program on the pygmy-owl and its habitat in this region." This section of the report discusses the meaning of the District Court Order, and opportunities for pursuing a broad solution to the fragmentation in the federal permitting process that exists once endangered species issues arise.

b) The injunction on the Army Corps of Engineers "from any further authorization under Nation Wide Permits (NWP) 13, 14, and 26, until the [Corps] conducts a regionally based, programmatic impact analysis." A few questions and answers are found below to convey the meaning and impact of the District Court injunction.

Question 1: What is Section 404 of the Clean Water Act?

Answer 1: In 1977, the Clean Water Act amended the 1972 Federal Water Pollution Control Act to establish the framework for regulating the discharge of pollutants into the waters of the United States. Section 404 of the Clean Water Act provides authority to the Army Corps of Engineers to permit discharges under certain circumstances.

Question 2: What government agencies are involved in administering Section 404?

Answer 2: From Pima County's perspective, the Administration of Section 404 involves the U.S. Army Corps and the Environmental Protection Agency. The U.S. Fish and Wildlife Service is involved if the 404 permit activity may affect a species listed under the ESA.

Department of Defense: Section 404 of the Clean Water Act allows the Secretary of the Army to issue permits to discharge dredged or fill material into the waters of the United States.

Environmental Protection Agency: The guidelines for this activity are developed by the Administrator of the Environmental Protection Agency (EPA), along with the Secretary of the Army. The EPA can deny, prohibit, restrict or withdraw the use of disposal site areas when discharge would have an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas, wildlife, or recreational areas. EPA regulations provide a definition for "unacceptable adverse effect."

Department of the Interior: Definition for fish and wildlife protection also calls on the expertise of the U.S. Fish and Wildlife Service. In addition, the Service consults with the Army Corps under Section 7 of the ESA if the issuance of a permit may affect a listed species.

Pima County Government: As these federal entities work to have edges of their standards and processes align on various permit issues, Pima County -- in both its projects and permitting practices -- is guided by the resulting federal decision. Under Title 16 of the Pima County Code, floodplain use permits require the County engineer to "review the proposed development to assure that all necessary permits have been received from those governmental agencies from which approval is required by federal or state law, including Section 404 of the Federal Water Pollution Control Act...."

Question 3: What is a Nation Wide Permit and how does it compare to other types of permits that are issued under the Clean Water Act?

Answer 3: Under Section 404(e), the Secretary of the Army can specify low impact activity that is exempt from individual permit (project-by-project) requirements. Individual permits are available, but require more time since an Environmental Assessment or Environmental Impact Statement is prepared for the project that would be permitted. For Nationwide Permits, the National Environmental Policy Act analysis is done on a programmatic level.

In 1996, the Department of Defense published Final Notice of Issuance, Reissuance, and Modification of Nationwide Permits. Forty NWP categories are listed, covering activities such as Structures in Artificial Canals (NWP 2); Scientific Measurement Devices (NWP 5); Utility Line Discharges (NWP 12); Single Family Housing (NWP 29); Cranberry Production Activities (NWP 34); and Farm Buildings (NWP 40).

All Nationwide Permits are subject to General Conditions in addition to the specific conditions of the particular permit. There are general conditions for protection of endangered species and historic properties.

Under the general condition relating to endangered species, "no activity is authorized under any NWP which is likely to jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation under the ESA, or which is likely to destroy or adversely modify the critical habitat of such species."

Question 4: What Nationwide Permits were enjoined by the District Court?

Answer 4: The District Court enjoined further authorization under Nation Wide Permits 13, 14, and 26 until the Army Corps conducts a regionally based programmatic impact analysis.

- ▶ NWP 13 covers "bank stabilization activities necessary for erosion prevention."
- ▶ NWP 14 covers "fills for roads crossing waters of the United States (including wetlands and other special aquatic sites)."
- ▶ NWP 26 covers "discharges of dredged or fill material into headwaters and isolated waters." This permit was set to expire.

c) The Order to "engage in Section 7 consultation with the Fish and Wildlife Service regarding the effect of its Nation Wide Permit program on the pygmy-owl and its habitat in this region. -- Under one part of the District Court Order discussed above, the Corps must complete a programmatic impact analysis for NWP's 13, 14 and 26. The Court further Ordered that the Corps must consult with the Service about the effect of the program on the pygmy-owl and its habitat.

The information gathered during the cumulative impact analysis should correspond with some of the information that is being gathered by the Science Technical Advisory Team for the Sonoran Desert Conservation Plan as the biological evaluation for Pima County is undertaken.

Likewise, the Section 7 consultation Ordered by the Court for the federal agency should be parallel to the Section 10 negotiation that Pima County undertakes with the Service to establish the terms of the conservation plan, since both these processes address the effects of urban development on native species and their habitats.

d) Fragmentation in the federal permitting process for endangered species issues -- As Pima County moves forward with the Sonoran Desert Conservation Plan, and the federal entities move forward with their assessment of permitting programs on wetlands, a number of deficiencies within and between the programs can be addressed.

- ▶ The varying standards that exist between local and federal entities could be aligned, so that the resource is effectively protected and the permit seeker gained assurances.
- ▶ Permitting programs for water and land protection could be streamlined and work in a coordinated fashion.
- ▶ The application of standards could be more accurately tailored to conditions within the Pima County environment.<sup>3</sup>

e) Summary -- The District Court's scrutiny of federal permitting practices might result in a shared study effort and a more effective and coordinated permit program at the federal and local level when impacts are better understood, and advance planning allows permit seekers to know where biologically sensitive areas are so they can be avoided.

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3. Judicial interpretation of Section 404 has extended the regulations to apply beyond navigable waters to "wetlands." The definition of wetlands makes sense for east coast systems, but is not a neat fit for the arid west. Under 33 CFR 328.3(b), the term 'wetlands' means those "areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." Even where the definition fits the ecosystem, the Corps and EPA do not always agree on implementation.

### 3. Federal Reserved Right

A July report entitled *Water Resources and the Sonoran Desert Conservation Plan* described the potential importance of the federal reserved right in water to endangered species and imperiled riparian habitats. Since July, the Arizona State Supreme Court has held that federal reserved rights holders are entitled to greater protection from ground water pumping than are water users who hold only state law rights.

a) Indian Water Rights: During this century, the reserved right in water has been defined in part through litigation and settlement attempts which make room within the community's water budget for the reserved right of water for Native American Tribes or Nations. The 1908 United States Supreme Court decision of *Winters v. United States*<sup>4</sup> upheld the lower federal court's finding that "the Government of the United States has the power to reserve waters of a river flowing through a Territory and exempt them from appropriation under the laws of the State which that Territory afterwards becomes."

b) Federal Purposes Include Wildlife Protection on Land Under the Jurisdiction of the United States: The reserved right also applies to other federal purposes, such as wildlife protection. In 1964, the Supreme Court made it clear that federal purposes includes protection of wildlife on land under the jurisdiction of the United States. In *Arizona v. California*,<sup>5</sup> which predates enactment of the Endangered Species Act, the Court upheld a reserve right in water sufficient to protect wildlife on federally designated land. In another case thirteen years later, which still did not rely on the Endangered Species Act, the Supreme Court applied the *Winters* doctrine to stop groundwater pumping which interfered with the habitat needs of a "unique species of desert fish," the Devil's Hole Pupfish. In *Cappaert v. United States*,<sup>6</sup> the court held:

"since the implied-reservation-of-water rights doctrine is based on the necessity of water for the purpose of the federal reservation, we hold that the United States can protect its water from subsequent diversion, whether the diversion is of surface or ground water."

It is clear from this line of cases, that next century, protection of federal purposes such as wildlife and related habitat protection will require accommodation within water resource policy. Federal purposes, when established, override local laws and policies which have ignored hydrologic reality and depleted water resources. In light of the current state of the riparian ecosystem, new proposals for groundwater pumping will face credible challenges from those who assert claims to protect federally listed species and their habitats, as such species are threatened or endangered by the proposed water use.

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<sup>4</sup> 207 U.S. 564 (1908).

<sup>5</sup> 373 U.S. 546 (1963).

<sup>6</sup> 426 U.S. 128 (1976).

c) The 1999 Arizona Supreme Court ruling in support of federal reserved water rights in the Gila River Adjudication -- In November of 1999, the State Supreme Court found that:

1) "... the federal reserved water rights doctrine applies not only to surface water but to groundwater."

2) "We have held that the federal reserved right extends to groundwater when groundwater is necessary to accomplish the purpose of the federal reservation. We similarly hold that once a federal reservation establishes a reserved right to groundwater, it may invoke federal law to protect its groundwater from subsequent diversion to the extent such protection is necessary to fulfill its reserved right."

3) "Holders of federal rights enjoy greater protection from groundwater pumping than do holders of state law rights to the extent that greater protection may be necessary to maintain sufficient water to accomplish the purpose of the reservation."

The Court cited and relied on *Cappaert v. United States*, acknowledging its validity. A few quotes include:

- ▶ "Cappaert bears most directly upon our discussion.... That federal reserved rights law declines to differentiate surface and groundwater -- that it recognizes them as integral parts of the hydrologic cycle -- when addressing the diversion of protected waters suggests that federal reserved rights would similarly decline to differentiate surface and groundwater when identifying the water to be protected."
- ▶ "In our view, Cappaert provides an explicit answer to that question. First, Cappaert tells us that 'determination of reserved water rights is not governed by state law but derives from the federal purpose of the reservation.' Second, it tells us that 'the United States can protect its water from subsequent diversion, whether the diversion is of surface or groundwater.'"

d) Summary -- In the past, the gridlock of local water decisionmaking has been overcome by protection of federal purposes. The major water policy decisions that have succeeded in overriding local concerns and entrenched interests created by our history of utilizing the resource within an artificial legal and administrative construct, share certain important characteristics. They are all **regional** and **comprehensive** in nature, and involve a **federal** connection.

The most profound interruption to the rules of the local water decisionmaking process has involved the federal government's protection of federal purposes. The November 1999 decision by the Arizona Supreme Court is consistent with this pattern and confirms the importance of the federal purpose of wildlife protection.

### C. The Relation of Water Budgets to Habitat Types and Species Protection under the Sonoran Desert Conservation Plan

The Sonoran Desert Conservation Plan includes a Riparian Restoration Element that will provide a comprehensive assessment of the decline in water, riparian habitat and riparian dependent wildlife.

In order to gain a sense of the magnitude of riparian losses, the role of the Endangered Species Act, and some of the decisions that will be a part of the Sonoran Desert Conservation Plan, four questions help to establish preliminary benchmarks:

- (1) What amount of water maintained the Upper Santa Cruz sub-basin ecosystem before agricultural and development uses competed for water resources?
- (2) What amount of water maintains the vegetation community, and the various types of vegetation we have today?
- (3) How adequate is the current resource base from the perspective of maintaining suites of species and from the perspective of compliance with federal law?
- (4) What is the relationship of current conditions and pre-development conditions to the Sonoran Desert Conservation Plan?

#### 1. What amount of water maintained the Upper Santa Cruz sub-basin ecosystem before agricultural and development uses competed for water resources?

The illustration on the next page describes the baseline conditions for wildlife within the Santa Cruz sub-basin before water was mined and diverted for intensive human consumptive uses.

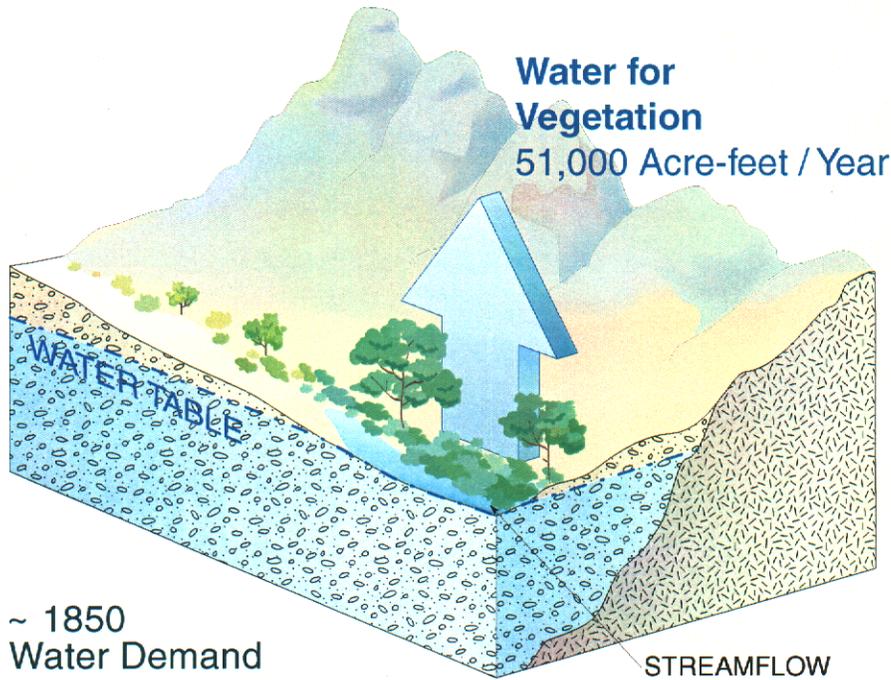
In pre-development conditions, the amount of water available for aquatic and riparian habitat was equal to the net natural recharge rate, on the order of 51,000 acre feet per year.

Current volumes, which support about 6,000 remaining acres of groundwater dependent vegetation, are around 12,000 acre feet per year.

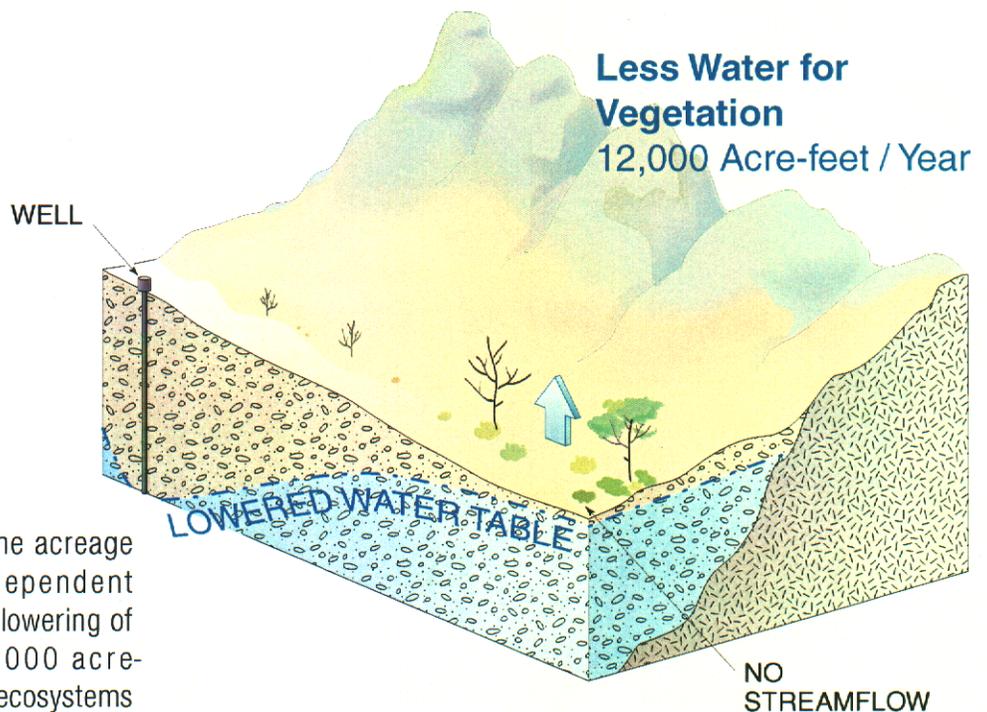
The 39,000 acre-foot difference between conditions at the beginning and end of the century reflects how great the alteration of water resources from wildlife to human uses has been.

This estimate of water diverted from wildlife use does not consider the areas outside the Upper Santa Cruz subbasin such as the Santa Cruz River outside the Tucson Active Management Area, Arivaca Creek, Sopori Wash, Cienega Creek, and the San Pedro River. In these areas, diversions of water and groundwater pumping may have also diminished aquatic and riparian habitat for wildlife. This estimate also does not include natural off-channel springs whose flows are now diverted or eliminated.

# Water Needed for Riparian Ecosystems



A high groundwater table supports flowing streams with native fish. Groundwater-dependent riparian vegetation provides extensive, high-quality habitat for many other wildlife species.



Aquatic habitats are gone, and the acreage and quality of groundwater-dependent riparian habitat is reduced due to lowering of the water table. At least 39,000 acre-feet/year is diverted from riparian ecosystems in the Tucson area. There is no protection for existing shallow groundwater zones.

*(after Freethy and Anderson, 1986. USGS Atlas HA-664)*

2. What amount of water maintains the vegetation community and the various types of vegetation we have today?

The water demand of an acre of habitat is different depending on whether the vegetation type is hydroriparian<sup>7</sup> (such as cottonwood), mesoriparian<sup>8</sup> (such as mature, dense mesquite), xeroriparian<sup>9</sup> (such as less dense mesquite), or desert upland<sup>10</sup> (such as native grass or creosotebush). Meso- and hydroriparian vegetation are groundwater dependent, i.e., they use water stored underground for their life cycles.

Table 1 quantifies the water needed (per unit area) to support various types of native vegetation which could occur or might occur in or along our watercourses. These figures are derived from staff's review of existing literature.

Whereas desert upland vegetation requires the least amount of water, young cottonwoods and willows require the most.

Desert upland vegetation can persist without artificial irrigation, but young cottonwoods and willows require nearly constant moisture until their root systems mature.

Also listed is the water needs of various other features for comparison purposes. A typical park is irrigated with enough water to support mesoriparian vegetation. A pecan grove uses about as much water as a grove of cottonwood or willow trees or evaporation from a lake.

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<sup>7</sup> Hydroriparian vegetation is generally found along perennial watercourses or wetlands. The vegetation is dominated by wetland plants and plants such as willow or cottonwood that need large amounts of water supplied for long amounts of time. While this is the least common riparian community type, it is vitally important for the life cycles of many specialized forms of wildlife. Mature and immature stands of these trees provide different functions for wildlife, and are both important

<sup>8</sup> Mesoriparian vegetation is generally found along intermittent watercourses or where groundwater is close to the surface. Mesquite bosques and sycamore-ash vegetation are examples of this type of vegetation.

<sup>9</sup> Xeroriparian vegetation grows in areas where stormwater flows provide additional moisture, such as in ephemeral stream channels. In a landscaping setting, depressions and constructed channels can be used to harvest stormwater to supply xeroriparian vegetation. These plant communities typically contain plant species which are also found in upland habitats, however these plants are typically larger or occur at higher densities than adjacent uplands. Xeroriparian vegetation is the most common type of riparian vegetation, and provides important food and shelter for wildlife.

<b>Table 1. Water Needs for Vegetation (in Tucson area)</b>	
<b>Type of Vegetation</b>	<b>Water Needs (acre-feet/acre)</b>
<b>Desert Upland</b>	
Saltbush, native grass	0.5 - 1
Creosotebush	0.8
<b>Xeroriparian</b>	
Less dense mesquite	1.6
<b>Mesoriparian</b>	
Mature, dense mesquite	3.0
<b>Hydroriparian</b>	
Mature cottonwoods	5.0 - 5.8
Young cottonwoods, willows	8.3
<b>Wetlands</b>	
Cattails	6.9
<b>Other features</b>	
Open water	5.4
Park with turf and trees	2.9 - 4.0
Pecan grove with ground cover	5.7
Golf course with water features	4.7

Current Santa Cruz Subbasin Water Budget -- This table allows water budgets to be determined by habitat type, and by the quality of the vegetation. A relatively low annual rate of evapotranspiration (2 AF of water/acre of land) is assumed in determining that the volume of water currently supporting 6,000 acres of vegetation in the Upper Santa Cruz subbasin is 12,000 acre-feet per year.

The basis of this assumption includes factors such as: (1) the groundwater table decline in many places has already eliminated cottonwood-willow forest, and has caused canopy dieback of mature mesquite trees and decreased leaf volumes, and (2) the vegetation in many riparian areas is young and scrubby due to previous disturbance.

Current Eastern Pima County Hydromesoriparian Vegetation Water Budget -- A similar analysis based on the amount, type and quality of habitat can be performed for Eastern Pima County. Arizona Game and Fish Department (AGFD) estimated based on early 1990's mapping that there were 7402 acres of hydromesoriparian vegetation in eastern Pima County, primarily along Sabino Canyon and Cienega Creek. Of this amount, AGFD estimated there were 1049 acres of cottonwood-willow and 3430 acres of mesquite. Pima County mapped 8241 acres of hydromesoriparian vegetation in eastern Pima County in the early 1990's, but this mapping did not extend into the existing public reserves. A figure of approximately 10,000 acres of hydromesoriparian vegetation is not unreasonable for eastern Pima County, including those portions of the Santa Cruz and San Pedro watersheds. The water demand to support existing hydromesoriparian vegetation is probably around 3 feet per acre, considering that a) some riparian zones are at a higher elevation than Tucson and therefore require less water, and b) cottonwood-willow is a low percentage of the total area of hydromesoriparian vegetation. Therefore 30,000 acre feet is an estimate of the total water needs of existing vegetation.

3. How adequate is the current resource base from the perspective of maintaining suites of species and complying with federal law?

The ability to measure reductions in water budgets over time and the commensurate reduction in the size and quality of vegetation communities, helps to explain why we find a disproportionate number of riparian dependent species imperiled today. Science planning for the Sonoran Desert Conservation Plan has been underway since the Board ordered the Plan to be developed. Some of the early findings and understandings of the planning process to date indicate that the current resource base is not sufficient to maintain suites of species much less reverse the direction of continued listings under the Endangered Species Act. These include that:

- ▶ Over 100 plants and animals in Pima County are in need of protection under the conservation plan. A large percent of these, and a disproportionate number of extirpated native species are (or were) dependent on riparian or aquatic habitat which is now lost.
- ▶ Continued groundwater mining has contributed to substantial damage to riparian environments and ecosystems. It is estimated that 60 to 75 percent of Arizona's resident wildlife depends on this riparian habitat for some part of its life cycle, including the long list of endangered, extirpated and imperiled species.
- ▶ Loss of riparian environments has been identified as a factor contributing to the decline in the population of pygmy-owls.
- ▶ Riparian habitat itself has been targeted by the Science Technical Advisory Team for protection under the Sonoran Desert Conservation Plan. A recent report to the Team confirms the need for such protection. In answer to the question of what percentage of each vegetation community exists in public preserves, riparian habitat was found to be largely unprotected.

The Riparian Restoration Element of the Sonoran Desert Conservation Plan recognizes the importance of riparian areas in achieving a balanced and sustainable ecosystem in Pima County. To meet Federal Endangered Species Act criteria, we will be required to commit to significant riparian restoration and protection. Without such, the balance of the Conservation Plan is essentially meaningless.

4. What is the relationship of current conditions and pre-development conditions to the Sonoran Desert Conservation Plan?

Just restricting analysis to the Upper Santa Cruz subbasin, we find that if water is to be allocated for riparian and aquatic restoration sufficient to recover a level of natural function, something on the order of 39,000 acre-feet per year would be needed for evapotranspiration.

The present water budget of 12,000 acre feet is supporting an often scrubby 6,000 acres of vegetation that has populations of riparian dependent species crashing at an increasing rate.

A balance point between the inadequate ecosystem in existence today, and the historic conditions of 51,000 acre-feet/ year is likely to be the baseline recommended by the Science Team and Steering Committee of the Sonoran Desert Conservation Plan.

Similar analysis can be performed to determine baseline resource goals on a smaller or larger scale within Pima County.

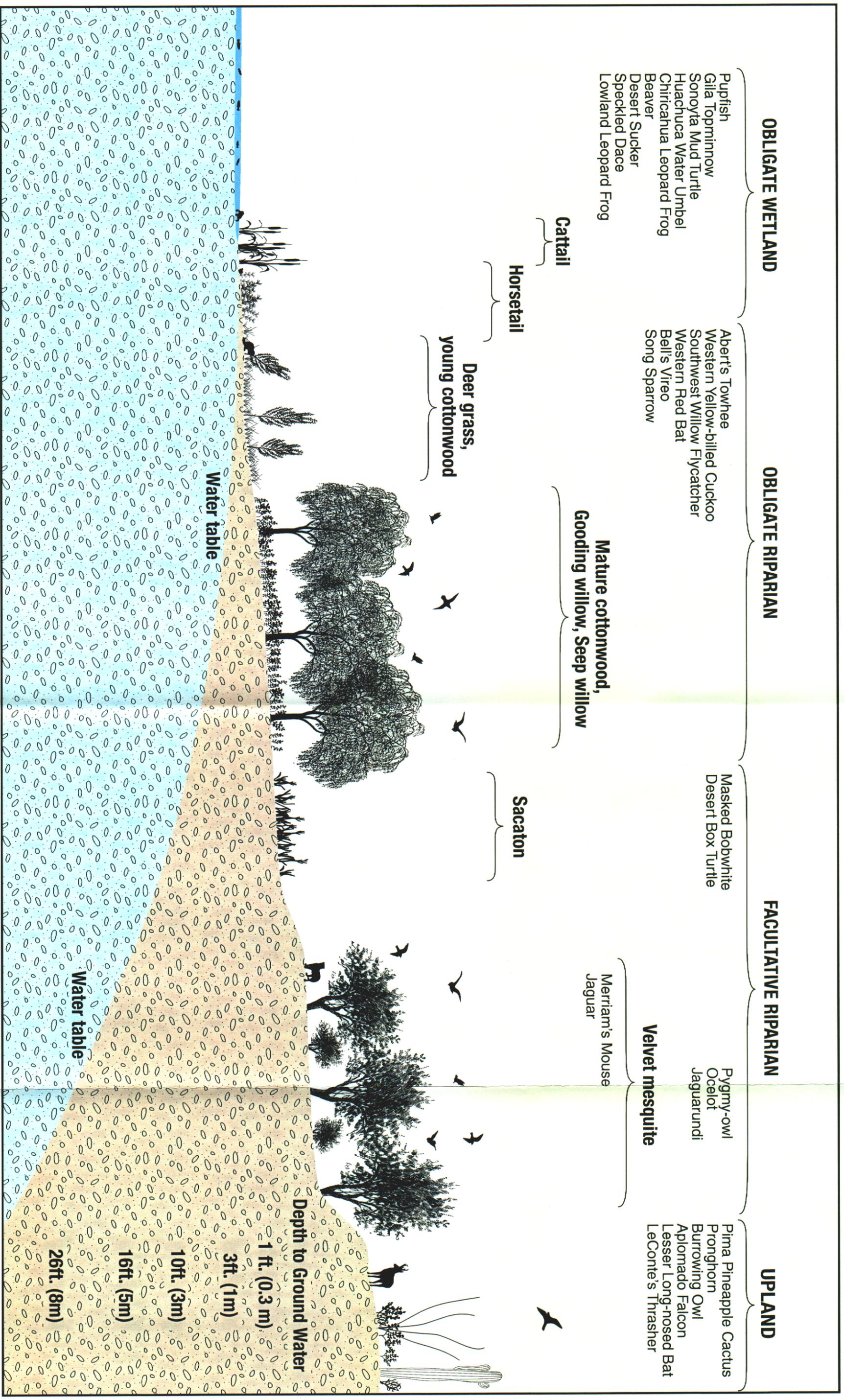
Over half of the remaining 6000 acres of groundwater dependent vegetation is jeopardized by existing and future groundwater pumping, as well as outright habitat destruction.

Measures are needed to reduce groundwater pumping in the vicinity of riparian areas along Sabino Creek, Tanque Verde Creek and Agua Caliente Wash, and to prevent increased pumping along Rincon Creek. Substitution of effluent for groundwater-based turf uses will be needed to protect these systems, among other measures.

Summary -- Just as legal decisions involving natural resources are achieving a greater integration of the component parts of the resource systems, meaningful conservation planning requires a comprehensive approach that quantifies the connections between the water, land (habitat) and animals within the protected ecosystem.

The illustration on the next page describes the relationship between:

- (1) the depth of the water table; and
- (2) the vegetation type; and
- (3) the animals that depend on or are found in the various types of habitat and plant communities.



Species change with increasing depth to groundwater in a Sonoran riparian ecosystem. (Based on ADWR, 1994.)

## **PART II: Army Corps Projects -- Building Blocks of a Riparian Restoration Solution**

This section of the report describes three riparian restoration projects that Pima County is pursuing in partnership with the Army Corps of Engineers: Paseo de las Iglesias; the Rillito River Habitat Restoration; and the Ajo Detention Basin.

### **A. Paseo de las Iglesias**

#### **1. Project Description**

Paseo de las Iglesias (Walk of the Churches) is the name given to the recent plan to restore the Santa Cruz River between the San Xavier Mission, the San Agustín Mission, and the Convento site at the base of Sentinel Peak. The project provides potential recharge opportunities for CAP water, native farming restoration opportunities on the Tohono O'odham Reservation, preservation of an area rich in history and culture, 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. Paseo de las Iglesias will provide low-flow bank protection for erosion threatened neighborhoods along the Santa Cruz River. 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.

#### **2. Scope of Restoration**

a) Erosion and 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.

b) 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.

c) 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 along a sixteen mile reach of Roger and 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.

d) 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.

e) 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.

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 to 75% percent of Arizona's resident 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.

### 3. Walk of the Churches

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  
San Agustin Mission to Silverlake




Mission San Agustin  
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.

Congress

Pedestrian  
Access

## **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  
Silverlake to Ajo Way

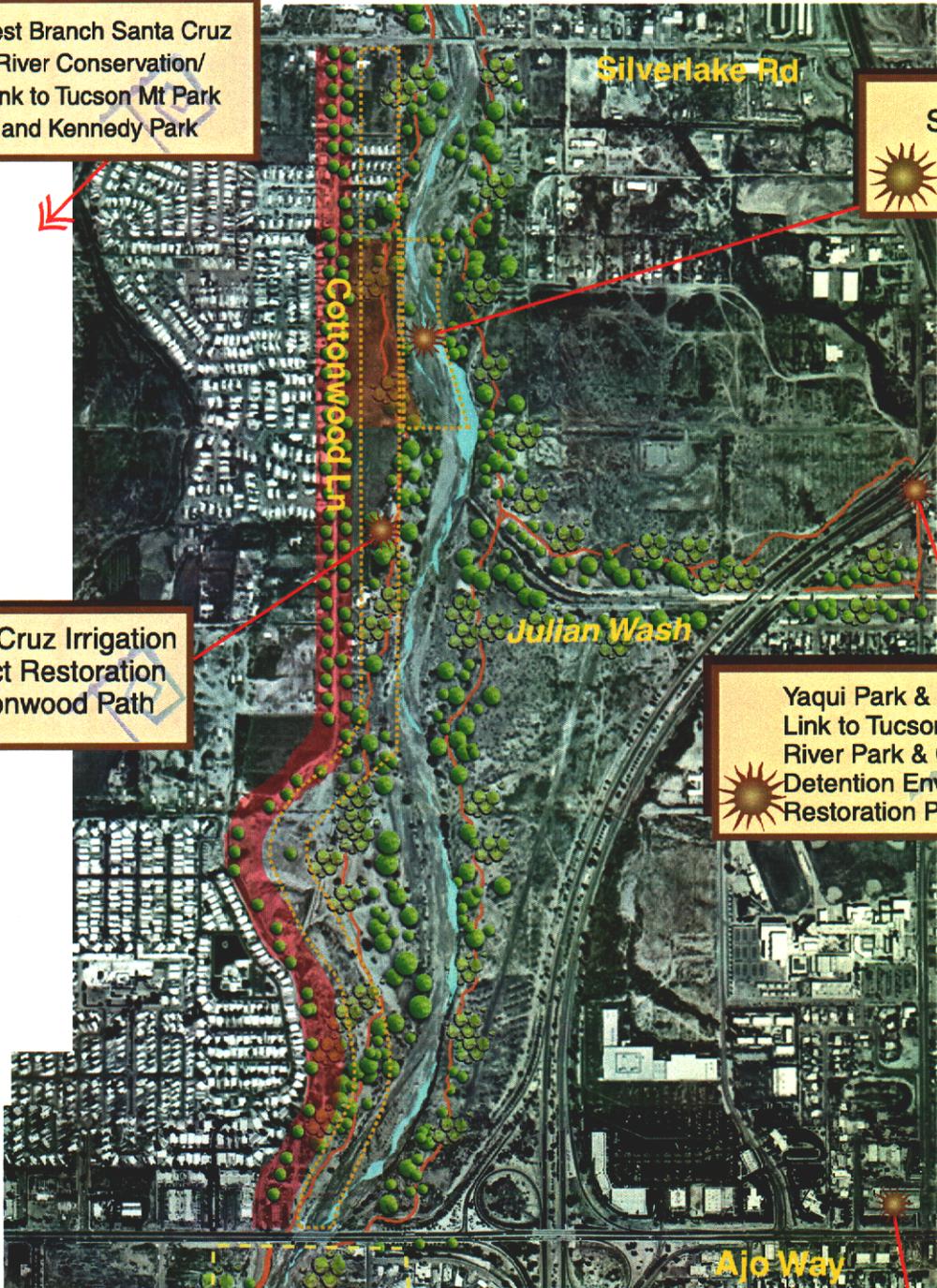


West Branch Santa Cruz River Conservation/  
Link to Tucson Mt Park and Kennedy Park

Silverlake Resort Historic Site

Santa Cruz Irrigation District Restoration  
Cottonwood Path

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



St. John's Catholic Church

## 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.

# Paseo de las Iglesias



Proposed Santa Cruz Riverpark  
Ajo Way to South of Irvington



St. John's  
Catholic Church

Santa Cruz  
River Extension

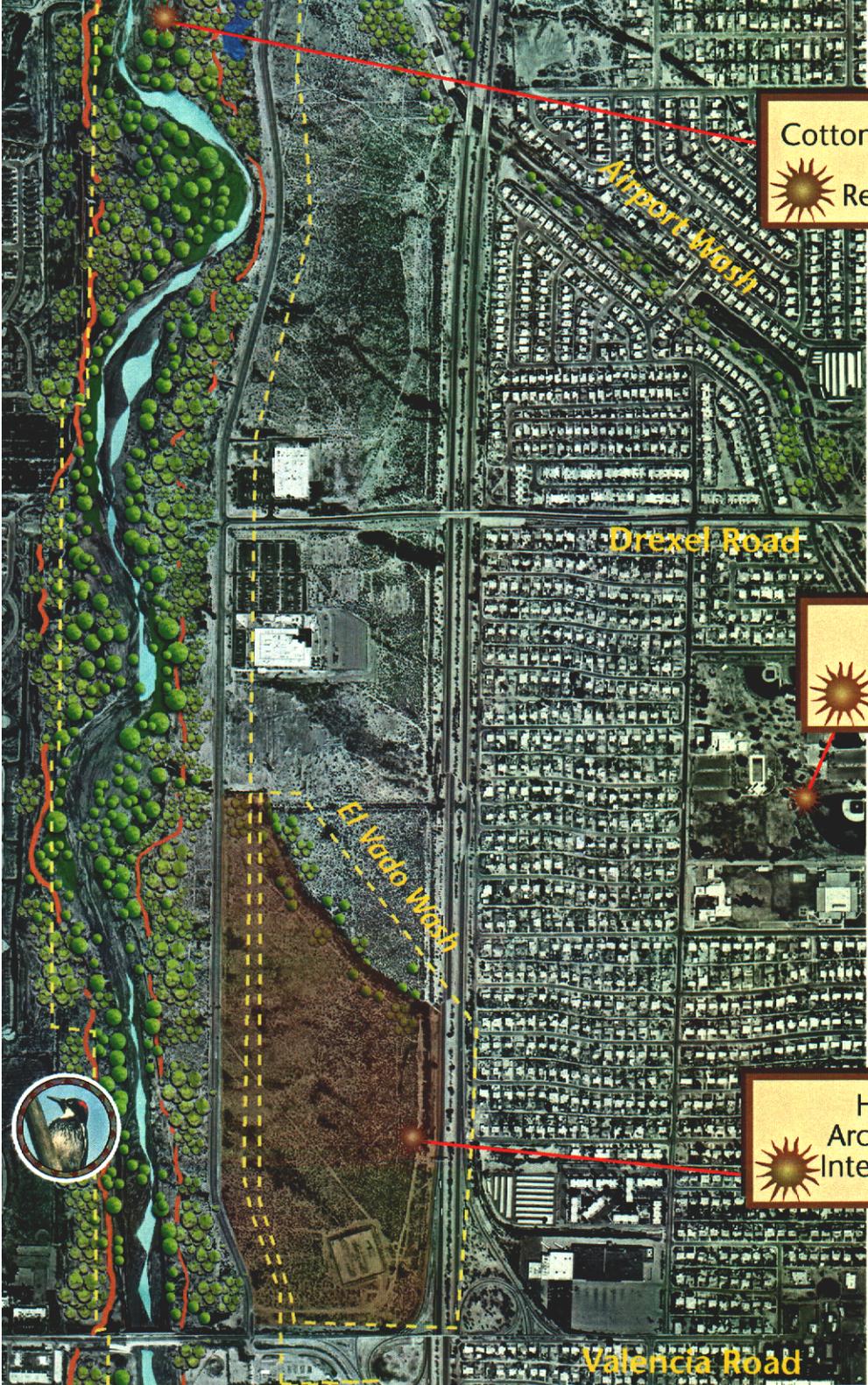
Cottonwood/Willow  
Habitat  
Restoration

### 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

## 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.

# 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



Native Seed Traditional Flood Irrigation Farming

Mission San Xavier



CAP Surface Flow Option from Pima Mine to Feed Recharge Lake



## **B. Rillito River Habitat Restoration**

### **1. Project Description**

The proposed project helps restore a higher water table along the Rillito Creek, which will benefit existing riparian areas along the Rillito River, Tanque Verde Creek, and lower Pantano Wash. Wetlands and riparian habitat will be restored along the south bank of the Rillito River near Swan Road. A park will be constructed on the north bank of the River. Water supply for the project will consist of reclaimed treated wastewater transported from the Roger Road Treatment Plant. The water will be obtained from a reclaimed water pipeline that will be constructed along the Alamo Wash from the City of Tucson's reclaimed water distribution system to the wetland areas. This water will cycle through wetlands before being recharged in the riverbed. On-site stormwater runoff will be directed to the wetlands as well as vegetated areas around them. In addition, Pima County is cooperating with the City of Tucson on a wildlife habitat project just upstream which would be located on County land east of Swan Road.

### **2. Scope of Restoration**

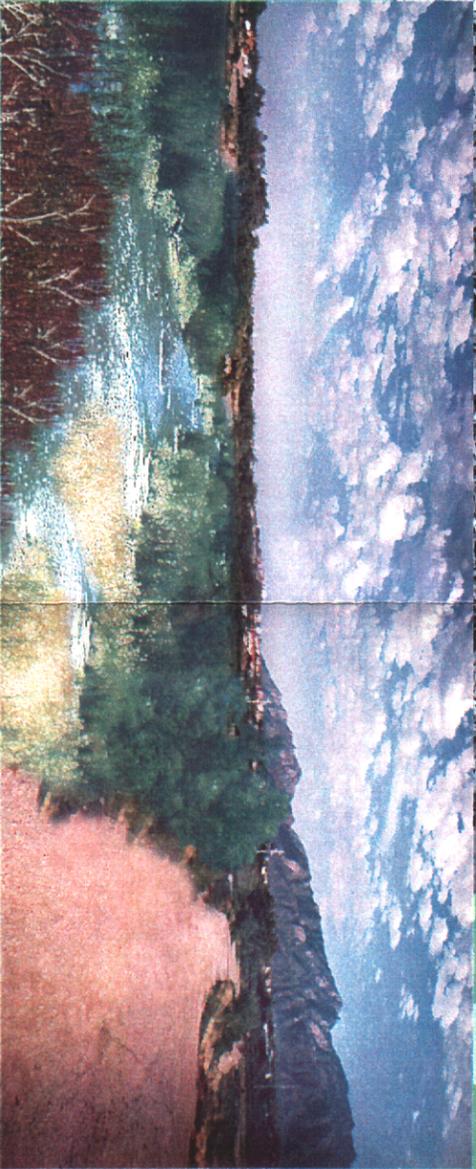
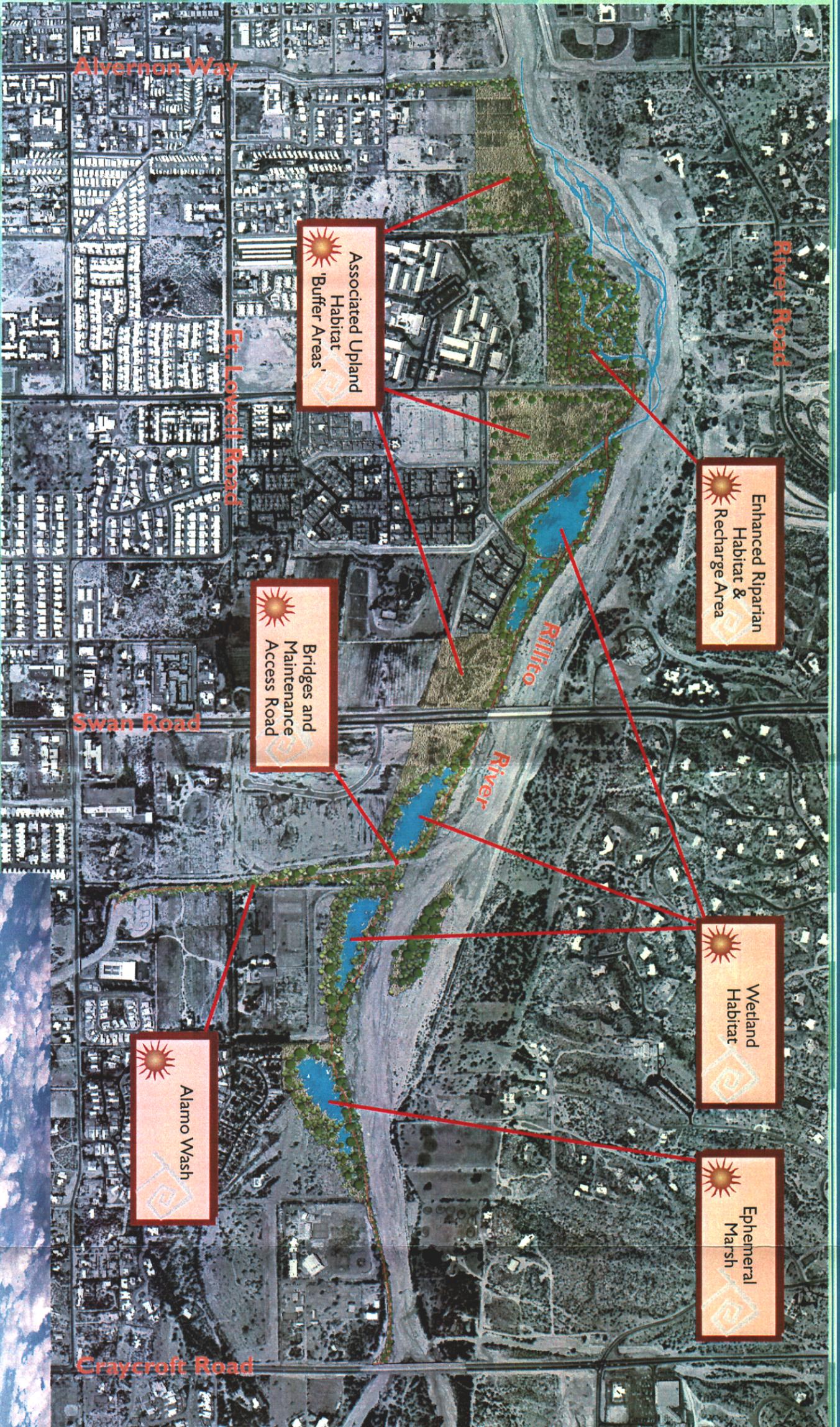
The Rillito Recharge Project (RRP) examined the effectiveness of natural and artificial ground water recharge in a formerly perennial stream. Under current conditions, the Rillito flows only in response to storm flows or persistent snowmelt. Near the confluence of Tanque Verde Creek and Pantano Wash, the water table can rise to the surface following large natural recharge events, such as the 1993 flood. Feasibility studies, research and monitoring were funded by the Bureau of Reclamation, Pima County Flood Control District, Arizona Department of Water Resources, City of Tucson, and U. S. Geological Survey. The availability, water quality and potential impacts of three sources of recharge water (CAP water, reclaimed water, and surface water from Alamo Wash and Rillito Creek) were evaluated for a project reach located between Swan and Craycroft Roads. However, Tucson Water's expressed lack of interest in recharging CAP water or reclaimed water at the site meant that the project design would be restricted to surface-water recharge only. In 1995, the District decided not to construct the stormwater recharge component of the project.

Near-surface sediments were tested using ring infiltrometers, and were found to have favorable infiltration rates. Analytical models of ground-water mounding indicated the project area would provide limited capacity for CAP recharge, if surface flows and reclaimed water were concurrently recharged. Gravity methods were used to estimate ground-water storage change caused by natural flow events, including the January 1993 flood. The distribution of gravity changes indicated recharged water moved toward Tucson's central wellfield in the west part of the study area (Pool and Schmidt, 1997).

In the area east of Swan Road, flow away from highly transmissive stream deposits appeared to be inhibited by lower permeability sediments to the south, resulting in ground water mounding to the surface. In all, 10,900 acre-feet naturally infiltrated in the floodplain reach between Craycroft Road and Dodge Boulevard between December 1992 and March 1993 (Pool and Schmidt, 1997). Recharge in this area is needed to increase groundwater levels upstream along Tanque Verde Creek and lower Pantano Wash, restoring the aquifer and allowing riparian vegetation to re-establish. Recharge of the central well field is also a pressing need.



# Rillito River Habitat Restoration



## C. Ajo Detention Basin

### 1. Project Description

The Tucson/Ajo Detention Basin Project will create 50 acres of wetlands and riparian habitat within 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 earlier this year. 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 stormwater within the project water features and will use this water for turf irrigation, thereby becoming an important water conservation project.

### 2. Scope of Restoration

The recently completed Letter Report for Design Modification contains these restoration Goals and Objectives:

- ▶ Restore wetland and riparian vegetative communities representative of historical/optimal conditions in the region
- ▶ Restore habitats for target/beneficial fish and wildlife species
- ▶ Maximize the acreage of functional wetland habitat within limits of course design
- ▶ Achieve an optimal mix of habitats that supports the greatest diversity of target/beneficial species while promoting the principal fish and wildlife objectives proposed by a restoration alternative
- ▶ Restore wetlands to ecologically resilient and self-sustaining
- ▶ Design for and maintain adequate vector control in restored wetlands
- ▶ Enhance water quality of the reclaimed water source
- ▶ Maintain the existing flood protection capacity of the Tucson (Ajo) Detention Basin
- ▶ Accommodate incidental recreational values



EPHEMERAL OVERFLOW  
CIENEGA

MESQUITE BOSQUES

WETLANDS

RECREATIONAL PATHS

AJO WAY

SAM LENA PARK

COUNTRY CLUB ROAD

**PROPOSED PLAN**



U.S. Army Corps of Engineers  
Los Angeles District

**Collins/Piña**  
Consulting Engineers, Inc.

**Tucson (Ajo) Detention Basin**  
Pima County, Arizona  
1135 Environmental Restoration Project



## **PART III: Integration in Both Planning and Regulatory Approaches**

### Federal and Local Government Cooperation -- Special Area Management Planning

On November 16, 1999, a letter was forwarded to request a meeting with the District Engineer of the Los Angeles District to discuss a cooperative effort between Pima County Government and the Army Corps of Engineers to address the issues that were raised as part of the October 1999 United States District Court Order enjoining the Corps from authorizing certain Nationwide Permits under Section 404 of the Clean Water Act until a regionally based programmatic environmental impact statement is prepared.

The letter stated that since Pima County is developing a regional multi-species habitat conservation plan, the Sonoran Desert Conservation Plan, we have a long range interest in the programmatic assessment and in the consultation ordered by the District Court between the Army Corps of Engineers and the United States Fish and Wildlife Service.

And, because we have conducted a great deal of work with the local science community and are in the process of requesting proposals from biologists to conduct a regional biological evaluation, the existing habitat conservation planning process could serve to assist the Army Corps of Engineers as it assesses cumulative impacts of the Section 404 permit program on the endangered cactus ferruginous pygmy-owl.

The Riparian Restoration element of the Sonoran Desert Conservation Plan has evolved into one of the most important aspects of the Plan, and we would like to discuss opportunities to develop a Special Area Management Plan with the Army Corps of Engineers.

A Special Area Management Plan is defined in regulations as "a comprehensive plan providing for natural resource protection and reasonable [riparian dependent] economic growth containing a detailed and comprehensive statement of policies, standard and criteria to guide public and private uses of lands and waters; and mechanisms for timely implementation in specific geographic areas with the [riparian area]."

The benefit to the economic interests in the community include the potential for one stop shopping, if Pima County, the Service, the Environmental Protection Agency and the Army Corps can collaborate and agree on what riparian areas have special sensitivity. The conservation benefit of this approach is that riparian protection will be at the system level, rather than pursued at the case by case level.

Pima County also requested a meeting to discuss potential solutions to the problems that could be created as we seek Individual Permits for projects once covered under the Nationwide Permits.

This report demonstrates that legal decisions involving natural resources are achieving a greater integration of the component parts of the resource systems. Meaningful conservation planning, too, requires a comprehensive approach that quantifies the connections between the water, land (habitat) and animals within the protected ecosystem.