



Anza Park Aquatic and Riparian Ecosystem Enhancement and Restoration Evaluation



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ABBREVIATIONS AND ACRONYMS

af	acre feet
AGFD	Arizona Game and Fish Department
CFPO	cactus ferruginous pygmy-owl
cfs	cubic feet per second
CLS	Conservation Land System
EPCTSM	Eastern Pima County Trail System Master Plan
FEMA	Federal Emergency Management Agency
GPD	gallons per day
IRA	Important Riparian Area
MGD	million gallons per day
mg/L	milligrams per liter
NRCS	Natural Resources Conservation Service
PAG	Pima Association of Governments
PCA	Priority Conservation Area
PCCRHPO	Pima County Cultural Resources and Historic Preservation Office
PCMSCP	Pima County Multi-Species Conservation Plan
PCNRPRD	Pima County Natural Resources, Parks, and Recreation Department
PCRFC	Pima County Regional Flood Control District
PCRWRD	Pima County Regional Wastewater Reclamation Department
PVS	Priority Vulnerable Species
SDCP	Sonoran Desert Conservation Plan
SFHA	Special Flood Hazard Area
STAT	Science Technical Advisory Team
TAS	Tucson Audubon Society
TRDN	Tres Rios del Norte
USACE	U.S. Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
WRF	Wastewater Reclamation Facility

1.0 Introduction

Pima County has been on the forefront of natural resources conservation in America, especially with the adoption of the Sonoran Desert Conservation Plan (SDCP), with the following stated purpose: “to ensure the long-term survival of the full spectrum of plants and animals that are indigenous to Pima County through maintaining or improving the habitat conditions and ecosystem functions necessary for their survival” (Pima County 2006).

Pima County has been making open space land acquisitions in support of SDCP goals and values. Wastewater treatment facilities provide a special opportunity for parks that achieve both restoration of precious riparian habitat and provide valuable public recreation opportunities. In Pima County such facilities are ideally suited to fulfill these roles, since they are (1) sited along watercourses on lands that are generally flood-prone and not suitable for other types of development and (2) produce effluent flow that can be harnessed to provide open water and support riparian vegetation.

There are growing numbers of wastewater treatment facilities that have successfully combined habitat restoration with public recreation and environmental education. The Sweetwater Wetlands Preserve adjacent to the Roger Road Wastewater Reclamation Facility in Tucson is a well-known destination among birders seeking unique sightings (Photograph 1). In Maricopa County, the Riparian Preserve and Water Ranch is part of the Town of Gilbert’s commitment to reuse 100 percent of its effluent wastewater. The preserve is managed by the non-profit Riparian Institute, which manages it to provide environmental education as well as a wide variety of habitats for a rich diversity of plants and animals, especially avifauna. In addition, Pima County Regional Flood Control District (PCRFC) is working with Pima County Regional Wastewater Reclamation Department (PCRWRD) and other stakeholders at the Avra Valley Wastewater Treatment Facility to “create a world-class destination site for wildlife watching, protection and enhancement of scarce riparian areas and wildlife habitat, environmental education and other outdoor recreational activities, while reclaiming, reusing, and recharging valuable and scarce water resource” (RECON 2008a).

Anza Park was established in August of 2007 by Pima County Resolution 2007-175 (Pima County 2007a). The resolution identified the following conditions as supporting the location of Anza Park on lands adjacent to the Marana Wastewater Reclamation Facility (WRF):



Photograph 1. Sweetwater Wetland Preserve, adjacent to the Roger Road Wastewater Reclamation Facility in Tucson, Arizona.

- The Santa Cruz River at this location is included within the study area of Tres Rios del Norte (TRDN)¹, a project that is being planned to contribute to ecosystem restoration, flood control, recreation, and protection of cultural resources. Pima County is a local sponsor of this effort and is working with the U.S. Army Corps of Engineers (USACE) in project planning and analysis.
- PCRFCO has acquired land adjacent to the Marana WRF and the river in order to reduce the threats of inundation and erosion to downstream development.
- Anza Park includes a segment of the Juan Bautista de Anza National Historical Trail.
- The Pima County Natural Resources, Parks, and Recreation Department's (PCNRPRD) *Parks Master Plan* supports the use of river corridors for establishing parks.
- PCRWRD is investing in the expansion Marana WRF, including acquisition of additional adjacent property to satisfy buffer and setback requirements.

¹ Although Anza Park is within the TRDN study area, it is outside of the actual project area, which terminates at Sanders Road.

2.0 Regional Context

The Pima County Anza Park is located within Avra Valley in northern Pima County, Arizona, between the Tortolita, Tucson, and Silverbell/Ragged Top mountain ranges. The park is located adjacent to and west of the Town of Marana boundary and about three miles east of Ironwood Forest National Monument. The Santa Cruz River flows in a northwest direction through the central portion of the park. The Brawley Wash, located about two miles west of the park, flows from south to north through Avra Valley before joining the Santa Cruz River approximately eight miles northwest and downstream from the park.

The park consists of approximately 280 acres located along both sides of the Santa Cruz River west of Trico Road (Figure 1). The Marana WRF is located within the eastern portion of the park. Lands surrounding the park consist of City of Tucson parcels and privately owned parcels. Privately owned parcels are located to the north, south, and east. Land use of these parcels is primarily agricultural (cultivated fields). City of Tucson parcels, to the west and southeast, are cooperatively managed by the Tucson Audubon Society (TAS) for habitat preservation and restoration.

2.1 Study Area

Anza Park is situated along a segment of the Santa Cruz River that experiences perennial water flow as a result of effluent water releases upstream at Pima County's Ina Road and Roger Road wastewater reclamation facilities (discussed further in Section 2.6.1.3). This area is a riparian oasis that supports a rich diversity of native plants, birds, and other wildlife, especially as compared to adjacent lands that are biologically depauperate due to decades of intensive agricultural use. Because riparian areas and the species they support are variously imperiled throughout the southwest, particularly in the Sonoran Desert, it is not surprising that there are several planning efforts that relate to this river corridor. Pima County's SDCP establishes a framework for protecting its vast natural and cultural resources placing a significant focus on riparian conservation. The Riparian Element of the SDCP acknowledges that riparian resources and aquatic systems are the most vulnerable and least protected habitats in Pima County. The Santa Cruz River is the basis for several ongoing and planned restoration projects, including those at the neighboring City of Tucson–TAS parcels and the ambitious USACE TRDN Project (Figure 2).



-  Wastewater Reclamation Facilities
-  Marana Wastewater Reclamation Facility and Anza Park
-  Santa Cruz River



FIGURE 1
Project Location

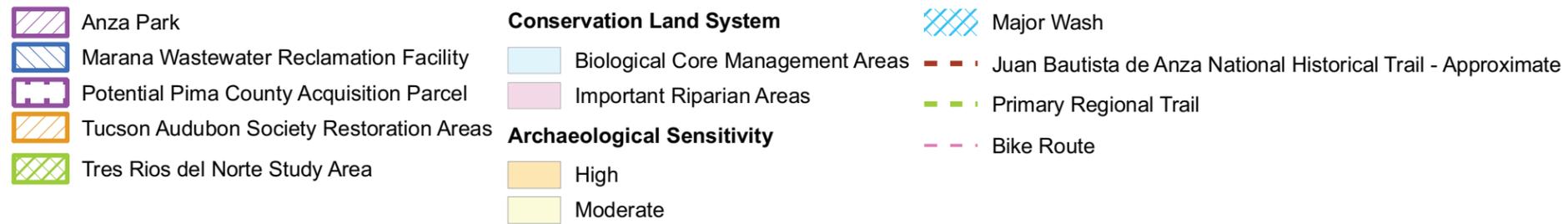
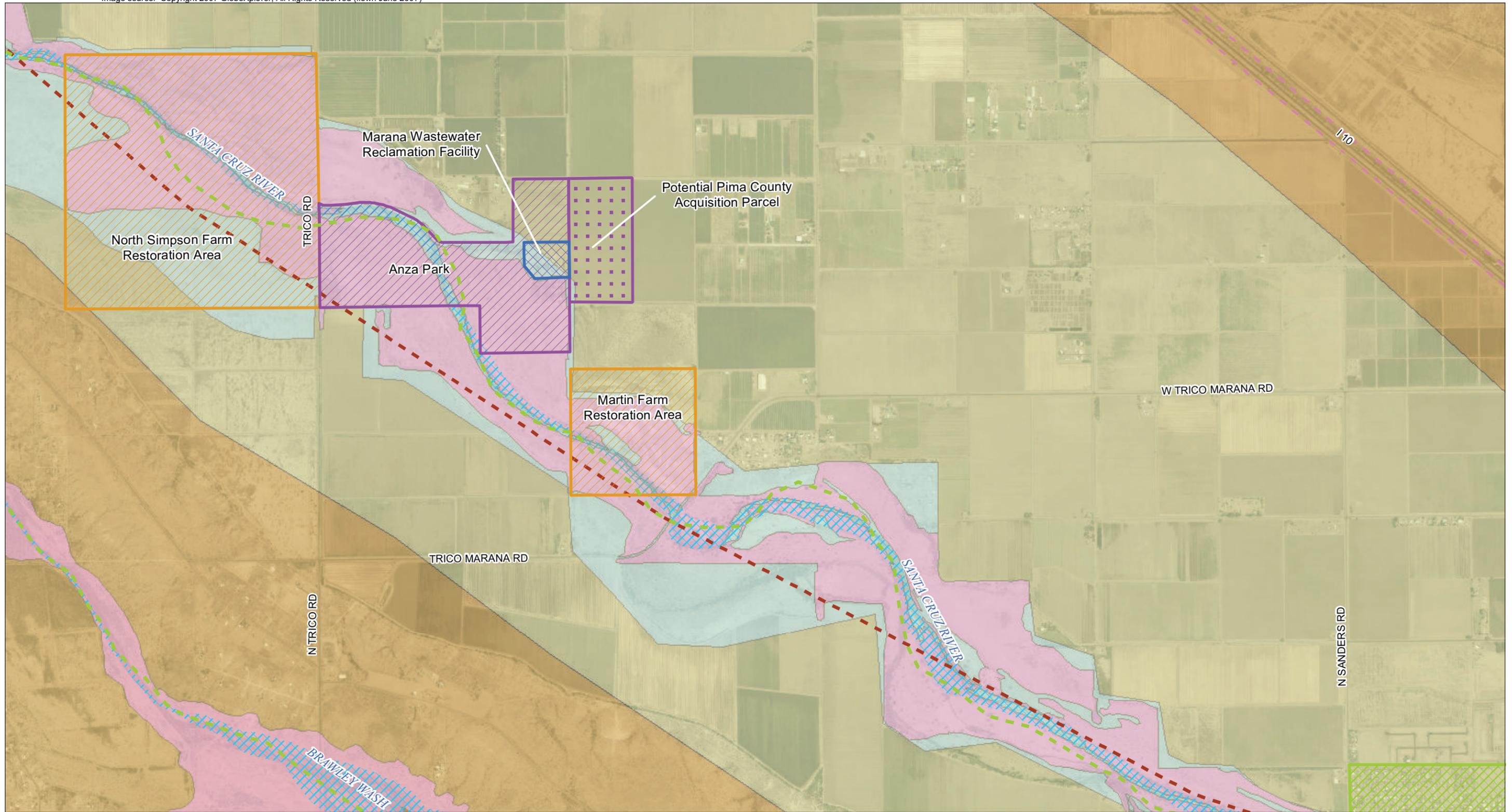


FIGURE 2
Regional Context

2.2 Sonoran Desert Conservation Plan (SDCP)

The SDCP is a long-range vision for protecting the rich natural and cultural heritage of Pima County.

2.2.1 Conservation Land System and Conservation Priorities

The Conservation Land System (CLS) of the SDCP was designed to protect biodiversity and provide land use guidelines consistent with the conservation goal of the SDCP (Pima County 2005). The CLS identifies a number of land designations based on biological values and establishes specific guidelines for open-space conservation. On private property these conservation guidelines are not triggered unless a landowner requests a land use change from the Board of Supervisors (e.g., a higher-density zoning than is currently assigned to landowner's land or a Conditional Use Permit).

The CLS establishes a reserve system that protects areas based on the particular resources that occur there. Seven CLS categories were created, defined, and mapped for the SDCP, each with an associated conservation guideline policy. Anza Park contains two CLS categories; the majority of the park is within the Important Riparian Area (IRA) category and the Santa Cruz River channel is within the Biological Core category (Pima County 2005) (see Figure 2).

2.2.1.1 Important Riparian Areas (IRA)

An IRA is characterized by hydriparian, mesoriparian, and/or xeroriparian biological communities. Hydriparian communities generally exist in areas where vegetation is supported by perennial watercourses or springs; mesoriparian communities generally exist in areas where vegetation is supported by perennial or intermittent watercourses or shallow groundwater; and xeroriparian communities generally exist in areas where vegetation is supported by an ephemeral watercourse. IRAs are essential elements in the CLS, valued for their higher water availability, vegetation density, and biological productivity. In addition to the inherent high biological value of these water-related communities, IRAs including their associated upland areas provide a framework for linkages and landscape connections.

Pima County's Conservation Guidelines for IRAs state:

At least 95 percent of the total acreage of lands within IRA designation shall be conserved in a natural or undisturbed condition. Every effort should be made to protect, restore, and enhance the structure and functions of IRAs, including hydrological, geomorphological, and biological functions. Areas within an IRA that have been previously degraded or otherwise compromised may be restored and/or

enhanced. Such restored and/or enhanced areas may contribute to achieving the 95-percent conservation guideline for IRAs (Pima County 2000).

Restoration activities at Anza Park would be congruent with these guidelines and the SDCP values and goals for riparian resources, and could expand the acreage in Pima County that meets the criteria for this IRA designation.

2.2.1.2 Biological Core Management Areas

Much of the land adjacent to the Santa Cruz River IRA has been designated as Biological Core Management Area. Biological Core Management Areas are primarily distinguished from other lands within the CLS by their potential to support high-value habitat for five or more Priority Vulnerable Species (PVS).

Pima County's Conservation Guidelines for Biological Core Management Areas state:

At least 80 percent of the total acreage of lands within this designation shall be conserved as undisturbed natural open space. Development shall be configured in the least sensitive portion(s) of the property. Area(s) of undisturbed natural open space will be configured to include onsite conservation values and preserve the movement of native fauna and pollination of native flora across and through the landscape. Land use and management within these areas shall focus on the preservation, restoration, and enhancement of native biological communities. Land uses appropriate for these areas must retain and improve conditions for onsite conservation values, preserve the movement of native fauna and pollination of native flora across and through the landscape, and preserve landscape integrity (Pima County 2000).

Restoration activities at Anza Park would be congruent with these guidelines by enhancing and/or restoring native biological communities.

2.2.1.3 Agriculture Holdings

Within the CLS, parcels that are currently utilized for agricultural purposes and/or where agricultural uses have been abandoned have been identified as areas where intensifying land uses should emphasize the use of native flora, facilitate the movement of native fauna and pollination of native flora across and through the landscape, and conserve on-site conservation values. Development within these areas will be configured in a way that does not compromise the conservation values of adjacent and nearby CLS lands.

Although not specifically identified as "Agricultural Holdings" on CLS maps, Anza Park is located on retired agricultural lands and is surrounded by lands that are currently in agricultural use.

2.2.2 Relationship to Open Space and Trail System

A primary goal of the SDCP is to create an interconnected system of conserved lands with ecological value throughout Pima County with open space acquisitions, development of set-aside guidelines, conservation easements, and other tools. Open space, trails, and preserve systems can include federal, state, and private holdings together with Pima County-owned land managed at the appropriate level of conservation. The primary threat to the open space resource base is urbanization and development. Open space currently surrounding Anza Park consists of private agricultural lands as well as the City of Tucson–TAS holdings both up- and downstream from the park.

There are two regionally significant planned trail alignments that occur in Anza Park, the Juan Bautista de Anza National Historic Trail (Anza Trail) and the Santa Cruz River Trail. The Eastern Pima County Trail System Master Plan (EPCTSMP; Pima County 1989) is currently being updated, and it emphasizes the importance of the existing (and planned expansion of) the river park system. These two proposed alignments may be combined through Anza Park where appropriate and if feasible.

2.2.2.1 Juan Bautista de Anza National Historic Trail

The Anza Trail is one of the three historically significant trails in Pima County; it was the first overland colonizing expedition for the Spanish empire in the Southwest, extending from Sonora, Mexico, to San Francisco.

The 1,200 miles of the Anza Trail north of the international border are part of the National Trail System of the United States, established in August 1990 by Public Law 101-356. There are 70 miles of trail within Pima County, and the county is working with the National Park Service to plan and construct this continuous segment (McGann & Associates 2002). Current plans include acquisition of necessary rights-of-way and easements, as well as improvements to the trail and six camp sites that follow the Santa Cruz River through Pima County.

Some segments of the route in Southern Arizona, such as the portion between the 18th Century mission at Tumacacori and presidio at Tubac, are complete and drawing visitors, while other portions remain in proposal stage by supporters of the trail. Pima County is currently working on developing the Canoa Ranch portion near Green Valley, and the Town of Marana is developing a segment between Cortaro and Twin Peaks roads. There is no estimate available for when the trail will be continuous in Pima County, but the plan is to connect all segments.

The Anza Trail, as shown in maps and plans, is not necessarily the exact route of the 1775–1776 colonizing expedition, but rather a representation of the journey. The Anza

Trail alignment (McGann & Associates 2002) crosses Anza Park, following the Santa Cruz River corridor. Development at Anza Park presents a unique recreational opportunity to site the trail in conjunction with restoration areas.

See Section 2.7—Cultural Resources for more details about the cultural significance of the Anza Trail.

2.2.2.2 Santa Cruz River Park Trail

Anza Park is located within the northern half of the EPCTSMP along the Santa Cruz River Park trail system. The Santa Cruz River Park is located along the banks of the river. Currently, the constructed portions of the Santa Cruz River Park trail extend from Grant Road to 29th Street and from Irvington Road to Ajo Way. Future plans propose a connected trail system from just south of the Pima/Pinal County line to the Tohono O’odham Reservation (San Xavier) boundary south of Tucson.

At Anza Park, the specific alignment of the Santa Cruz River Park Trail has not yet been finalized; its approximate location is shown on Figure 2. Development at Anza Park presents a unique recreational opportunity to coordinate the siting of the Santa Cruz River Park Trail with the Anza Trail through Anza Park.

2.3 Tres Rios del Norte

The section of the Santa Cruz River within Anza Park is north of Sanders Road, the northern boundary of the TRDN Project Area (Figure 2). TRDN is a collaborative effort between the USACE and local jurisdictions (PCRFC, City of Tucson, Town of Marana) that is being planned to contribute to: ecosystem restoration, flood control, recreation, and protection of cultural resources. A Feasibility Study and Environmental Impact Statement are being developed for this project, which proposes habitat restoration along 18 miles of the Santa Cruz River Corridor, from Prince to Sanders Road, south of the Pinal County line.

2.4 City of Tucson—Tucson Audubon Society Parcels

City of Tucson-owned parcels are located to the west, southwest, and southeast of the park. These parcels were historically agricultural fields which the City of Tucson purchased and retired to obtain the associated groundwater rights. These parcels are currently not available for standard residential or commercial development; the underlying groundwater is being reserved to meet future municipal water needs in the Tucson metropolitan area (Phillips et al. 2002).

The TAS has been conducting habitat restoration in the riparian forest and adjacent upland areas along the Lower Santa Cruz River on parcels owned by the City of Tucson through a right-of-entry agreement. These restoration areas are directly adjacent to Anza Park; the North Simpson Farm Riparian Project lies to the west (downstream), and the Martin Farm Riparian Project lies to the southeast (upstream) (see Figure 2).

These TAS restoration efforts are driven by principles of sustainability adapted from permaculture design principles (Mollison and Slay 1991); the specific goals include:

- Harvest rainwater.
- Increase plant diversity.
- Decrease erosion.
- Improve sustainability of riparian corridor.
- Link riparian corridor to adjacent abandoned agricultural areas to expand habitat.
- Monitor plant survival and restoration techniques.
- Engage the public in stewardship and education.
- Provide a model for other habitat recovery efforts.

2.4.1 North Simpson Farm Riparian Project

The TAS has a right-of-entry agreement with the City of Tucson to conduct restoration activities on 640 acres (North Simpson Farm) of a larger 1,700-acre city-owned parcel just west of Anza Park. The TAS's work at the North Simpson Farm has been supported by Arizona Department of Environmental Quality Habitat Protection Fund grant monies. From 2002 to 2005, portions of the North Simpson Farm parcel underwent habitat restoration and monitoring, as well as public outreach efforts under Phase I of the TAS restoration plan. Additional phases of restoration have been ongoing (Kroesen 2005). Restoration plantings are supported by two groundwater wells at the site as part of a water use agreement with Tucson Water (Macys et al. 2007). To date, restoration activities have included 120 acres that have been seeded and planted with native trees, shrubs, and grasses, along with an additional 20 acres that received seed only (Macys et al. 2007).

2.4.2 Martin Farm Riparian Project

The Martin Farm is a property about one mile upstream from the North Simpson Farm site, along the lower Santa Cruz River. The TAS is currently enhancing habitat on 34 acres with a floodplain area that was never used for agriculture. Tucson Water personnel, who manage the city's properties in Avra Valley, are coordinating with the TAS and are fencing the perimeter to keep out cattle and off-highway vehicles (TAS 2008).

2.5 Access

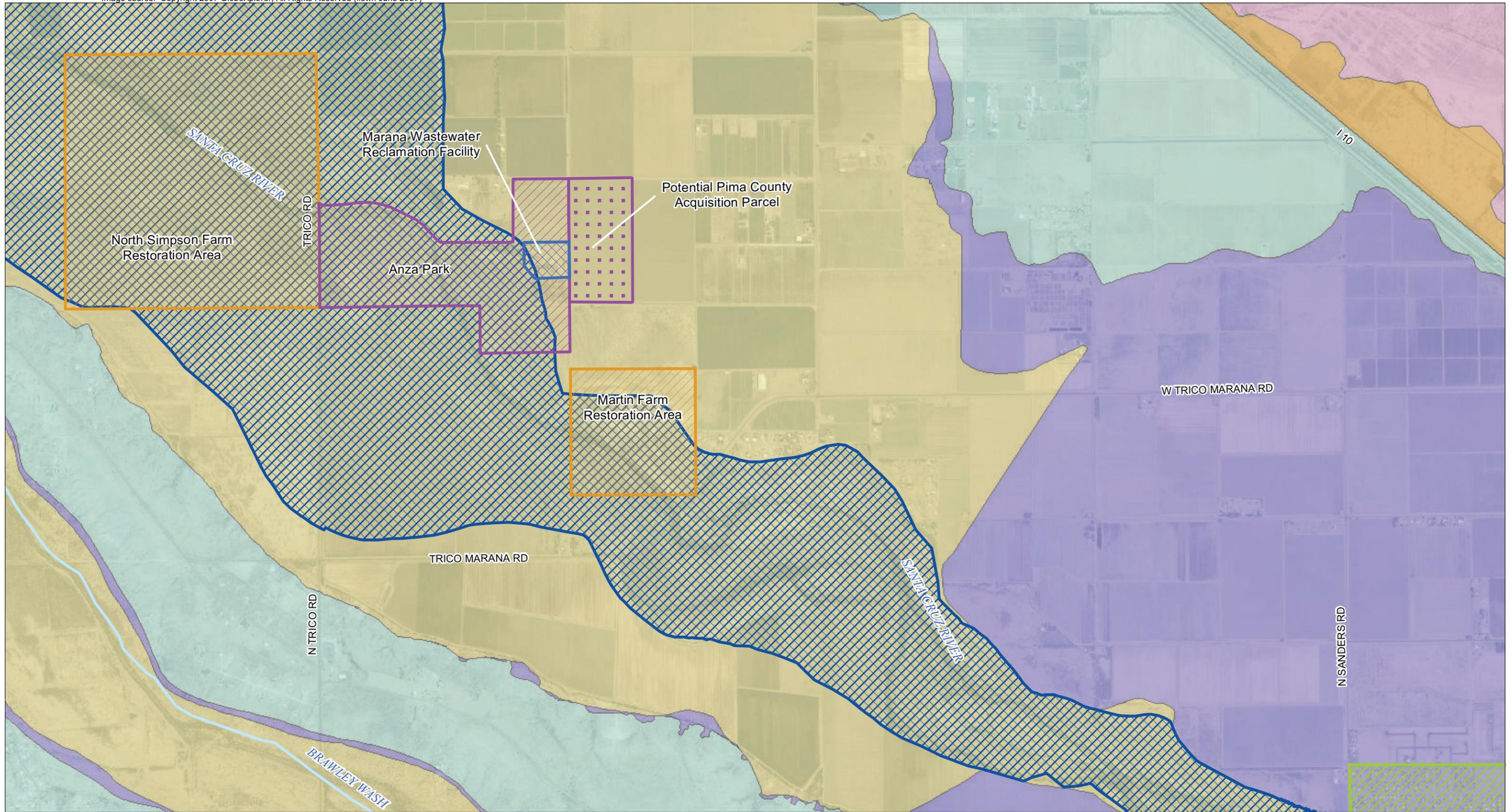
Anza Park is located east of Trico Road south of Hardin Road. The park can be accessed from the east (from the Marana WRF), north, or south from Interstate 10 to Marana Road, taking Marana Road west. The park is currently accessed by taking Marana Road to Luckett Road north, and then west on Treatment Plant Road to the Marana WRF.

2.6 Floodplain and Water Resources

Anza Park is located in a Federal Emergency Management Agency (FEMA) Floodway, as well as in a Special Flood Hazard Area (SFHA) (Figure 3). A SFHA refers to an area that has a one percent chance of being inundated in any given year (also referred to as the 100-year floodplain). Insurable structures associated with federally funded projects within an SFHA are required to have flood insurance.

Historically, the Santa Cruz River had perennial flow along most reaches and supported riparian vegetation along its banks. During the late 1800s, an increase in the human population in the Tucson area resulted in increased pumping of groundwater, construction of irrigation diversion structures, entrenchment of various reaches of the river, shifting and severing river meanders, changes in sediment deposition and erosion patterns, and channelization of portions of the river. These changes in hydrologic functions, along with groundwater declines and the introduction of effluent flow, have resulted in significant changes to the vegetation along the banks of the Santa Cruz River (Phillips et al. 2002).

The low-gradient slope of the Santa Cruz River within the Avra Valley and Marana segments results in aggradation (accumulation) of river sediments. Aggradation is a natural process in this stretch of the river, but the effects are now accentuated through upstream channelization and bank stabilization projects that have counteracted normal floodplain processes. Without these developments, the flow would be slower and allow sediments to be deposited along a greater length of the river (Phillips et al. 2002).



- | | |
|--|--|
|  Anza Park |  Floodway Boundaries* |
|  Marana Wastewater Reclamation Facility | DFIRM Zone Designation* |
|  Potential Pima County Acquisition Parcel |  ZONE A - Areas subject to inundation by the 100 year flood event |
|  Tucson Audubon Society Restoration Areas |  ZONE AE - Used on new revised maps instead of A1 - A30 |
|  Tres Rios del Norte Study Area |  ZONE AH - Areas subject inundation by 100 year shallow flooding (usually areas of ponding) |
| |  ZONE X |
| |  ZONE X - SHALLOW 100-YEAR |

* Source data provided by Pima County, AZ

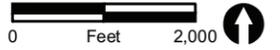


FIGURE 3
Regional Context: Floodplain Resources

Within the northern/western portion of Anza Park, the Santa Cruz River channel has been contained within steep sandy trapezoidal-shaped berms constructed out of sediment after the 1993 flood (Photograph 2). On the north bank, the berm is about 13 feet above the river level; on the south bank it is higher, at 20 feet above the river level. The bases range in width from 25 to 320 feet, and the river channel itself ranges from 40 to 120 feet wide. Phillips et al. (2002) noted that the berms have begun to erode in approximately the same locations as historic meanders.



Photograph 2. Aerial view of Anza Park project area during a summer flood event in August 2006. The Marana WWTF is in the foreground, and the view is westward toward the Santa Cruz River channel. Photo courtesy of Pima County Regional Flood Control District.

Between massive flood events, an algal layer/mat (referred to by scientists as “schmutzdecke”) develops on the channel bottom, which blocks infiltration and allows water to flow farther downstream that it would without the layer. When scouring flood flows remove the layer, there is increased infiltration downstream of the WRFs, reducing or even eliminating the effluent flow from reaching the Anza Park project area, until the algal mat is re-established. The TAS found that after a large flood event in October 2000, it took 50 days for flows to resume to the North Simpson Farm project area (Kroesen 2005). In addition, TAS has found that floods can result in project area inundation, removal of plantings, erosion, damage to irrigation systems, and removal of invasive species as well as deposition of new invasive propagules (Kroesen 2005).

2.6.1 Effluent Water Resources

The Santa Cruz River within the Anza Park area receives effluent water from three wastewater reclamation facilities managed by Pima County: Ina Road, Roger Road, and Marana. These facilities produce effluent water that can be used for many purposes including irrigation, dust control, ground water recharge, habitat restoration, and recreation. Since 1983, the majority of effluent water produced has been discharged into the Santa Cruz River, which flows northward through Tucson and Marana. Over 50,000 acre feet (af) of effluent flow is released annually (Pima County 2007b).

Effluent flow within the Santa Cruz River frequently extends to the Pinal County line (north of Anza Park), but varies by season, time since last scouring flood, and extent of recent precipitation. In addition, there are daily fluctuations in flow that result from water use patterns and time of effluent release (i.e., A.M. and P.M. surges associated with peak water-use periods). It takes about 10 hours for water to reach the Anza Park area from the Roger Road and Ina Road WRFs (Kroesen 2005). Typical daily effluent flow in the Santa Cruz River at the Anza Park location is 10 to 30 cubic feet per second (cfs) and several feet in depth (Macys et al. 2007).

Studies by the USGS have shown that in the effluent-dominated reach of the Lower Santa Cruz River, periphytic chlorophyll-*a* levels are as many as two orders of magnitude above levels observed in non-effluent waters. This, and other water quality variables, may limit the aquatic flora and fauna species to those that can tolerate organic loading (Pima Association of Governments [PAG] 2002a; Gebler 1998).

Under an Inter-governmental Agreement between the City of Tucson and Pima County, up to 10,000 af of treated effluent per year may be set aside specifically to support riparian restoration projects². The effluent may be delivered to sites via the reclaimed water system or left in the channel of the Santa Cruz River. Up to 5,000 af/yr were available until 2005, after which the amount could rise to 10,000 af/yr, if there is sufficient demand (Pima County 2007b).

² City of Tucson–Pima County Supplemental Intergovernmental Agreement relating to Effluent, Resolution No. 2000-28: The 2000 Supplemental Intergovernmental Agreement, signed on February 8, 2000, placed restrictions on how PC could use effluent. This agreement also exempted outlying treatment facilities from the City control, identified the need for reopening the Randolph Park WRF, and provided an avenue for the County to deliver County effluent to County facilities. This supplemental agreement also established a Conservation Effluent Pool for use with riparian habitat projects and identified how the Southern Arizona Water Rights Settlement Act (SAWRSA) volumes are to be treated in determining effluent allocations.

2.6.1.1 Ina Road Wastewater Reclamation Facility

The Ina Road WRF serves parts of northwest Tucson, Oro Valley, and Marana. In 2007, it discharged 27,864 af of effluent into the Santa Cruz River. The current capacity of this facility is 37.5 million gallons per day (MGD), producing class B and B+ effluent using high-purity oxygenated sludge and biological nutrient removal activated sludge processes (Pima County 2007b). The Ina Road WRF is located about 18 miles upstream from Anza Park.

2.6.1.2 Roger Road Wastewater Reclamation Facility

The Roger Road WRF serves the greater Tucson Metropolitan area and produced 37,751 af of effluent in 2007. Of this, 24,494 af were discharged into the Santa Cruz River and 13,489.08 af were used for reuse discharge, and onsite use. This facility is the largest in Pima County with a capacity of 41 MGD (Pima County 2007b). The Roger Road WRF is located about 21 miles upstream from Anza Park.

2.6.1.3 Marana Wastewater Reclamation Facility

The Marana WRF services the town of Marana located northwest of Tucson. The rated capacity (average dry weather flow) for this facility is 0.7 MGD. A biological nitrogen treatment process is used, and biosolids are transported to the Ina Road WRF for processing (Pima County 2008). Marana WRF maintains an Aquifer Protection Permit for B+ level effluent.

Effluent from the Marana WRF is reused or conveyed to the Santa Cruz River. In 2007, this facility discharged 188 af of effluent into the Santa Cruz River; 26 af were used for onsite irrigation, and 7 af were used for on-site industrial purposes. Releases to the Santa Cruz River are currently conveyed from the facility directly west across the north boundary to the river in an open, earthen channel that has several small ponded areas. Surface flows do not always reach the river; the water often percolates into sandy aggregate soils near the confluence of the channel and the river (Pima County 2007b).

The following sections describe recent developments at Marana WRF.

2.6.1.3.1 Water Quality Improvements

The Marana WRF recently added sand filtration and ultraviolet light disinfection equipment to the facility. This addition did not affect treatment capacity but it does change the effluent discharge class, increasing it to Class A+, the highest standard (Brian Toothman, personal communication).

The Arizona Department of Environmental Quality has a set of Reclaimed Water Quality Standards—five different classes reflect a combination of minimum treatment

requirements and water quality criteria. Class A is the highest, and is the necessary standard for uses that include a relatively high risk of human contact. The addition of a “+” indicates that the water has a total nitrogen concentration of less than 10 milligrams per liter (mg/L), a level that allays groundwater contamination concerns.

2.6.1.3.2 Expansion and Increased Treatment Capacity

The current treatment capacity at Marana WRF is 700,000 gallons per day (GPD) total. The Marana WRF has a permitted treatment capacity of 700,000 GPD and treated an average daily influent flow of 190,000 GPD in 2007 (27 percent capacity)³. There is a development plan for the Marana WRF, but these plans are on hold; any future expansion would be based on area demand. Although an expansion in the next 10 to 20 years is likely, it is not possible at this time to project future effluent flow volumes; any future development would, however, be contained within the current Marana WRF property (Glen Peterson, personal communication 2008).

2.7 Cultural and Historic Resources

The Santa Cruz River has had nearly continuous human use for over 11,500 years, from early subsistence agricultural farming through Spanish missionaries to Anglo settlers. Spanish explorers entered the region and began constructing missions as well as presidios around A.D. 1697, after the arrival of Father Eusebio Kino, a Jesuit priest who traveled along the Santa Cruz River in 1694. The Camino Real gradually developed from traditional Native American trails along the Santa Cruz River.

Land surrounding Anza Park, including City of Tucson properties, remained largely undeveloped or unused for agricultural purposes until the early 1900s. By about 1930, the lands in the area were being used for agricultural purposes, primarily cotton crops, until the land was retired by about the early 1980s (Phillips et al. 2002).

The Juan Bautista de Anza National Historic Trail is an overland route that the Spanish explorer Juan Bautista De Anza and over 240 followers and 1,000 livestock animals used to travel from Mexico to California during the winter of 1775 and 1776. Although de Anza began in Mexico, the trail—as it exists today—starts in Nogales, Arizona, and ends in San Francisco, California. The expedition reached Monterey, California, in March of 1776, after 130 days of travel. Lieutenant-Colonel de Anza returned along the same route in April of that year (National Park Service 1996). There are many interpretive

³ 2008. City of Tucson and Pima County. Water Infrastructure, Supply & Planning Study. A City of Tucson and Pima County Cooperative Project. Website: <http://www.tucsonpimawaterstudy.com/Reports/DraftFinalReports.html>.

markers along the route commemorating events of historical significance and points of interest. The Juan Bautista de Anza Trail was designated as a National Historic Trail by the U.S. Congress in 1990.

In Pima County, the trail roughly follows the Santa Cruz River. The Anza Trail, as shown in maps and plans, is not necessarily the exact route of the 1775–1776 colonizing expedition, but rather a representation of the journey. North of Tucson, the trail passes through the town of Marana and near the Marana WRF. Anza Park is located between two estimated expedition camps (National Park Service 1996).

2.8 Connectivity

River corridors and riparian areas inherently connect the landscape that they run through, and they are especially important in fragmented habitats. In the arid southwest, and especially Arizona, riparian areas are heavily used as breeding habitat, watering holes, and links between wildland blocks. This connectivity provides the contiguous habitat necessary to sustain viable populations of sensitive and far-ranging species in the Sonoran Desert.

Within Avra Valley, the Santa Cruz River flows from southeast to northwest, and through the central portion of Anza Park. The Brawley Wash, located about two miles west of the park, flows from south to north through Avra Valley before joining the Santa Cruz River approximately eight miles downstream of the park. Healthy riparian areas along the river near Marana provide a link between the Tucson Mountains (40,000 acres [ac]), Ironwood Forest National Monument (129,000 ac), and the Tortolita Mountains to the northeast, including the 5,000-acre Tortolita Mountain Park. The Tortolitas are, in turn, linked to the Santa Catalina Mountains (360,000 ac) to the east of Tucson. These linkages provide gene flow, sustenance, and extend habitat for rare animals such as badgers, black bears, bobcats, javelina, snakes, desert tortoises, and Gila monsters to name a few (Beier et al. 2006).

In order for riparian areas to be used as connections to other open space and wildlands, they must be managed properly. Maintaining natural fluvial processes such as restoring timing, magnitude, frequency, and duration of surface flows would help in sustaining riparian ecosystems. In the case of Anza Park, the continuance of effluent flow in the Santa Cruz River is imperative. In addition, the eradication of non-native species and maintenance of a buffer of native vegetation on either side of the channel would help maintain a healthy riparian ecosystem and promote connectivity between fragmented wildlife habitats (Beier et al. 2006).

On a more local scale, the location of Anza Park, adjacent to and directly in between two TAS habitat restoration sites, makes it an important linkage between the Martin Farm site upstream and the North Simpson Farm site downstream.

3.0 Existing Site Conditions

3.1 Overview

Anza Park is located at the crossroads of many different land uses, including wastewater treatment, agriculture, and habitat restoration. Within Anza Park, there is a variety of site conditions to consider in restoration and recreation planning (Figure 4).

3.2 Topography

Surface elevation within Anza Park ranges from 1,910 to 1,920 feet above mean sea level. Land slope is generally toward the west throughout most of the park. Site topography is dominated by the Santa Cruz River, which defines the northern boundary of the park on the west end and turns south at the center, bisecting the western and eastern portions of the park.

Former agricultural fields surrounding the Marana WRF are relatively flat. Flood control berms were built along the northern bank of the river in the northwestern portion of the park, running along the northern boundary and surrounding the Marana WRF. Park land east of the river and south of the Marana WRF (south of flood control berms) contains undulations or hummocks throughout the area, most likely formed by flood erosion and sediment deposition. The hummocky area contains many localized depressions where rainwater collects.

3.3 Soils

3.3.1 Soil Types at Anza Park

Soils near the Marana WRF are characterized mainly by sand, silt, clay, and organic material deposited by floods in the Santa Cruz River 100-year floodway (Natural Resources Conservation Service [NRCS] 2008). Consisting mostly of an upper floodplain, the area has many shallow, undulating channels and low berms. The NRCS has conducted extensive soils mapping in northern Avra Valley, and eight soil units have been identified within Anza Park (Figure 5) (NRCS 2008).

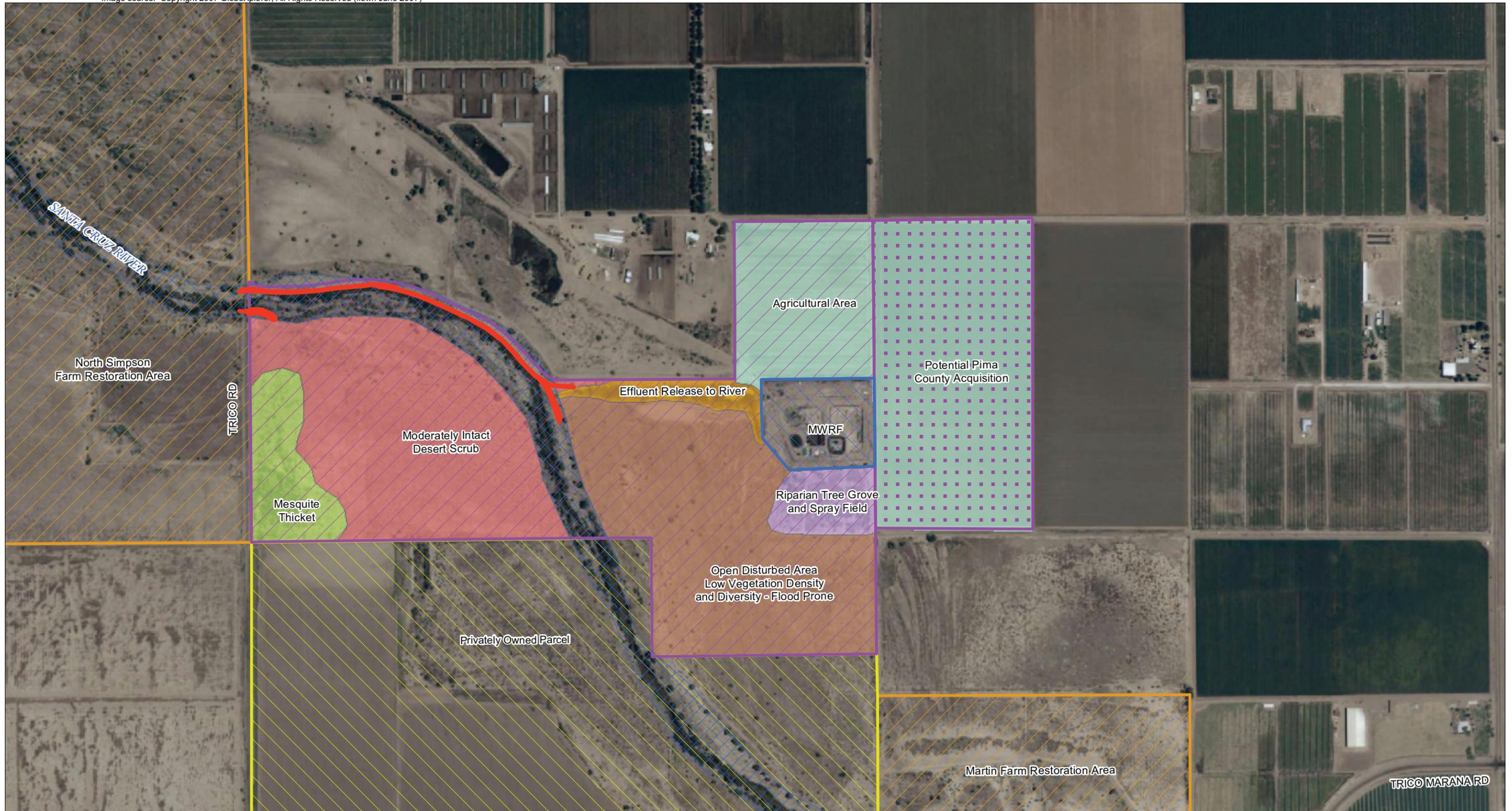
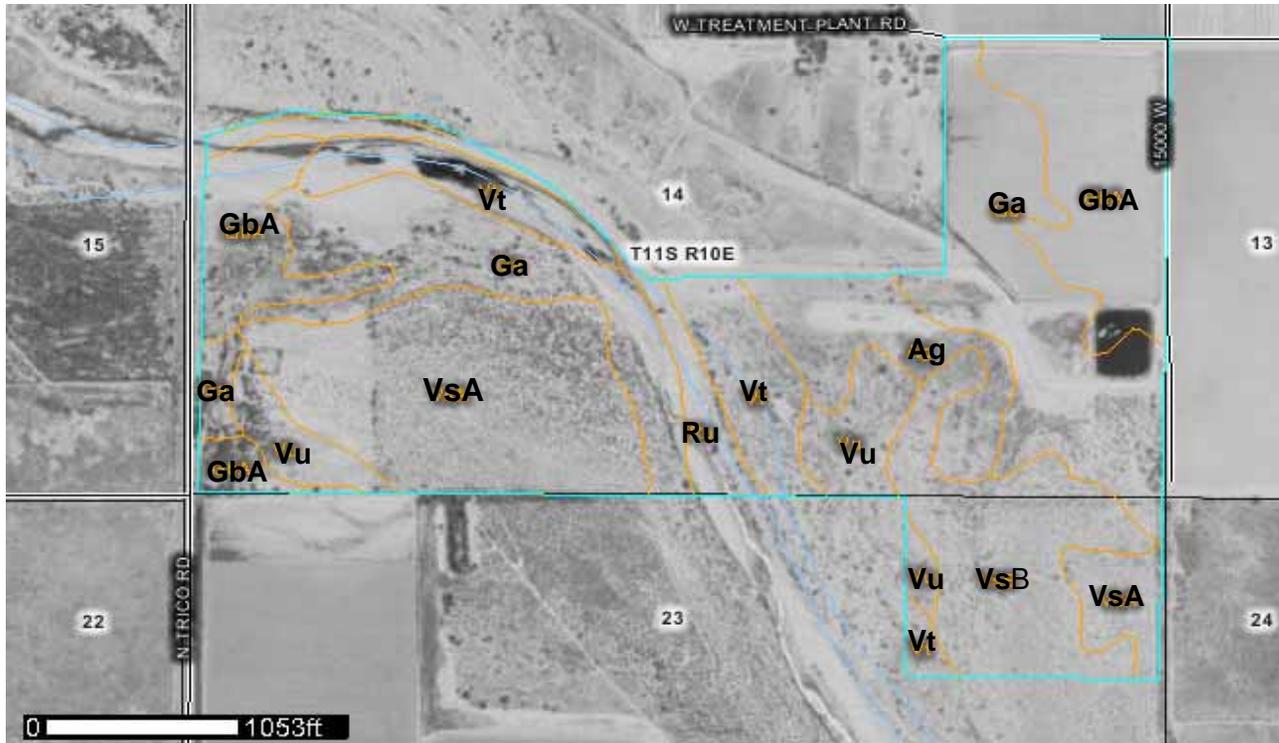


FIGURE 4
Existing Site Conditions



Map Unit Symbol	Map Unit Name	Percent of Area of Interest
Ag	Agua very fine sandy loam	6.5
Ga	Gila sandy loam	26.7
Gba	Gila loam, 0 to 1 percent slopes	16.6
Ru	Riverwash	4.0
VsA	Vinton loamy sand, 0 to 1 percent slopes	19.6
VsB	Vinton loamy sand, 1 to 3 percent slopes	11.3
Vt	Vinton sandy loam	9.2
Vu	Vinton-anthony sandy loams	6.0

FIGURE 5
Soil Types Present at Anza Park
Source: NCRS 2008

3.3.2 Microphytic Crusts

Microphytic crusts (also referred to as cryptobiotic soils), composed of mosses, liverworts, algae, cyanobacteria, and/or lichens are valuable biotic components of some desert soils, binding soil together to lessen erosion and also fixing atmospheric nitrogen to make it available to larger plants (McAuliffe 2000). Disturbance of these crusts can be very detrimental to a site. Microphytic crusts are abundant adjacent to the Santa Cruz River channel in areas of old channel meanders at the North Simpson Farm (Phillips et al. 2002).

3.4 Vegetation

In a recent comparison of floristic change at the West Branch of the Santa Cruz River (in metropolitan Tucson), Mauz (2002) documented a shift in vegetation from hydriparian to mesoriparian over the last 100 years. About half of the species from the historic set (Thornber 1909) are still present, and 154 plant species were documented in the recent work (Mauz 2002).

Effluent flow in the Santa Cruz River at Anza Park has re-established hydriparian floristic elements not present upstream from the wastewater treatment facilities. Vegetation at Anza Park is a mosaic of different communities, some of which are in good, others in poor condition. Because Anza Park is located in the floodplain of the Santa Cruz River, it is exposed to periodic flood events that disturb the area. In addition, ongoing and historic agricultural use has degraded or removed naturally occurring vegetation communities.

3.4.1 Riparian

Riparian corridors in the Southwest are water oases valuable for a variety of wildlife species and verdant “ribbons of green” through desert landscapes.

3.4.1.1 Santa Cruz River Corridor

The most dominant vegetation feature in Anza Park is the Santa Cruz River corridor which bisects the park and follows its northern boundary on the west side (Photographs 3 and 4). Cottonwood (*Populus fremontii*), willow (*Salix* sp.), blue paloverde (*Parkinsonia florida*), and seep willow (*Baccharis glutinosa*) are important native species that add vertical structure, sometimes forming dense thickets along the river channel. Non-native elements include tamarisk (*Tamarix* spp.), Mexican paloverde (*Parkinsonia aculeata*), giant reed (*Arundo donax*), Johnson grass (*Sorghum halapense*), and Bermuda grass (*Cynodon dactylon*).



Photographs 3 and 4. Santa Cruz River at Anza Park. At left is the view west from the location of the effluent channel confluence. Note that at the time of this photograph, the surface flow from the effluent channel did not reach the Santa Cruz River. At right is the view south, directly upstream, with an area of large cottonwood trees.

3.4.1.2 Effluent Release Channel

The Marana WRF releases effluent via a straight drainage channel along the northern boundary of Anza Park. The channel has several ponded areas that attract waterfowl and other wildlife. Vegetation along the channel is dominated by problematic invasive species such as Mexican paloverde, Johnson grass, Russian thistle, and tamarisk (Photograph 5).



Photograph 5. Typical vegetation along a ponded section of the effluent release canal at Anza Park. Mexican paloverde is in full bloom.

3.4.1.3 Riparian Tree Grove

The Marana WRF maintains a grove of riparian trees and Bermuda grass just south of the facility with a portable gas-pump powered water cannon overhead spray watering system. The trees are mature (including cottonwood, Arizona ash [*Fraxinus velutina*], Arizona walnut [*Juglans major*], and Goodding willow) and provide valuable habitat for a variety of birds (Photograph 6).



Photograph 6. Riparian tree grove south of the Marana WRF.

The Marana WRF currently manages the area such that there is no ponding, although this is not precluded by the Aquifer Protection Permit (Glen Peterson, personal communication 2009). Only one cannon operates at a time. This type of water distribution loses a great deal of volume to evaporation. In addition, wind carries the spray a considerable distance, past the grove to an area of creosote to the south. The result has been an explosion of unmanaged, weedy annual species in that area (Photograph 7).



Photograph 7. This spray cannon, south of the tree grove (seen in the background) promotes weedy annual growth.

3.4.2 Agricultural Fields and Open, Disturbed Floodprone Areas

The Santa Cruz River floodplain, with its rich soil deposits, has been an important center of agricultural activity for thousands of years. Modern agricultural fields, both active (Photograph 8) and retired, surround Anza Park. These areas, disturbed both by their natural floodplain location and by planting of crops and livestock use, are either devoid of native vegetation if in active use, or have sparse native species cover with extensive invasive plant species issues. Active agriculture fields are located north and east of the Marana WRF.



Photograph 8. Active agricultural field adjacent to and east of the Marana WRF. PCRFC is in the process of acquiring this parcel.

Native plant species that commonly occur in the retired agricultural fields include: burrowweed (*Isocoma tenuisecta*), saltbush (*Atriplex* spp.), creosote (*Larrea tridentata*), sacred datura (*Datura* spp.), weedy annual native Palmer's amaranth (*Amaranthus palmeri*), and sparse groups of velvet mesquite trees (*Prosopis velutina*). Common invasives include Russian thistle (*Salsola* sp.), Johnson grass (*Sorghum halapense*), and Bermuda grass (*Cynodon dactylon*). This vegetation is characteristic of the area to the south and west of the Marana WRF (Photograph 9).



Photograph 9. Floodprone area of retired agriculture south and west of Marana WRF. Floodplain deposits have created an area of undulating hummocks visible in the middle ground of the photograph.

3.4.3 Creosote Desertscrub

Creosote desertscrub occurs at in large areas both east and west of the Santa Cruz River. This vegetation community is not very diverse, consisting mainly of creosote (*Larrea tridentata*), white-thorn acacia (*Acacia constricta*), and bunchgrasses. The condition of these areas ranges from relatively intact (Photograph 10) to fairly disturbed.



Photograph 10. Relatively intact creosote desertscrub in the western portion of Anza Park.

3.4.4 Mesquite Woodland

At the western edge of Trico Road, overland water is retained and has resulted in a thicket of mesquite and other trees. This area has a great deal of dead and down woody fuel and appears to be a place where green debris has been dumped (Photograph 11). Native velvet mesquite (*Prosopis velutina*), blue paloverde (*Parkinsonia florida*), and white-thorn acacia (*Acacia constricta*) are joined by dense growth of non-native invasives such as athol tree (*Tamarix aphylla*), shrub tamarisk (*T. ramosissima*), Mexican paloverde (*Parkinsonia aculeata*), and Russian thistle (*Salsola* sp.).



Photograph 11. Mesquite thicket along Trico Road. Some of the native trees have attained a good height, however there are many invasive species and a build-up of woody fuels.

3.5 Wildlife

Diverse wildlife species are typically found along and adjacent to riparian systems. In the arid southwest, riparian areas are high-value habitat corridors. Riparian areas are vital wildlife linkages between stream/wash systems and surround uplands and mountain ranges. It is estimated that 90 percent of desert wildlife rely on riparian areas for at least some part of their life cycles, and the United States Fish and Wildlife Service (USFWS) recognizes that the majority of Arizona’s federally listed threatened and endangered species rely on riparian systems for survival (USFWS 2001).

Intact riparian gallery forests are floristically and structurally diverse and they provide a wide variety of insects, feeding zones, and nesting sites for birds (Powell and Steidl 2000). Different bird species utilize different niches and zones within the vegetation community (Wilbur 2005). Cottonwood/willow is a fast-declining habitat type in the Southwest, and the remaining patches are increasingly important for migrating birds that depend on the great insect blooms that occur in the spring within the riparian trees (Askins 2000). Mesquite bosques and native bunchgrass habitats also support a wide variety of animal species, especially birds (Wilbur 2005).

Native fish are present in the Upper Santa Cruz River effluent from the Nogales International Wastewater Treatment Plant, including longfin dace (*Agosia chrysogaster*), desert sucker (*Catostomus clarkia*), Sonora sucker (*Catostomus insignis*) and Gila topminnow (*Poeciliopsis occidentalis*). However, no native fish are currently documented in the effluent from the Ina Road and Roger Wastewater Reclamation Facilities Lower Santa Cruz River (PAG 2002a).

Within Anza Park, a variety of birds, mammals, reptiles, and amphibians are likely to occur (Photograph 12). Surveys conducted within the adjacent City of Tucson–TAS North Simpson Farm Site recorded over 90 bird species, 13 mammal species, and 13 reptile and amphibian species (Phillips et al. 2002). These species are also likely to occur within Anza Park.



Photograph 12. Green-backed heron at effluent release canal at Anza Park.

3.5.1 Federally Listed Species

The USFWS list of federally protected species for Pima County was reviewed to determine if any listed species have the potential to occur within the Anza Park area (Appendix A). In addition, the Arizona Game and Fish Department (AGFD) Heritage Data Management System On-line Environmental Review Tool was used to generate a list of special status species known to occur within three miles of Anza Park (Appendix B). Based on the habitat conditions observed in the area and potential habitat improvements through restoration, six ESA-protected species were determined to have potential to occur within Anza Park, including five listed endangered species (southwestern willow-flycatcher [*Empidonax traillii extimus*], Huachuca water umbel [*Lilaeopsis schaffneriana* spp. *recurva*], Gila chub [*Gila intermedia*], Gila topminnow, and desert pupfish [*Cyprinodon macularius macularius*]) and one candidate species (western yellow-billed cuckoo [*Coccyzus americanus occidentalis*]). These species are also Pima County PVS.

3.5.2 Priority Vulnerable Species

Pima County PVSs are species that are being considered and analyzed by the under the draft Pima County Multi-Species Conservation Plan (PCMSCP) (Pima County 2006). These species were chosen through a process of scientific review of over 100 variously imperiled species. The PCMSCP process included development of habitat models and priority conservation area (PCA) identification for each PVS.

Of the 56 PVS included by Pima County in 2006, 21 species were identified as having a PCA and/or modeled habitat within Anza Park. The habitat requirements of these species and their potential to occur within Anza Park are summarized in Table 1. Based on habitat conditions currently existing within the park, habitat that could be expected with restoration, and information for the adjacent TAS restoration sites, the following 19 species could possibly occur within Anza Park:

- Abert's towhee
- Bell's vireo
- Cactus ferruginous pygmy-owl
- Rufous-winged sparrow
- Southwestern willow flycatcher
- Swainson's hawk
- Western burrowing owl
- Western yellow-billed cuckoo
- California leaf-nosed bat
- Merriam's mesquite mouse
- Western yellow bat
- Longfin dace
- Gila topminnow
- Desert pupfish
- Gila chub
- Lowland leopard frog
- Mexican garter snake
- Huachuca water umbel
- Tumamoc globeberry

**TABLE 1
PVS WITH MODELED HABITAT OR PCA WITHIN ANZA PARK, ALONG WITH
DETERMINATION OF LIKELIHOOD OF OCCURRENCE**

Common Name	Latin Name	Habitat Requirements	PCA	Modeled Habitat	Potential to Occur within Anza Park
Birds					
Abert's towhee	<i>Pipilo abertii</i>	Sonoran riparian deciduous woodland and riparian scrubland, with a dense understory of shrubs. They are also found in Sonoran and Chihuahuan desertscrub habitats, usually near washes (Pima County 2001).	x	x	Known to occur (common) at North Simpson Farm, both in the riparian zone and in the former agricultural fields (Phillips et al. 2002).
Bells vireo	<i>Vireo bellii</i>	Lowland riparian areas with willows, mesquite, and seep willows. The vireo prefers dense, low, shrubby vegetation in riparian areas (Pima County 2001).		x	Known to occur at North Simpson Farm from the riparian zone (Phillips et al. 2002). This species is likely to continue to increase as mid-story habitat increases upstream [and downstream].
Cactus ferruginous pygmy-owl (CFPO)	<i>Glaucidium brasilianum cactorum</i>	In Arizona, habitat use has included cottonwood and mesquite riparian woodlands, upland Sonoran desertscrub, and semidesert grasslands. Pygmy-owls are obligate cavity nesters (Cartron et al. 2000b). Historically, CFPOs in Arizona used cavities in cottonwood, mesquite, ash trees, and saguaro cacti for nest sites (USFWS 2002a).			Possible. Restoration activities that provide cavity-nesting opportunities would likely benefit this species, if it were able to disperse to the area.
Rufus-winged sparrow	<i>Aimophila carpalis</i>	Desert grasslands scattered with thorn bushes, bunch grasses, mesquite, or cholla. It also occurs in washes with sandy bottoms and vegetated slopes, brushy irrigation ditches, and creeks bordered by broad-leaved trees, mesquite, grasses, and weeds. The sparrow prefers grassy areas with scattered shrubs that are thorny and dense (Pima County 2001).		x	Possible. Restoration activities would likely benefit this species if it were able to disperse to the area.

**TABLE 1
PVS WITH MODELED HABITAT OR PCA WITHIN ANZA PARK, ALONG WITH
DETERMINATION OF LIKELIHOOD OF OCCURRENCE (CONT.)**

Common Name	Latin Name	Habitat Requirements	PCA	Modeled Habitat	Potential to Occur within Anza Park
Birds (cont.)					
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	Dense riparian habitats along streams, rivers, and other wetlands (Pima County 2001).		×	Possible. Restoration activities that increase the density, patch size, and connectivity of cottonwood/willow forest will likely benefit this species.
Swainson's hawk	<i>Buteo swainsonii</i>	Grasslands, either apart or intermixed with open desertscrub habitats (Glinski 1998).		×	Known to occur at North Simpson Farm in the riparian zone (Phillips et al. 2002).
Western burrowing owl	<i>Athene cunicularia hypugaea</i>	Open plains, with sparse vegetation and a proliferation of small burrowing mammals (Glinski 1998).	×	×	Highly likely. This species is known to occur within 3 miles of Anza Park, and the open agricultural floodplain provides excellent habitat.
Western yellow-billed cuckoo	<i>Coccyzus americanus occidentalis</i>	Mid-story guild. This species requires large patches of riparian habitat.		×	Known to occur at North Simpson Farm. Mid-story guild. This species is likely to benefit from connected restoration initiatives.
Mammals					
Arizona shrew	<i>Sorex arizonae</i>	This species is known only from high-elevation (above 5,675 feet) locations in areas with downed woody debris, generally near surface water along drainages in mountain canyons (Pima County 2001).		×	Not likely. Anza Park is outside of the known elevational range for this species.
California leaf-nosed bat	<i>Macrotus californicus</i>	This species of bat is known from caves, mines, and rock shelters, mostly in Sonoran desert scrub. There is some limited information that indicates this species forages primarily along washes, where they may be drinking or foraging for insects (Pima County 2001).		×	Possible. May forage along Santa Cruz River where water is present.

**TABLE 1
PVS WITH MODELED HABITAT OR PCA WITHIN ANZA PARK, ALONG WITH
DETERMINATION OF LIKELIHOOD OF OCCURRENCE (CONT.)**

Common Name	Latin Name	Habitat Requirements	PCA	Modeled Habitat	Potential to Occur within Anza Park
Mammals (cont.)					
Lesser long-nosed bat	<i>Leptonycteris curasoae yerbabuena</i>	Lesser long-nosed bats are found in desert grassland and shrubland up to oak transition habitats. They roost in caves, mines, tunnels, and occasionally in old buildings. Typically forage in areas of saguaro, ocotillo, paloverde, prickly pear, and organ pipe cactus. Later in the summer they forage among agave. Typically found at lower elevations, below about 3,500 feet, from April to at least September or October (AGFD 2003a).		×	Not Likely. Little to no forage or roosting habitat present within Anza Park.
Merriam's mesquite mouse	<i>Peromyscus merriami</i>	Mesquite bosques (Hoffmeister 1986).		×	Possible, especially with restoration that includes heavy planting of mesquite.
Pale Townsend's big-eared bat	<i>Plecotus townsendii pallescens</i>	This species is known to use caves, mines, and buildings (generally abandoned or inactive) through a range of elevations and vegetation communities. Found within Sonoran Desert Scrub, oak woodland, oak/pine, pinyon/juniper, and coniferous forests of Arizona (Pima County 2001). Water and abundant moth populations are necessary habitat features.		×	Not likely. Suitable roost site appears to be the most important habitat requirement. There are no known suitable roost sites within or surrounding Anza Park.
Western yellow bat	<i>Lasiurus xanthinus = ega</i>	This species is likely to be found primarily in association with planted fan palms in residential and park areas. It is also found in riparian deciduous forests and woodlands. This bat is known to roost in trees and it may need water (Pima County 2001).		×	Possible. May roost in trees along Santa Cruz River within Anza Park.

**TABLE 1
PVS WITH MODELED HABITAT OR PCA WITHIN ANZA PARK, ALONG WITH
DETERMINATION OF LIKELIHOOD OF OCCURRENCE (CONT.)**

Common Name	Latin Name	Habitat Requirements	PCA	Modeled Habitat	Potential to Occur within Anza Park
Fish					
Longfin dace	<i>Agosia chryogaster</i>	Sandy perennial stream habitat (Pima County 2001).			Possible only with restoration and re-introduction.
Gila topminnow	<i>Poeciliopsis occidentalis</i>	Perennial or intermittent water without invasive predators. Broad range of suitable habitat (Pima County 2001), but preferred habitats include dense mats of algae and debris, usually along stream margins of below riffles, with sandy substrates sometimes covered with organic muds and debris (Minckley 1973). Shallow, warm, quiet waters (Matthews 1990).			Possible only with restoration and re-introduction.
Desert pupfish	<i>Cyprinodon macularius macularius</i>	Shallow springs, smallstreams, and marshes. Broad range of tolerance for water quality and temperature (Pima County 2001).			Possible only with restoration and re-introduction.
Gila chub	<i>Gila intermedia</i>	Adults utilize deep pools with heavily vegetated margins and undercut banks; juveniles use riffles, pools, and undercut banks of runs (Pima County 2001).			Possible only with restoration and re-introduction.
Reptiles and Amphibians					
Lowland leopard frog	<i>Rana yavapaiensis</i>	Permanent waters below elevations of 3,000 feet. It is found in small to medium streams, and occurs in small springs, stock ponds, and occasionally in large rivers. Populations typically occur in aquatic systems with surrounding desert scrub, semidesert grassland, or evergreen woodland (Pima County 2001).	x	x	This species could be introduced if predatory invasive animals, such as bullfrogs were aggressively managed. It is known from the nearby Brawley Wash (Pima County 2000).

**TABLE 1
PVS WITH MODELED HABITAT OR PCA WITHIN ANZA PARK, ALONG WITH
DETERMINATION OF LIKELIHOOD OF OCCURRENCE (CONT.)**

Common Name	Latin Name	Habitat Requirements	PCA	Modeled Habitat	Potential to Occur within Anza Park
Reptiles and Amphibians (cont.)					
Ground snake	<i>Sonora semiannulata</i>	This species is generally found in desert grassland and mesquite thicket valley floors and in grassland to encinal slopes. Occupies plains, valleys, and foothill habitats but found mostly near mountains with higher slopes and areas with poorly drained soils. Specifically, this species is found in tobosa desert grassland over silty, loamy clay soils on the Tohono O’odham Nation, Lower Santa Cruz Valley, and Sulfur Springs Valley (Pima County 2001).	x	x	Not likely to occur within Anza Park or surrounding areas.
Mexican garter snake	<i>Thamnophis eques megalops</i>	In general, this species requires dense riparian vegetation communities along permanent water that is free from bullfrog infestation. Found primarily within cienegas within desert grasslands to elevations of 8,500 feet. Habitat also includes reaches of permanent water with cottonwood-willow riparian and lower oak-pine woodland (Pima County 2001).		x	This species could be introduced if predatory invasive animals, such as bullfrogs were aggressively managed.
Tucson shovelnose snake	<i>Chionactis occipitalis klauberi</i>	Found primarily on valley bottoms with sand dunes or soft sand loams in the lower Sonoran life zone. Regularly found in open, sandy sites and in mixed riparian scrub, creosote bush, Sonoran desert scrub, and mesquite bosques (Pima County 2001).	x	x	?????

**TABLE 1
PVS WITH MODELED HABITAT OR PCA WITHIN ANZA PARK, ALONG WITH
DETERMINATION OF LIKELIHOOD OF OCCURRENCE (CONT.)**

Common Name	Latin Name	Habitat Requirements	PCA	Modeled Habitat	Potential to Occur within Anza Park
Plants					
Acuña cactus	<i>Echinomastus erectocentrus</i> var. <i>acunensis</i>	The Acuña cactus is found on well-drained knolls and gravel ridges at 1,300–2,000 feet elevation in the Sonoran desert scrub.		×	Unlikely. Suitable habitat does not exist at Anza Park, and appropriate conditions are not likely to be achieved with restoration.
Huachuca water umbel	<i>Lilaeopsis schaffneriana</i> spp. <i>recurva</i>	The water umbel is found between 4,000 and 6,500 feet in cienegas, springs, and other healthy riverine systems. The water umbel appears to benefit from intermediate flooding to inhibit competition. The plant is usually found in water with a depth of two to six inches (Pima County 2001).	×	×	Possible. This species could be introduced if appropriate habitat is restored.
Tumamoc globeberry	<i>Tumamoca macdougalii</i>	This vine grows in the Arizona Upland subdivision of Sonoran Desert scrub. It is associated with a variety of nurse plants and in settings ranging from sandy valley bottoms to rocky bajada slopes (Pima County 2001).		×	Possible.

3.5.3 Restoration Goals for PVS

Restoration at Anza Park has the potential to enhance and create habitat for a variety of PVS. Particularly significant restoration would capitalize on the effluent water source from Marana WRF to include aquatic habitat opportunities for species that require water, especially as it is such a special circumstance to have access to this resource for restoration. Aquatic PVS that could benefit from aquatic restoration include the longfin dace, Gila topminnow, desert pupfish, Gila chub, lowland leopard frog, Mexican garter snake, and Huachuca water umbel.

The Pima County Priority Vulnerable Species Report (Pima County 2001), identified specific restoration goals all of the PVS that could possibly occur within Anza Park, with the exception of the pygmy-owl. Relevant goals from that report are included below for consideration in the development of restoration opportunities at Anza Park.

- **Abert's towhee:** "Pima County will restore suitable habitat for this species on appropriate reserve system lands that have had brush cleared by human or natural actions. In planning future riparian habitat restoration projects, Pima County will include areas of dense shrub cover suitable for Abert's towhees."
- **Bell's vireo:** "Pima County will restore suitable habitat for this species on appropriate reserve system lands that have had brush cleared by human or natural actions. In planning future riparian habitat restoration projects, Pima County will include areas of dense shrub cover suitable for Bell's vireos."
- **Rufous-winged sparrow:** "Pima County will restore suitable habitat for this species on reserve system areas that have or could be made to have suitable habitat for this species. Controlled burns for vegetation management will be done outside of nesting season."
- **Southwestern willow flycatcher:** "Pima County will evaluate all known and potentially suitable riparian habitats on reserve system lands to determine and evaluate potential for restoration of this species. Where it is deemed appropriate, site-specific plans will be developed to restore suitable habitat on reserve system lands that have or could be made to have sufficient sustainable water that would provide for growth of riparian vegetation that might be suitable habitat for this species. On such lands, the County will manage vegetation so as to assure that sufficient remains in the seral stage favored by this species. However, the County will attempt such habitat creation using only native plants species and will not encourage growth of tamarisk."
- **Swainson's hawk:** "Pima County will restore suitable habitat on appropriate County lands that have or could be made to have suitable habitat for this species."

Controlled burns and other grassland restoration techniques will be evaluated for application within County lands.”

- **Western burrowing owl:** “Prior to any disturbance of reserve system lands that are potentially suitable for burrowing owls, Pima County will assess the presence or absence of this species on the project site, and if the species is present, appropriate mitigation measures will be taken. These measures may include, but not be limited to: deferment of action until after the nesting system, avoidance of burrowing owl nests, flushing owls prior to earth moving activities, and construction of artificial burrows. Also, Pima County will assess reserve system lands for potential suitability for this species, and, if appropriate, construct artificial nest burrows and hunting perches.”
- **Western yellow-billed cuckoo:** “Pima County will restore suitable habitat for this species on appropriate reserve system lands that have or could be made to have suitable habitat for this species. Where possible and appropriate, Pima County will support, through funding and provision of water, restoration of potentially suitable habitat and management of that habitat so as to favor this species.”
- **California leaf-nosed bat:** “Pima County will evaluate the known roosts for this species on reserve system lands for conditions and specific needs for structural stabilization. Known watering sites in the reserve system will be evaluated for conditions and evident threats, and management plans specifically developed for maintaining continued availability of water for bats.”
- **Longfin dace:** “Pima County will evaluate all known and potentially suitable aquatic habitats in [the] reserve system to determine and evaluate potential for restoration, enhancement, or mitigation for longfin dace. Where it is deemed appropriate, site-specific plans will be developed to restore suitable habitat on appropriate reserve system lands that have or could be made to have sustainable water that would provide suitable habitat for this species. Pima County will support efforts to prevent or eliminate non-indigenous and invasive aquatic species in waters in the reserve system. Pima County will seek the cooperation of the AGFD, U.S. Fish and Wildlife Service, other appropriate agencies, and private landowners to translocate or reestablish fish from waters in which they are abundant (e.g., Cienega Creek County Park) to other waters that are deemed potentially suitable for this purpose.”
- **Gila topminnow:** “Pima County will restore suitable habitat for this species on appropriate reserve system lands that have or could be made to have natural sustainable water that would provide suitable habitat for this species. Pima County will support efforts to prevent or eliminate non-indigenous and invasive aquatic species in waters in the reserve system. Pima County, with the cooperation of the AGFD, the Bureau of Land Management, and the U.S. Fish and Wildlife Service, will

translocate and reestablish fish from the Las Cienegas National Conservation Area to Cienega Creek County Park, and other waters in the reserve system that are deemed potentially suitable for this purpose.”

- **Desert pupfish:** “Pima County will evaluate all known and potentially suitable aquatic habitats on reserve system lands to determine and evaluate potential for reestablishment and restoration of this species. Where it is deemed appropriate, site-specific plans will be developed to restore suitable habitat on reserve system lands that have or could be made to have sustainable water that would provide suitable habitat for this species. Pima County will support efforts to prevent or eliminate non-indigenous and invasive aquatic species in waters in the reserve system. Pima County will seek the cooperation of the AGFD, the U.S. Fish and Wildlife Service, other appropriate agencies, and private landowners to translocate or reestablish fish from waters in which they are present to reserve system waters that are deemed by the Recovery Team potentially suitable for this purpose.”
- **Gila chub:** “Pima County will restore suitable habitat for this species on appropriate reserve system lands that have or could be made to have natural sustainable water that would provide suitable habitat for this species. Pima County will support efforts to prevent or eliminate non-indigenous and invasive aquatic species in waters in the reserve system. Pima County, with the cooperation of the AGFD, Bureau of Land Management, and U.S. Fish and Wildlife Service, will translocate and reestablish fish from the Las Cienegas National Conservation Area to Cienega Creek County Park, and other waters in the reserve system that are deemed potentially suitable for this purpose.”
- **Merriam’s mesquite mouse:** “Pima County will restore suitable habitat for this species on appropriate reserve system lands that have or could be made to have suitable habitat for this species. Where possible and appropriate, Pima County will support, through funding and provision of water, restoration of potentially suitable habitat and management of that habitat so as to favor this species. Pima County will seek the cooperation from the AGFD, the U.S. Fish and Wildlife Service, other appropriate agencies, and private landowners to translocate mice from areas in which they are present to other areas that are deemed potentially suitable for this purpose.”
- **Western yellow bat:** “Pima County will restore suitable habitat for this species on appropriate reserve system lands that have or could be made to have suitable habitat. Where possible and appropriate, Pima County will support, through funding and provision of water, restoration of potentially suitable habitat management of that habitat so as to favor this species.”

- **Lowland leopard frog.** “Pima County will restore suitable habitat for this species on appropriate reserve system lands that have or could be made to have natural sustainable water that would provide suitable habitat for this species. Pima County will support efforts to prevent or eliminate non-indigenous and invasive aquatic species in waters in the reserve system. Pima County, with the cooperation of the AGFD, the U.S. Fish and Wildlife Service, and other agencies will translocate or reestablish frogs from areas recommended by the agencies to waters in the reserve system that are deemed potentially suitable for this purpose. Where possible and appropriate, Pima County will support, through funding and provision of water, restoration of potentially suitable habitat and management of that habitat so as to favor this species over non-indigenous and invasive species.”
- **Mexican garter snake.** “Pima County will restore suitable habitat for this species on appropriate reserve system lands that have or could be made to have natural sustainable water and riparian vegetation that would provide suitable habitat for this species. Pima County will support efforts to prevent or eliminate invasive aquatic exotic species in reserve system areas. Where possible and appropriate, Pima County will support, through funding and provision of water, restoration of potentially suitable habitat and management of that habitat so as to favor this species over non-native species. Pima County, with the cooperation of the AGFD, U.S. Fish and Wildlife Service, and other agencies will translocate snakes from areas recommended by the agencies to habitat restoration reserve system areas that are deemed potentially suitable to reestablish populations where this species has been extirpated.”
- **Huachuca water umbel.** “Pima County will restore suitable habitat for this species on appropriate reserve system lands that have or could be made to have natural sustainable water that would provide suitable habitat for this species. Pima County will support efforts to prevent or eliminate invasive aquatic exotic species in reserve system areas. Pima County, with the cooperation of the Bureau of Land Management, and the U.S. Fish and Wildlife Service, will translocate plants from the Las Cienegas National Conservation Area to Cienega Creek County Park, and from the San Pedro National Riparian Conservation Area to the San Pedro River in Pima County. Other potential translocation of reestablished areas will be evaluated, and if found suitable, a translocation and re-establishment plan will be developed with the appropriate agencies.”
- **Tumamoc globeberry.** “Where this species must be transplanted from project sites and private lands under development within the County, the County will develop a procedure for moving this species to appropriate adjacent or nearby protected habitat. The County will maintain a fund for the maintenance and monitoring of transplanted and re-established plants.”

3.5.4 Invasive Species at Anza Park

Invasive plant and animal species are present at Anza Park, and many of them will require active management to ensure successful restoration for as many PVS as possible. Species known to occur at Anza Park include, but are not limited to, the species described below.

3.5.4.1 Brown-headed cowbirds

The brown-headed cowbird (*Molothrus ater*) is a native invasive species that has negative effects on many sensitive bird species through nest parasitism. Cowbirds evict the eggs of passerine bird species, then lay their own eggs for the other birds to raise (Lowther 1993). Brown-headed cowbirds have been shown in numerous studies to reduce the reproductive success of native passerine birds, leading to population declines (Riparian Habitat Joint Venture 2003), including some imperiled species such as the Bell's vireo.

Brown-headed cowbirds are known to occur at the North Simpson Farm site and can be assumed to also be present, or at least a threat, at Anza Park.

3.5.4.2 Bullfrogs

Bullfrogs (*Rana catesbeiana*) are the largest frog in the United States, and their natural range is east of the Rocky Mountains (Stebbins 1985). These frogs were introduced for sport, food, and also inadvertently during fish stocking operations. In Pima County, they are well established in areas of permanent water, including stock ponds, urban lakes and gardens, and in marshy areas. Bullfrogs will eat just about anything—including their own young—and are a serious predatory threat to native aquatic animals, including frogs, snakes, and fish. The explosion of bullfrog populations has been blamed for the decline of native leopard frogs and the Mexican garter snake (*Thamnophis eques*), whose young fall prey to adult bullfrogs (Rosen 2000).

Bullfrogs are difficult to control because they are prolific breeders and their natural predators are not present to control them. In addition, during summer monsoon season, juveniles can travel up to a mile to colonize new areas, allowing them to expand their range and associated impacts (Rosen 2000).

At Anza Park, bullfrogs are currently present in the effluent drainage channel.

3.5.4.3 Crayfish

The northern crayfish (*Orconectes virilis*) is a small lobster-like crustacean that lives in ponds, lakes, rivers, and streams with perennial water. The crayfish is not native to

Arizona, but has invaded waters here through its popularity as fishing bait and for the control of aquatic weeds. This species is an “opportunistic omnivore,” consuming aquatic plants, larval fish, snakes, turtles, insects, and other invertebrates (Miera 1999). Rosen (2000) noted that crayfish prey on and compete for food with Sonoran mud turtles (*Kinosternon sonoriense*), Chiricahua leopard frogs, and the Mexican garter snake.

At Anza Park, crayfish are likely present in the effluent release channel.

3.5.4.4 Tamarisk

Tamarisk (*Tamarix* spp.) is a non-native shrub or tree from Eurasia which has become extensively established in the highly managed waterways of the American West. Rosenberg et al. (1991) found that avifaunal diversity was significantly lower in tamarisk-dominated habitat as compared to native-dominated habitat; however, southwestern willow flycatchers have adapted to using dense tamarisk thickets as habitat (Brown and Trosset 1989).

Tamarisk is present at Anza Park both in the Santa Cruz River channel and in the existing effluent release channel. Tamarisk plants are generally scattered among native vegetation and do not form a monocultural stand.

3.5.4.5 Giant Reed

Giant reed is indigenous to the Mediterranean Basin or to warmer regions of the Old World. It was brought to North America and grown for roofing material, to construct musical instruments, and for erosion control. The species reproduces vegetatively, either from underground rhizome extensions or from plant fragments carried downstream—primarily during floods—to become rooted and to form new clones. Large colonies of this species typically occur in low-gradient riparian areas and floodplains of medium-sized to large streams. Scattered colonies occur in moist areas or springs and on steeper slopes of dry riverbanks.

Scientists suspect that giant reed alters hydrological regimes and reduces groundwater availability by transpiring large amounts of water from semi-arid aquifers. It alters stream flow and channel morphology by the retention of sediments and constricting stream flows. During storm flows, the shallow roots of giant reed are undercut. The roots then slump and break away from the stream banks, taking the soil with them. The material then floats downstream and clogs culverts, channels, and bridge crossings. This results in the giant reed spreading vegetatively downstream. These obstructions have been known to cause flooding and to wash out bridges, causing millions of dollars in damages.

Giant reed displaces native plants and associated wildlife species because of the massive stands it forms (Bell 1996). As giant reed replaces riparian vegetation, it reduces habitat and food supply, particularly insect populations, for avian species (Frandsen and Jackson 1994) and reduces shade cover to the in-stream habitat, leading to increased water temperatures and reduced habitat quality for aquatic wildlife (Franklin 1996).

Giant reed is currently established at Anza Park, primarily along the Santa Cruz River and within the effluent flow channel.

3.5.4.6 Buffelgrass

Buffelgrass is a bunchgrass native to Africa that has spread extensively through the wildlands of the Sonoran Desert. Buffelgrass was introduced for livestock forage and reclamation applications in the 1930s and has since become an extensive problem in many different kinds of areas, including roadsides, uplands, and within the urban core.

Buffelgrass is scattered throughout Anza Park.

3.5.4.7 Johnson grass

Johnson grass is an aggressive coarse perennial grass with bright green leaves and it can reach heights of over 6 feet. It spreads both by seeds and by rhizomes, and can be dispersed by wind, water, and wildlife. It is native to the Mediterranean. It is an agricultural weed that is common throughout Anza Park.

3.5.4.8 Russian thistle

Russian thistle, also known as tumbleweed, is an annual that grows 1 to 4 feet tall. This common inhabitant of disturbed areas blooms from July to October. In the fall, the plant often breaks off at the ground and tumbles around dropping its seeds along the way. Russian thistle is a native to Eurasia. Russian thistle is prevalent throughout Anza Park.

3.6 Cultural Resources

Anza Park has not been fully surveyed for cultural resources, and as such the full extent of existing cultural resources there are unknown. There is one known archaeological site within the boundaries of Anza Park (Roger Anyon, personal communication).

4.0 Ecosystem Restoration Constraints and Opportunities

4.1 Science Technical Advisory Team Guidance

The SDCP Science Technical Advisory Team (STAT) adopted *Proposed Guidelines for the use of Effluent and Reclaimed Water* in 2000 that recommended the following guiding principles for activities in Pima County involving effluent water, such as proposed uses at Anza Park:

- Protect systems that are self-sustaining over those that need continual inputs (i.e., long-term irrigation).
- Restore or enhance native riparian and aquatic ecosystems by releasing water to restore local aquifer conditions.
- If plantings are to be used: (1) favor revegetation in areas that will not need perpetual irrigation, (2) minimize conflicts with other social objectives, (3) use site-appropriate, native species, and (4) favor sites which augment existing high-quality riparian habitats.
- Enhance the ability of secondary effluent or reclaimed water to support aquatic life.
- Manage riparian and aquatic ecosystems for native species.

These principles lay the foundation for ecological restoration and recreation goals at Anza Park.

4.2 Anza Park Project Goals

According to Dr. Phillip Rosen (2005), “the Lower Santa Cruz currently supports the most mesic riparian forests and the most nearly functional floodplain of the Santa Cruz River in the Tucson Region.” This condition, along with the availability of effluent water in the river, clearly qualifies Anza Park as a favorable site for restoration in conformance with the values of the SDCP and STAT. Rosen (2005) further suggests that restoration activities in the Lower Santa Cruz River Valley will be much less expensive on a per-acre basis, as opposed to projects within the urban core. Because urban core projects are necessarily more limited in scope (i.e., do not incorporate open water elements), it can be argued that restoration at Anza Park is a very good value—pairing lower cost with higher habitat value per acre than what can be achieved in the urban core.

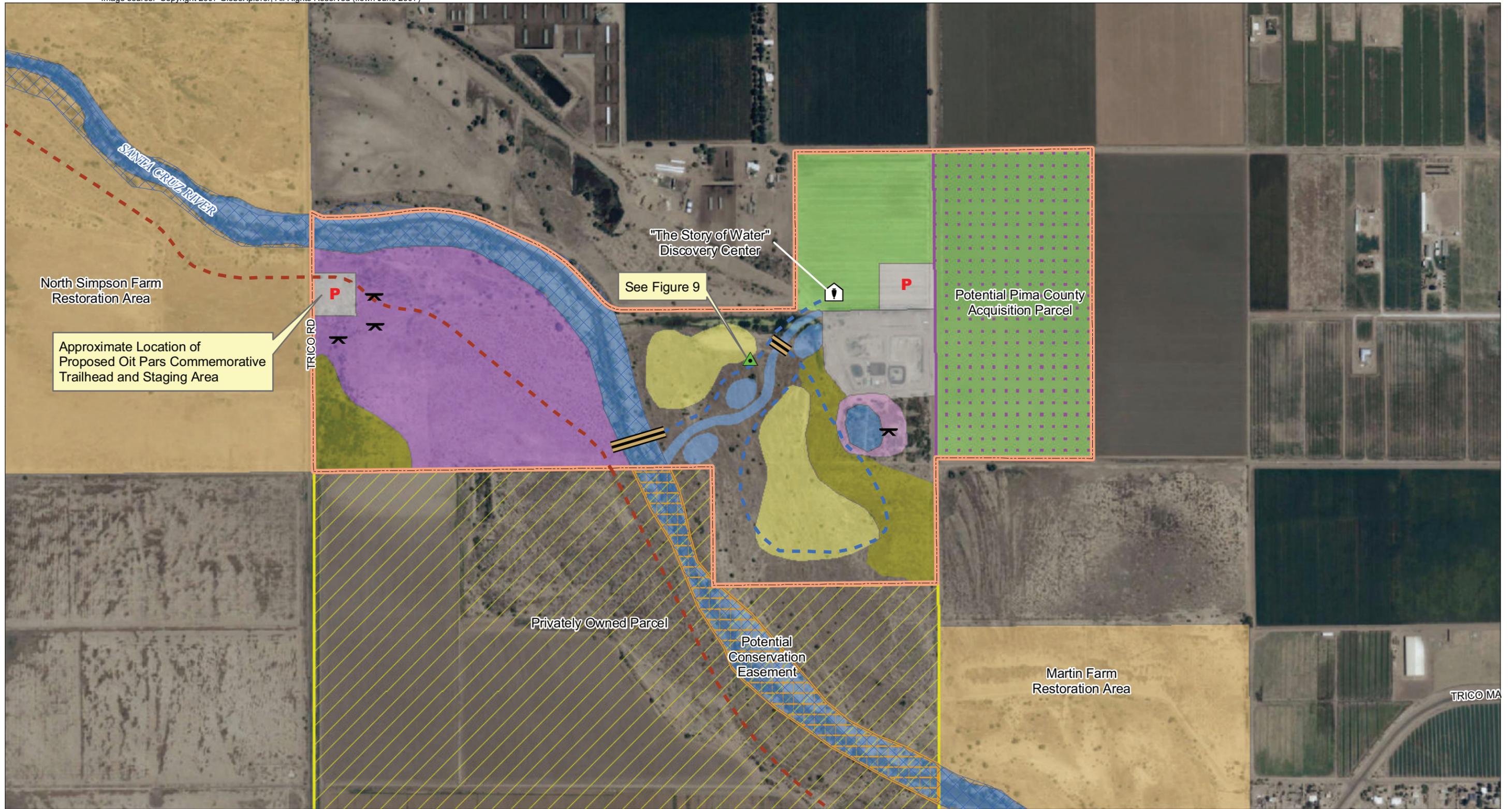
Overall goals in developing a concept plan include:

1. Preserve existing positive habitat and site elements.
2. Create new habitat areas. Accommodate effluent releases in a manner that encourages new habitat areas and provides passive recreation opportunities. Work with existing conditions (including topography) and design to accomplish this.
3. Support conservation of PVS. Design-specific habitat restoration elements to support the PVS that are either known to occur or could potentially occur in the vicinity of Anza Park.
4. Manage site challenges. Correct issues such as drainage and invasives that reduce existing habitat values and are counter to the project goals.
5. Create a new recreation destination in Pima County. Incorporate the Juan Bautista de Anza National Historic Trail, the Santa Cruz River Park Trail, and public bird watching opportunities that are not available at the adjacent TAS properties.
6. Coordinate restoration efforts. Help develop, through restoration, a substantial connection between adjacent TAS restoration projects that would have a greater regional benefit than restoration at a more isolated location.

A preliminary (and highly diagrammatic) restoration and recreation concept plan is presented in Figure 6, and its elements are described throughout this section. This plan builds upon a previous *Juan Bautista de Anza Avian Preserve—Master Plan* developed by PCNRPRD.

4.3 Proposed Habitat–Recreation Zones at Anza Park

This concept plan proposes five general habitat–recreation zones at Anza Park: riparian, mesquite woodland, desertscrub, grassland, and agricultural areas. These areas are discussed below in relation to project goals. The most intensive habitat restoration activities are concentrated on the east side of Anza Park, between the Marana WRF and the Santa Cruz River. This strategy allows for aquatic and riparian features close to the effluent water source. Recreational components are incorporated throughout, but are not as detailed; these elements will be designed in collaboration with the Pima County Natural Resources, Parks, and Recreation Department. A preliminary plant palette appropriate for each zone is presented in Table 2. This list was developed using personal experience, and current and historic records of plants appropriate for the area (Mauz 2002, 2007).



- Anza Park Boundary
- Potential Pima County Acquisition Parcel
- Privately Owned Parcel
- Potential Conservation Easement

- Discovery Center
 - Parking
 - Picnic Table
 - Viewing Platform (see Fig 9)
 - Anza Trail Extension & Realignment
 - Pedestrian Bridge
 - Approximate Alignment of Anza Trail within Anza Park*
- * Trail alignment adapted from McGann & Associates 2002

- TAS Restoration Sites
- MWRP
- Parking
- Picnic Area (Pond)

- Habitat Restoration Zones**
- Zone 1: Aquatic and Riparian Elements
 - Zone 2: Mesquite Woodland
 - Zone 3: Native Grassland
 - Zone 5: Agricultural Fields
 - Zone 4: Desert Scrub

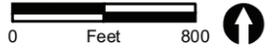


FIGURE 6
Overview of Habitat-Restoration Zone Concept

**TABLE 2
PRELIMINARY PLANT PALETTE FOR HABITATS PROPOSED AT ANZA PARK**

Common Name	Scientific Name	Riparian	Mesquite Wood- land	Desert- scrub	Grass- land
Trees					
catclaw acacia	<i>Acacia greggii</i>	▲	X		X
netleaf hackberry	<i>Celtis reticulata</i>	X			
desert willow	<i>Chilopsis linearis</i>	▲			▲
Arizona ash	<i>Fraxinus velutina</i>	X			
Arizona walnut	<i>Juglans major</i>	X			
ironwood	<i>Olneya tesota</i>			X	
blue paloverde	<i>Parkinsonia florida</i>	▲	X	X	▲
cottonwood	<i>Populus fremontii</i>	X			
screwbean mesquite	<i>Prosopis pubescens</i>	▲	X		
velvet mesquite	<i>Prosopis velutina</i>	▲	X	▲	X
coyote willow	<i>Salix exigua</i>	X			
Goodding's willow	<i>Salix gooddingii</i>	X			
western soapberry	<i>Sapindus saponaria</i>	▲			
Shrubs					
Sonoran bursage	<i>Ambrosia cordifolia</i>	▲			
white thorn acacia	<i>Acacia constricta</i>	▲	X	▲	X
catclaw acacia	<i>Acacia greggii</i>		X		▲
four-wing saltbush	<i>Atriplex canescens</i>	▲	▲	X	▲
saltbush	<i>Atriplex linearis</i>	▲		X	▲
desert saltbush	<i>Atriplex polycarpa</i>			X	▲
seep willow	<i>Baccharis salicifolia</i>	X			
desert hackberry	<i>Celtis pallida</i>	▲	X	X	X
bush spiderling	<i>Commicarpus scandens</i>		X		
chuparosa	<i>Justicia californica</i>	▲		▲	
creosote	<i>Larrea tridentata</i>			X	X
wolfberry	<i>Lycium andersonii</i>	▲	X		X
wolfberry	<i>Lycium fremontii</i>	▲	X		X
arrowweed	<i>Tessaria sericea</i>	X			
graythorn	<i>Zizyphus obtusifolia</i>	▲	X	▲	X
Vines					
five-finger gourd	<i>Cucurbita digitata</i>		X		X
snapdragon vine	<i>Maurandya antirrhiniflora</i>		X		
ivy-leaf morning glory	<i>Ipomoea hederacea</i>	▲	X		
climbing milkweed	<i>Sarcostemma cynanchoides</i>			▲	
Cacti and Succulents					
buckhorn cholla	<i>Cylindropuntia acanthocarpa</i>			▲	
Christmas cholla	<i>Cylindropuntia leptocaulis</i>			▲	
cane cholla	<i>Cylindropuntia spinosior</i>			▲	X
staghorn cholla	<i>Cylindropuntia versicolor</i>			▲	
brownschine pricklypear	<i>Opuntia phaeacantha</i>		▲	X	X
soaptree yucca	<i>Yucca elata</i>				X

**TABLE 2
PRELIMINARY PLANT PALETTE FOR HABITATS PROPOSED AT ANZA PARK
(CONT.)**

Common Name	Scientific Name	Riparian	Mesquite Wood- land	Desert- scrub	Grass -land
Small Perennials and Grasses					
Indian mallow	<i>Abutilon incanum</i>	X	▲		
canyon ragweed	<i>Ambrosia ambrosioides</i>	▲			
slimleaf bursage	<i>Ambrosia confertiflora</i>	▲	X		
triangle-leaf bursage	<i>Ambrosia deltoidea</i>		▲	X	
purple three-awn	<i>Aristida purpurea</i>		▲	X	X
spidergrass	<i>Aristida ternipes</i>		▲	X	X
desert bahia	<i>Bahia absinthifolia</i>			X	
Coulter's brickellbush	<i>Brickellia coulteri</i>		X		
cane beardgrass	<i>Bothriochloa barbinodis</i>		X		X
sprucetop grama	<i>Bouteloua repens</i>			X	X
Rothrock grama	<i>Bouteloua rothrockii</i>		▲	X	X
feather fingergrass	<i>Chloris virgata</i>	▲	▲		X
flat sedge	<i>Cyperus aristatus</i>	X			
Bearded flatsedge	<i>Cyperus squarrosus</i>	X			
datura	<i>Datura meteloides</i>			▲	X
Arizona foldwing	<i>Dicliptera resupinata</i>		X		
Arizona cottontop	<i>Digitaria californica</i>		▲	X	X
saltgrass	<i>Distichlis spicata</i>	X			
brittlebush	<i>Encelia farinosa</i>			X	
Gooding's verbena	<i>Glandularia gooddingii</i>		▲	▲	
snakeweed	<i>Gutierrezia microcephala</i>		▲	▲	X
tanglehead	<i>Heteropogon contortus</i>		▲	▲	X
tobosa	<i>Hilaria mutica</i>		▲		X
bull grass	<i>Muhlenbergia emersleyi</i>	X			
bush muhly	<i>Muhlenbergia porteri</i>		X	X	X
deergrass	<i>Muhlenbergia rigens</i>		X		
vine mesquite grass	<i>Panicum obtusum</i>		X		
pappus grass	<i>Pappophorum mucronalatum</i>	▲	▲		
odora	<i>Porophyllum gracile</i>			X	▲
devil claw	<i>Proboscidea parviflora</i>		X	▲	X
paperflower	<i>Psilostrophe cooperi</i>			X	▲
ruellia	<i>Ruellia nudiflora</i>	▲	▲		
desert senna	<i>Senna covesii</i>			X	
plains bristlegrass	<i>Setaria macrostachya</i>		X	▲	X
tall goldenrod	<i>Solidago altissima</i>				X
globemallow	<i>Sphaeralcea ambigua</i>			X	▲
Alkali sacaton	<i>Sporobolis airoides</i>	X			
spike dropseed	<i>Sporobolis contractus</i>	X	X		
sand dropseed	<i>Sporobolis cryptandrus</i>	X	X		▲
giant sacaton	<i>Sporobolis wrightii</i>	X			
wire lettuce	<i>Stephanomeria pauciflora</i>			▲	▲
golden crownbeard	<i>Verbesina encelioides</i>	▲	▲		X

**TABLE 2
PRELIMINARY PLANT PALETTE FOR HABITATS PROPOSED AT ANZA PARK
(CONT.)**

Common Name	Scientific Name	Riparian	Mesquite Wood- land	Desert- scrub	Grass -land
Annuals					
desert marigold	<i>Baileya multiradiata</i>			X	▲
six weeks grama	<i>Bouteloua barbata</i>		X	X	X
datura	<i>Datura discolor</i>		▲		X
spreading fleabane	<i>Erigeron divergens</i>		X		X
Arizona poppy	<i>Kallstroemia grandiflora</i>		X		X
Bigelow's bluegrass	<i>Poa bigelovii</i>		X		▲
Indian wheat	<i>Plantago ovata</i>				▲
chia	<i>Salvia columbariae</i>			X	
veronica	<i>Veronica peregrina</i>	X			

X: Species that should be primary components of a proposed habitat
 ▲: Species that would also be appropriate for a proposed habitat.

4.3.1 Habitat–Recreation Zone 1: Riparian and Aquatic Elements

4.3.1.1 Areas to Preserve

The Santa Cruz River corridor itself would remain a prominent feature in the Anza Park restoration. There are many mature, riparian tree and shrub species that should remain undisturbed (Photograph 13). In addition, the existing riparian tree grove south of Marana WRF is a valuable component of the existing habitat value of Anza Park. The Audubon Society Important Bird Area Program emphasizes the importance of preserving and enhancing this habitat type in Arizona to benefit a variety of bird species (Wilbur 2005).



Livestock should be excluded from the riparian corridor via fencing and adequate fence maintenance in order to promote cottonwood and willow recruitment (Wilbur 2005). The river corridor should be enhanced with dense plantings of cottonwood and willow to form continuous patches of at least 33 feet wide. The TAS recommends that pole-plantings should be planted parallel to river flow paths in “stringer rows” to imitate natural recruitment

Photograph 13. Santa Cruz River at Trico Road, with existing riparian corridor vegetation.

patterns; the first upstream tree takes the brunt of the water flow and lessens impact on downstream plantings (Kroesen 2005).

4.3.1.2 Creation of New Positive Habitat Elements

According to Rosen (2000) “water supplies that can be turned on or off, or at least re-routed to allow drying up of habitat, are ideal for the elimination of various exotic fish species that may invade (or be illegally introduced into) re-establishment sites [for aquatic species]. Thus, effluents, reclaimed water, and highly managed waters in general, offer a key opportunity for multi-species recovery of our native wetland fauna. This opportunity is not readily available in natural water systems, because flow is too difficult to regulate, divert, or turn on and off.” Anza Park presents a valuable and unique opportunity to provide a meaningful and managed restoration site for a variety of species, especially those requiring perennial water, that are not being addressed at many other locations.

4.3.1.2.1 Modify Effluent Flow Channel

Currently, the effluent channel is a straight drainage ditch that follows the north–central boundary of Anza Park. Modification and re-alignment could be accomplished with great ecological benefits. A series of associated off-channel ponds would create unique aquatic opportunities. Preliminary information indicates that no changes would be necessary to the existing Aquifer Protection Permit to allow these changes due to the high quality of effluent that Marana WRF is producing, as long as the existing discharge point is not moved (Glen Peterson, personal communication 2009). Proposed changes include:

- Dredge existing channel to remove all vegetation.
 - Native plant species such as cottonwood, Goodding’s willow, and seep willow should be salvaged via cuttings as planting stock for other elements of the project. These cuttings can be delivered to the Pima County Native Plant Nursery for holding if they are not needed immediately.
 - Invasive plant species should be removed from the site.
 - Invasive animal species (crayfish, bullfrogs) should be eradicated during the clearing and dredging process.
- Re-grade the area and realign the channel to cross the central part of Anza Park in a northeast to southwest direction (Figure 7). This would increase visual interest and allow for a channel designed specifically to provide a variety of riparian habitat elements, including a series of ponds. In addition, moving the confluence location

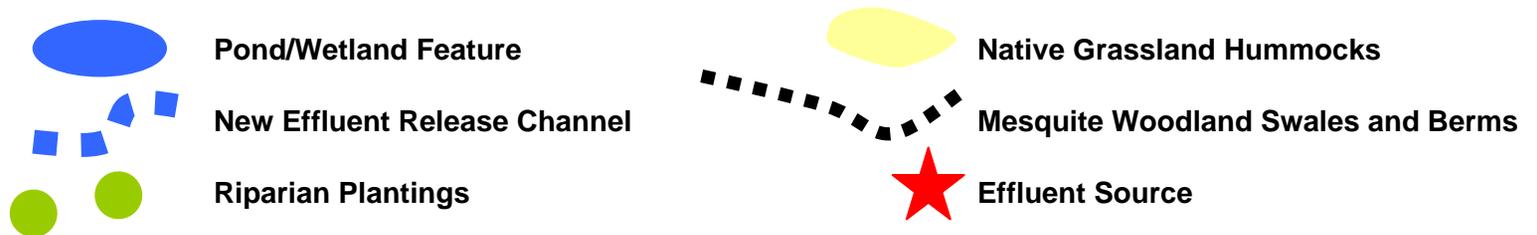
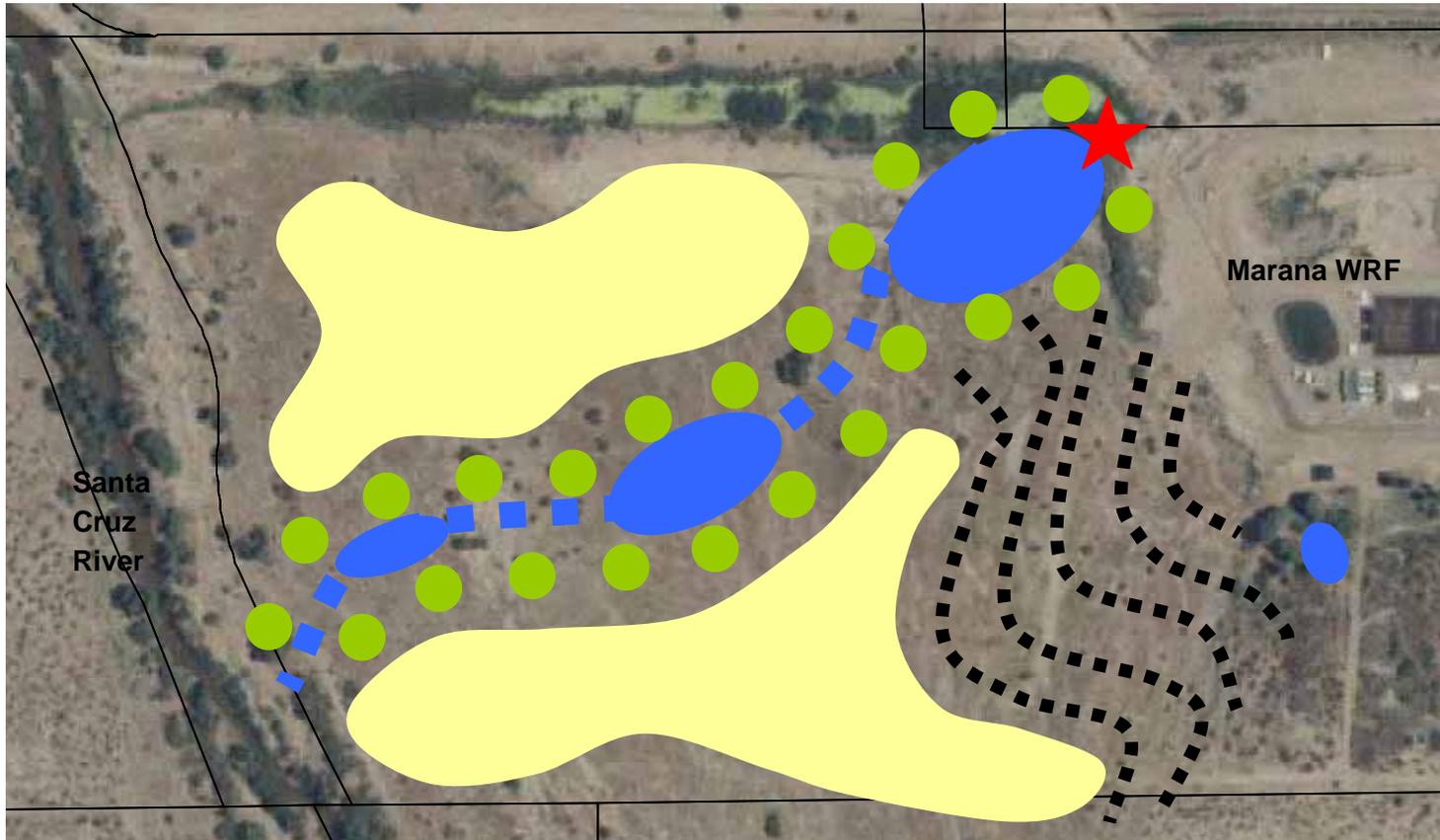


FIGURE 7
 Concept Plan for Aquatic and Riparian Restoration

upstream would allow for the Marana WRF effluent (if in great enough quantity) to be available to instream riparian plantings along the Santa Cruz River, assuring a water source even when flow is interrupted due to flooding or other factors. The channel gradient would not be uniform, but would have a stepped design to allow for the formation of ponded areas.

- Ponds should be constructed off-channel so that they can be isolated and dried if necessary for invasive species control. Preliminary information indicates that ponds will not need to be lined per the existing Aquifer Protection Permit due to the high quality of effluent that Marana WRF is producing (Glen Peterson, personal communication 2009).
- Construct the inflow mechanism to the channel such that water can be piped to a separate release point on the river to allow for periodic drying and invasive species management. This emergency overflow piping should be installed in the existing channel once it is dredged, then back-filled and re-graded. Plant new channel with native species salvaged from the project area and grown at the Pima County Sweetwater Native Plant Nursery (Figure 8). See Table 2 for a list of appropriate species.

4.3.1.2.2 Poned Wetland at Riparian Tree Grove

The recreation destination and species conservation opportunities of the grove of trees south of the Marana WRF could be greatly enhanced with a new pond/wetland feature. The current method of spray irrigation with effluent would no longer be appropriate, as that is inconsistent with the proposed recreational use. Irrigation of existing and new trees would be redesigned using bubblers (or other method) that would water the trees more efficiently, at the ground level, with less water loss to evaporation.

- Excavate a new pond. Some native trees may need to be removed to accommodate the surface area, but this will be avoided to the extent possible. Pond is to be fed by effluent from the Marana WRF.
- Design the pond such that it can be drained or allowed to dry up in the event that invasive species management needs to occur.
- Incorporate refugia and/or other mechanisms to preserve desirable native aquatic species during invasive species management. Protocols will need to be developed for this purpose.
- Protect the pond from invasion of crayfish and bullfrogs.
- Plant additional riparian trees at the perimeter of the pond as well as wetland species throughout. See Table 2 for a list of appropriate species.

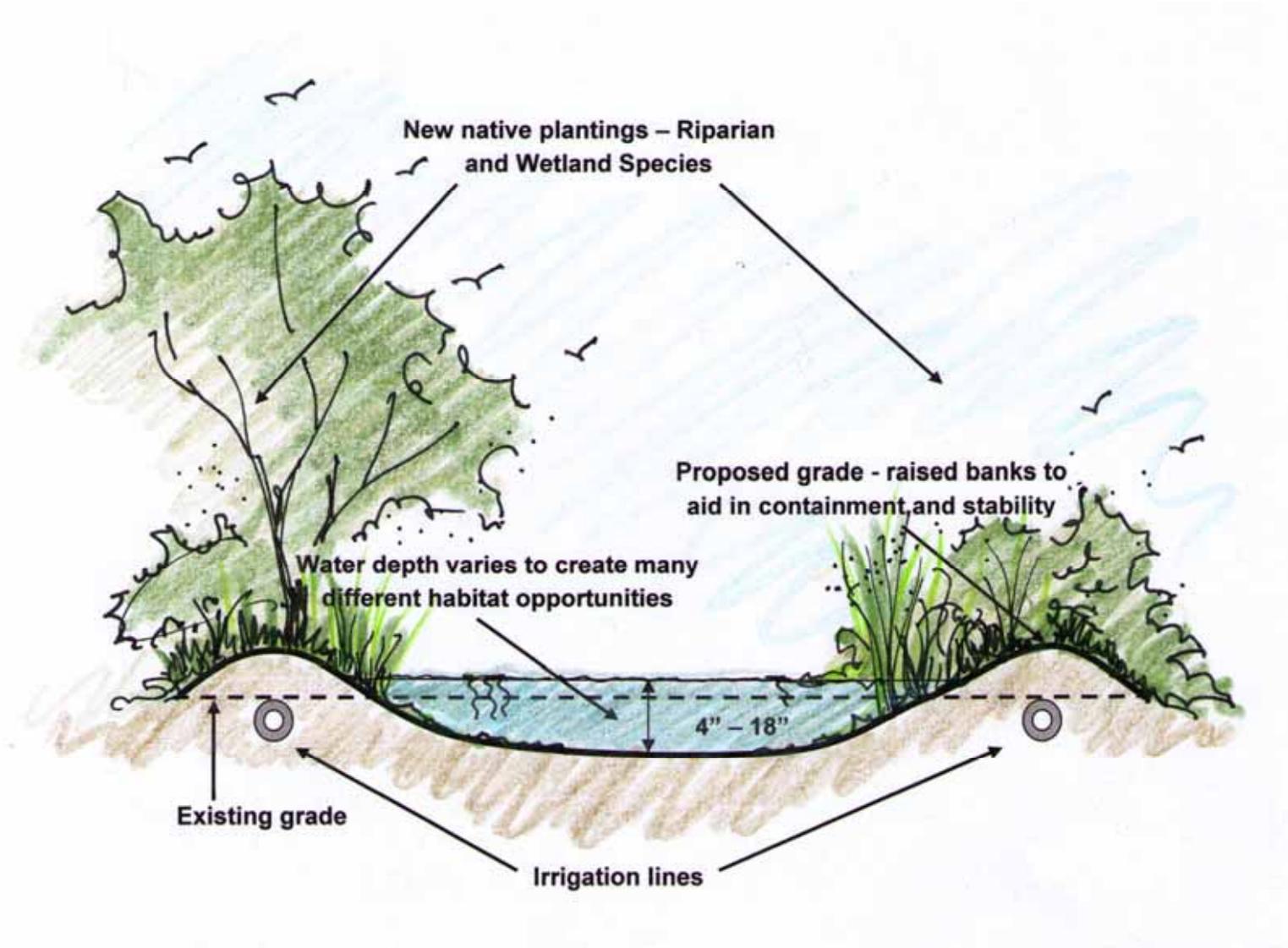


FIGURE 8
Cross-section of Effluent Flow Channel

- Incorporate a new picnic area.

4.3.1.2.3 Enhance Santa Cruz River Corridor

- Remove non-native invasive riparian plant species (e.g., tamarisk, Mexican paloverde, African sumac, tree tobacco) from the Santa Cruz River corridor.
- Plant additional native riparian species to enhance the river corridor. Plantings should add width and contiguous length to riparian woodland. See Table 2 for a list of appropriate species.

4.3.1.3 Value to Priority Vulnerable Species

The addition and enhancement of aquatic and riparian habitats at Anza Park will be valuable to a wide array of PVS.

4.3.1.3.1 Aquatic Elements

Additional areas of open water along the effluent release channel and in the existing cottonwood grove south of the Marana WRF would provide increased drinking water for a variety of species, including potentially the western yellow bat. Pond areas with species-specific design parameters could be developed to support lowland leopard frogs, Mexican garter snakes, Gila chub, Gila topminnows, desert pupfish, and longfin dace—pending their translocation and the effective control of predatory invasive non-natives. In addition, shallow areas (2 to 6 inches deep) may be appropriate for Huachuca water umbel, if invasive non-native aquatic predators (e.g., crayfish) are effectively managed.

4.3.1.3.2 Riparian Elements

Increasing the quality and quantity of riparian woodland along the new effluent release channel, the existing grove, and the Santa Cruz River corridor would potentially benefit the southwestern willow flycatcher, yellow-billed cuckoo, cactus ferruginous pygmy-owl, Bell's vireo, and western yellow bat. The quality of the riparian woodland would be improved by increasing the density and diversity of native riparian tree and understory species, as well as through the removal and continued management of invasive species such as tamarisk and giant reed. The quantity of riparian woodland would be increased both in linear and width extent, creating not only a more continuous stretch of habitat between the TAS restoration sites, but also creating adequate width for use by species such as the yellow-billed cuckoo and southwestern willow flycatcher.

The yellow-billed cuckoo nests and forages in cottonwood/willow and mesquite bosque habitats. Laymon and Halterman (1989) found that in California, the cuckoo needs dense, high-quality habitat patches of at least 50 to 100 acres, although patch sizes less

than 25 acres have been reported from southeastern Arizona (Halterman and Johnson 2002). The proposed patch at Anza Park would be connected to patches at the adjacent TAS restoration sites, creating up to 80 acres of contiguous habitat.

The southwestern willow flycatcher requires dense Goodding's willow thickets of at least 33 feet in width (USFWS 2002). Breeding patches are at least 21 acres, with particularly dense vegetation in the first 13 feet above ground and with cottonwood or willow canopy habitat in 49 to 65 feet above ground (USFWS 2002).

At the North Simpson Farm, TAS found that container planting, pole planting, invasive species treatment, and fencing to protect from off-road vehicles and grazing impacts resulted in a trend of higher species diversity for both winter and summer bird fauna. From 2001 to 2004, the summer fauna increased from 37 to 51 species. During winter surveys during the same time period, diversity increased from 32 to 45 species observed (Kroesen 2005). During the same time period, there was also an increase in the canopy and mid-story bird species guilds. The understory guild fluctuated, but seemed to be on an upward trajectory (Kroesen 2005).

4.3.1.4 Recreation Opportunities

The riparian and aquatic elements at Anza Park would not only serve as conduits and collection areas for effluent water but also as habitat corridors and recreational focal points. Visitors would be able to park at the Oit Pars commemorative trailhead and staging area at Trico Road, walk along the Santa Cruz River, and cross the river on a pedestrian bridge to the east side of the park. There, they can follow the trail along the effluent release channel and stop at the viewing platform for a close-up look at the birdlife (Figure 9). From there, they can continue on to the new ponded area at the existing riparian tree grove. Shaded benches and picnic tables would be located nearby.

Because the general public is not permitted on the TAS sites, public wildlife viewing opportunities at Anza Park would provide a welcome and unique passive recreation experience in the heart of a series of connected restoration projects. Restrictions may be necessary on recreational uses during the breeding season of sensitive bird species, if nesting pairs are present.

4.3.1.5 Coordination

Pima County should consider either acquiring the large parcel south of Anza Park or creating a conservation easement along the Santa Cruz River corridor within that parcel. This would increase the length of river that is protected in the interest of conservation, with a continuous corridor through Anza Park connected to both of the TAS restoration parcels that flank Anza Park.

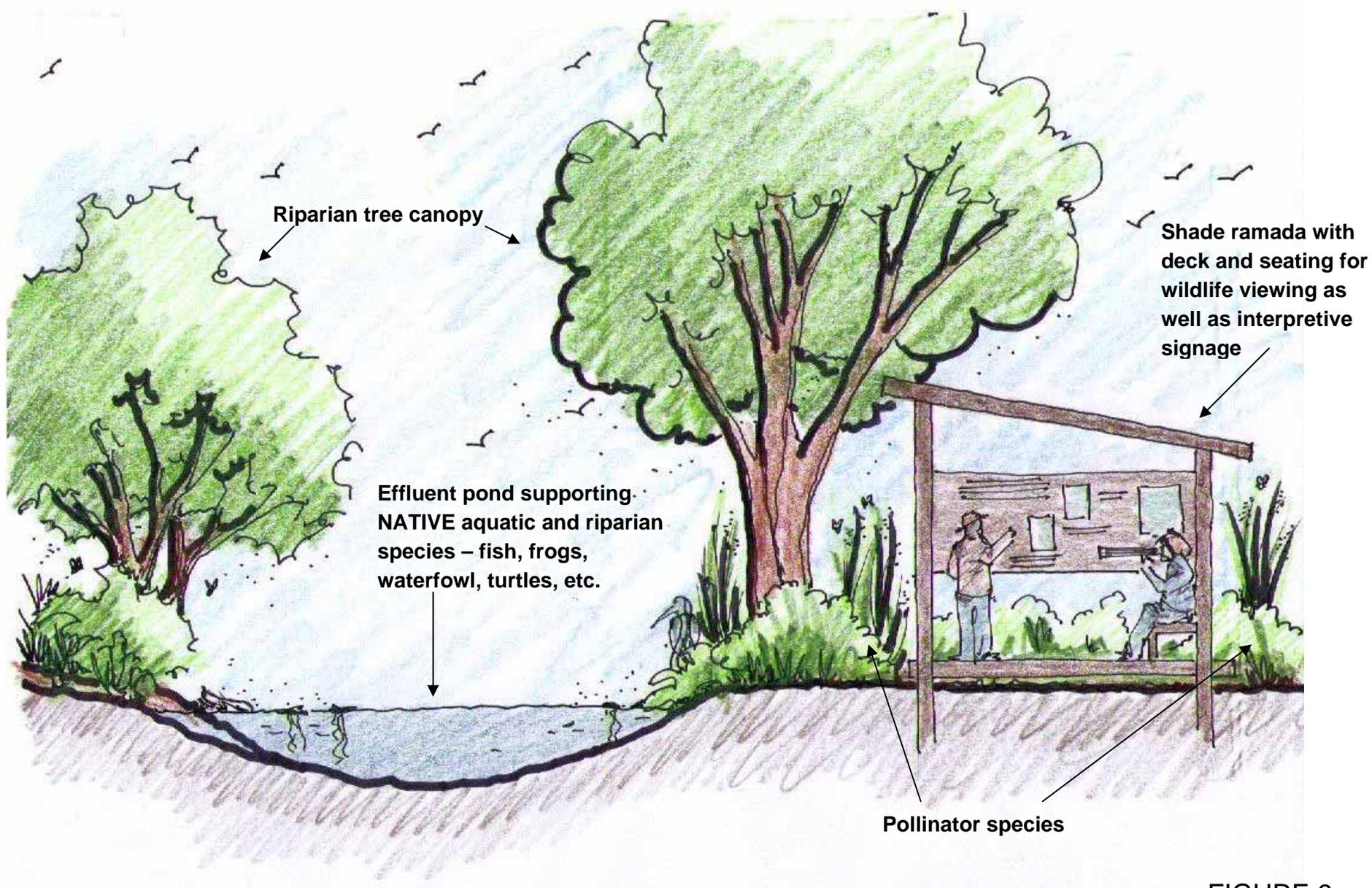


FIGURE 9
Wildlife Viewing Platform

If suitable habitat is created, there may be opportunities to work with the AGFD, USFWS, and other appropriate agencies or land owners to translocate PVS to Anza Park. Potential candidates for translocation to the riparian corridor habitat type include: endangered native fish (Gila topminnow, desert pupfish), lowland leopard frog, Mexican garter snake, and Huachuca water umbel.

4.3.2 Habitat–Recreation Zone 2: Mesquite Woodland

4.3.2.1 Areas to Preserve

The existing mesquite thicket adjacent to the east side of Trico Road should be retained, enhanced, and expanded. The Audubon Society Important Bird Area Program emphasizes the importance of preserving and enhancing this habitat type in Arizona to benefit a variety of bird species (Wilbor 2005).

Livestock should be excluded from the mesquite woodland area via fencing and adequate fence maintenance in order to protect the mid-story and understory habitat zones (Wilbor 2005). If possible, groundwater levels should be managed to maintain depths of not more than 49 feet to promote tall and diverse age classes of velvet mesquite within areas of floodplain mesquite bosque (Stromberg 1993).

4.3.2.2 Creation of New Positive Habitat Elements

The extent of mesquite woodland habitat is proposed to be increased significantly, forming a buffer between the riparian corridor areas and the drier desertscrub and grassland habitats. Wilbor (2005) placed the highest value on mesquite bosques with dimensions of at least 0.6 mile in length and 330 feet in width, because of their rarity within the Pima and Pinal county watershed of the Santa Cruz River. Mesquite bosques of this size are able to sustain birds that require large habitat patch size, such as gray hawks and yellow-billed cuckoos (Wilbor 2005).

Wilbor (2005) also placed high importance on bosques that are located at the confluence of the river with tributaries or washes, as they “have a high potential for long-term persistence, high capacity for trees to reach maximal size, serve as large seed dispersal ‘centers,’ and have high significance in terms of their importance to wildlife (birds and large mammals) within a regional landscape perspective.” The effluent flow channel, although not a natural tributary, can serve in this capacity.

New areas of mesquite woodland would be planted adjacent to the riparian corridors. On the east side of the Santa Cruz River, south of the Marana WRF, a series of contoured shallow berms and swales would be flood-irrigated with effluent water from Marana WRF to create dense mesquite woodland (Figure 10). West of the river, restoration activities will need to utilize storm water harvesting and dry land techniques unless there is

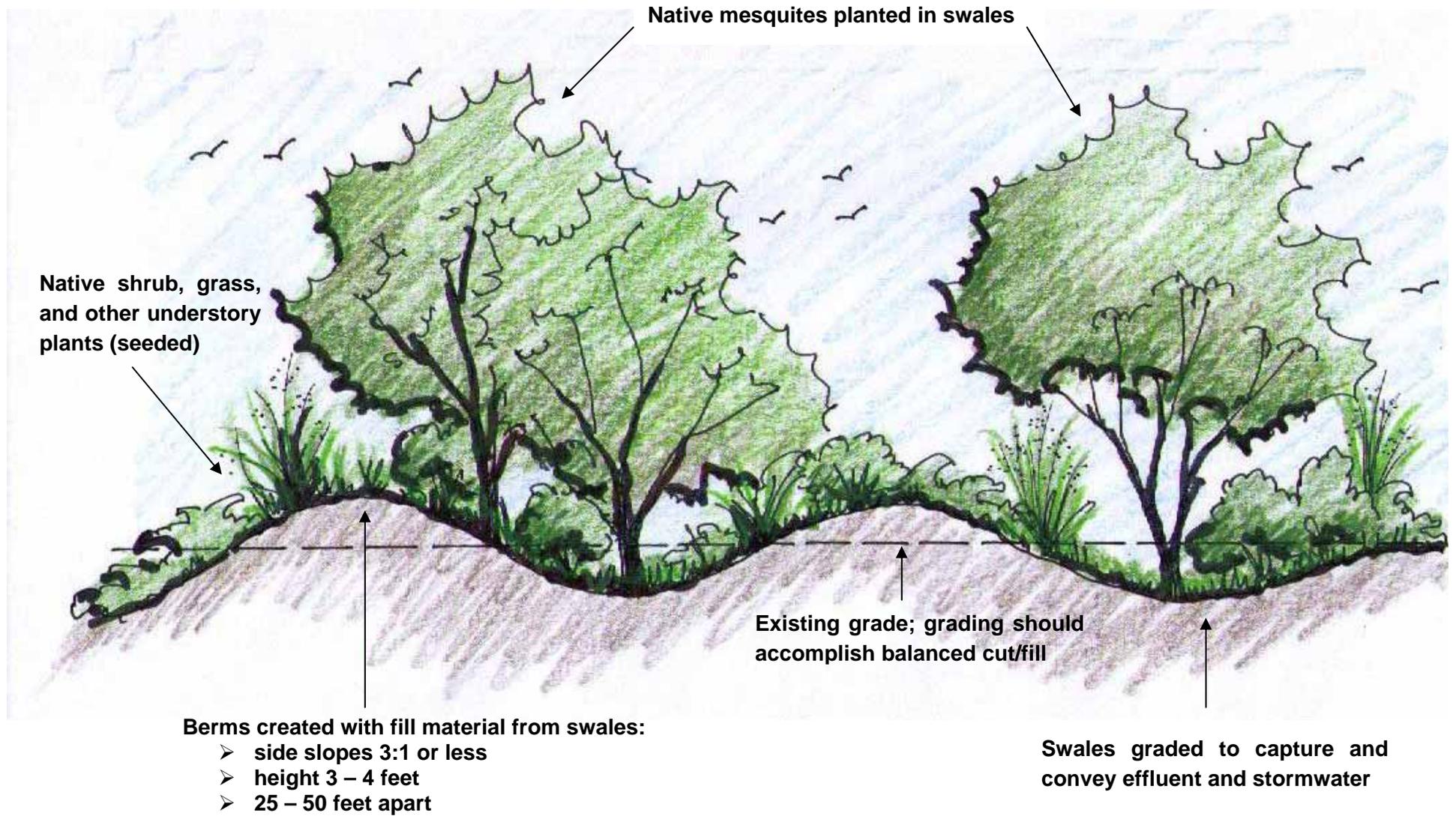


FIGURE 10
Representative Cross-section of Mesquite Woodland Berms and Swales

sufficient supply and support for piping effluent across the river or groundwater wells to support plantings.

4.3.2.3 Value to Priority Vulnerable Species

Areas planted with mesquites and dense shrubs may provide beneficial habitat for the Abert's towhee, Bell's vireo, yellow-billed cuckoo, cactus ferruginous pygmy-owl, and Merriam's mesquite mouse.

4.3.2.4 Recreation Opportunities

Mesquite woodland will provide shade for recreationists as well as provide wildlife viewing opportunities.

4.3.2.5 Coordination

If suitable habitat is created, there may be opportunities to work with the AGFD, USFWS, and other appropriate agencies or land owners to translocate the PVS mesquite mouse to Anza Park.

4.3.3 Habitat–Recreation Zone 3: Native Grassland

4.3.3.1 Creation of New Positive Habitat Elements

Open native grassland is proposed for the disturbed areas south and west of the Marana WRF. Located within the eastern interior of the park, this area would not be actively irrigated, but instead would be graded to encourage passive stormwater harvesting. At North Simpson Farm, TAS found that rainwater infiltrated up to five times deeper in microbasins than on adjacent slopes without microbasins, and that the structures encouraged recruitment of volunteer native plants (Kroesen 2005).

The area would receive intensive invasive species management and then be seeded with native grassland species. See Table 2 for a list of appropriate species. Seeding should be accomplished via hydroseed, hand-raking, or imprinting. The TAS experimented with seed pelletizing with native clay at the North Simpson Farm, but found that it was labor intensive and had low germination success (Kroesen 2005).

Much of the area has a hummocky topography, and this feature would be mimicked and exaggerated with careful grading. Cut and fill would be balanced to achieve a series of raised mounds that are 3–4 feet in height, with basins intervening (Figure 11). Container planting would be minimal, and limited to a few areas of scattered thorny shrubs and cholla plants. The entire area would be seeded with native grass species (See Table 2 for a plant list).

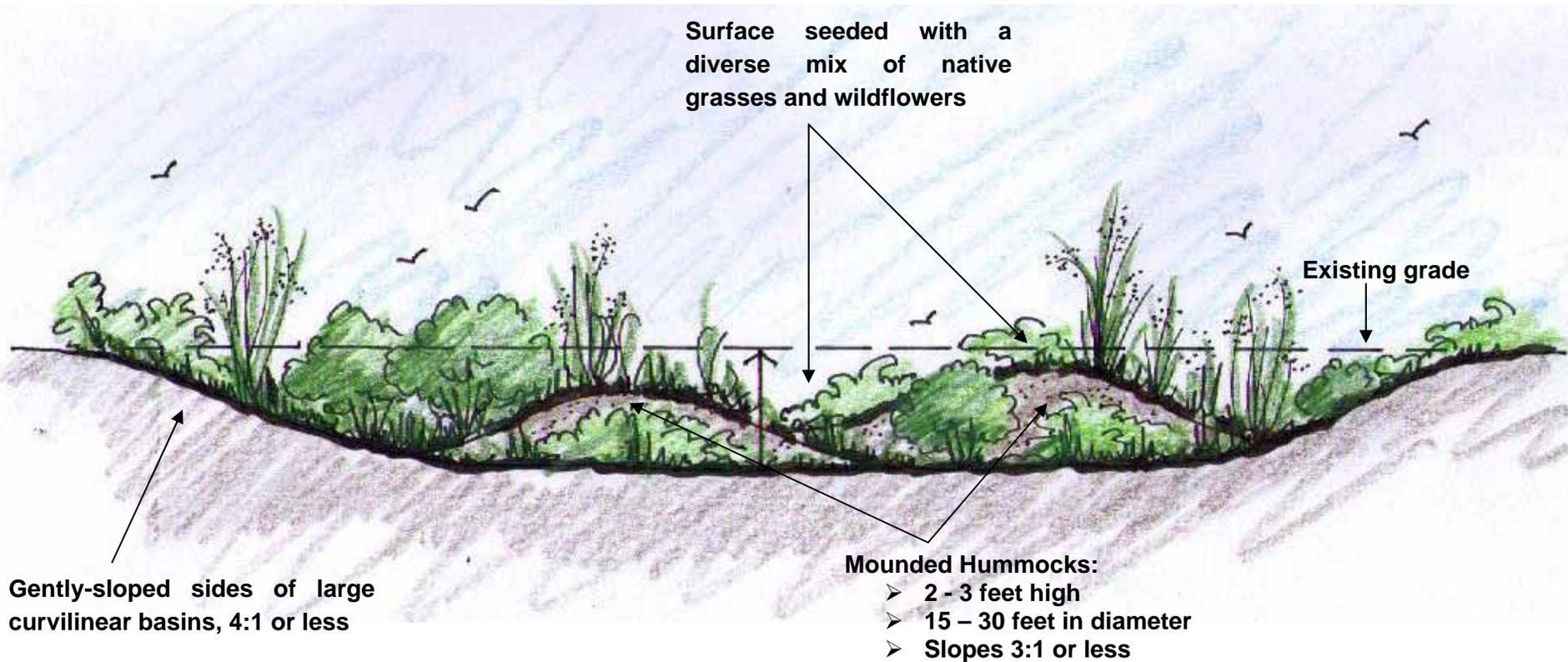


FIGURE 11
Representative Cross-section of Native Grassland Hummocks

4.3.3.2 Value to Priority Vulnerable Species

The open native grassland area may provide beneficial habitat for the rufous-winged sparrow, Swainson's hawk, and western burrowing owl. Additional habitat components designed to encourage the rufous-winged sparrow include the scattered planting of dense, thorny shrubs such as desert hackberry (*Celtis reticulata*) and wolfberry (*Lycium* spp.). Artificial nesting burrows and perches could be added to further encourage burrowing owls to use the area.

4.3.3.3 Coordination

If suitable habitat is created, there may be opportunities to work with the AGFD, USFWS, and other appropriate agencies or land owners to translocate the PVS western burrowing owl to Anza Park.

4.3.4 Habitat–Recreation Zone 4: Creosote Desertscrub

4.3.4.1 Areas to Preserve

The western interior of Anza Park is characterized by relatively intact creosote desertscrub. This area should remain completely intact to the extent possible.

4.3.4.2 Creation of New Positive Habitat Elements

This area can be enhanced in disturbed areas with seeding and container planting. See Table 2 for a list of appropriate species.

4.3.4.3 Value to Priority Vulnerable Species

Intact desertscrub in the western portion of Anza Park could possibly support Tumamoc globeberry's re-introduction from locations in Avra Valley.

4.3.4.4 Coordination

If suitable habitat is created, there may be opportunities to work with the USFWS and other appropriate agencies or landowners to translocate the PVS Tumamoc globeberry to Anza Park.

4.3.5 Habitat–Recreation Zone 5: Agricultural Fields

4.3.5.1 Areas to Preserve

Even though active and recently abandoned agricultural fields are completely disturbed, they have many positive site characteristics that can be used to support both restoration and recreation activities at Anza Park.

4.3.5.2 Creation of a New Pima County Native Plant Seed Source

Agricultural fields, conveniently located within Anza Park, could be used to grow native species for restoration purposes, including but not limited to those proposed for Anza Park. It is often very difficult to find native seeds from local seed sources appropriate for restoration projects and in the appropriate quantities. Pima County is already operating the Sweetwater Native Plant Nursery at the Roger Road WRF; having access to seed-bulking fields could add to the services provided and quality of plants that are produced, with potential benefits for a variety of Pima County Departments and restoration across Pima County.

4.3.5.3 Recreation and Environmental Education Opportunities

These areas can be used for park infrastructure such as the Story of Water Discovery Center, restrooms, and parking. These plans will need to be coordinated with PCNRPRD.

4.3.5.4 Coordination

The PCRFC and PCNRPRD should coordinate with other public works departments both within the county and in other local governments in order to identify needs for restoration seeds, as well as specific goals and details for park infrastructure.

4.4 Managing Site Challenges

The development of Anza Park into a successful habitat restoration project, recreation destination, and educational facility will not be without challenges that are unique to this type of project and the site. Distribution of effluent water across the site to support aquatic and riparian restoration must occur in a manner that is highly controllable, but also efficient and with low maintenance needs.

In *A Long Range Stewardship Plan for the Santa Cruz River Habitat Project*, TAS reports that the major threats to the North Simpson Farm site include the management

of sediment deposition, invasive species, and continued effluent flow to the project site (Macys et al. 2007). In addition, Rosen (2005) added water quality and desirable species colonization to the list of functional issues that must be managed for successful restoration along the Lower Santa Cruz River. These challenges are all cogent to plans at Anza Park, and potential design and management responses are presented below.

4.4.1 Irrigation and Distribution of Effluent Water

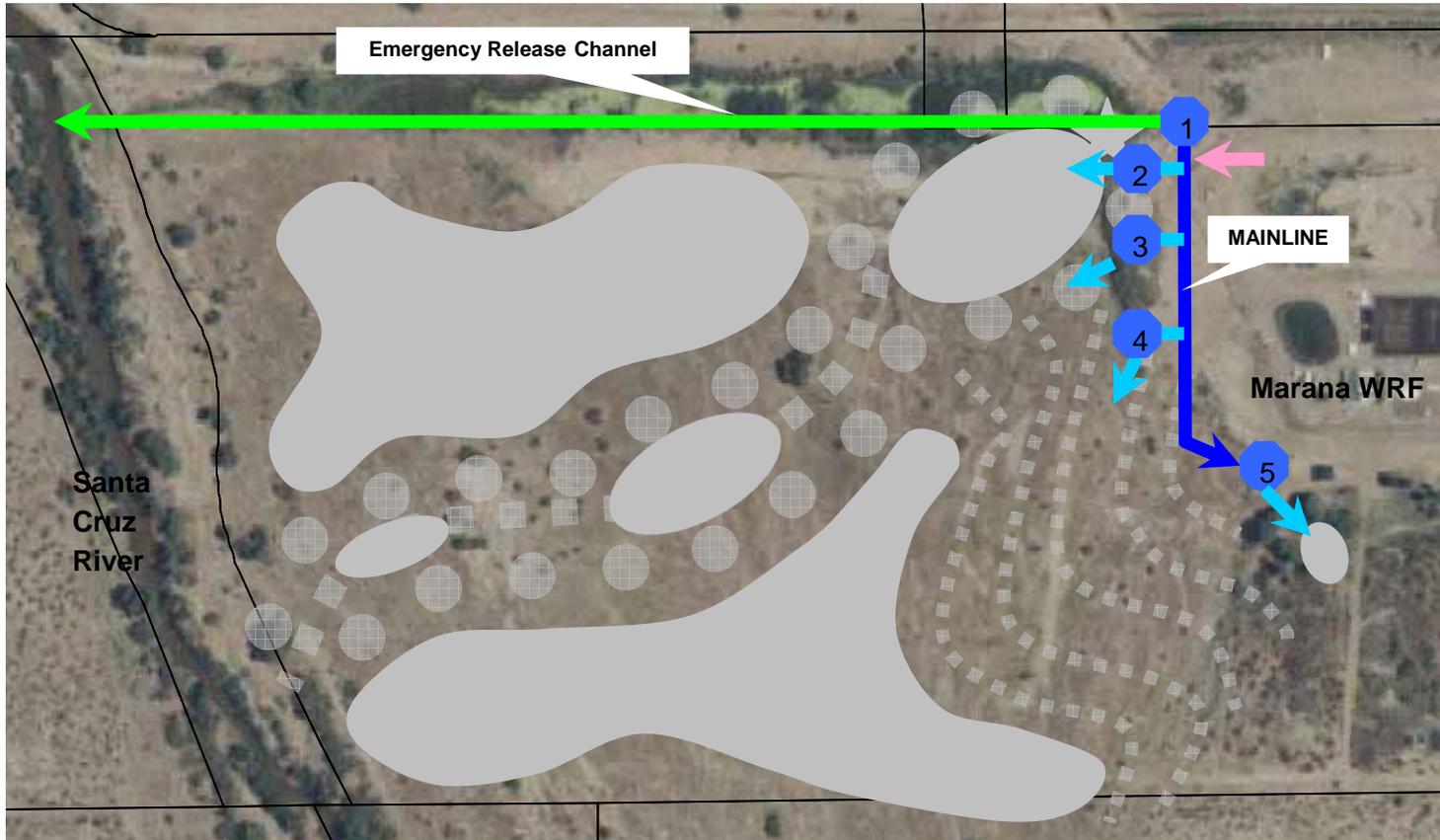
The irrigation concept to support the aquatic and riparian habitat elements is as low-technology as possible while providing adequate control over the movement of effluent water across the project area (Figure 12). The availability of effluent for restoration may necessitate a phased approach to the implementation of restoration elements. The preliminary concept includes a new mainline from the Marana WRF that services five control valves that manage the effluent distribution (from north to south):

1. Valve for emergency discharge. Piping to extend straight along the existing effluent release channel to the Santa Cruz River.
2. Valve for new effluent release channel and off-channel ponds. This is a gravity-flow system.
3. Valve(s) for drip irrigation of riparian corridor plantings adjacent to the new effluent. This system is temporary until plantings are established.
4. Valve(s) for bubbler/flood irrigation of mesquite woodland berms and swales. This is a gravity-flow system.
5. Valve(s) for bubbler/flood irrigation of cottonwood grove and ponded wetland south of the Marana WRF. This is a gravity-flow system.

Detailed irrigation plans are not presented here but would be part of the project work plan. A collaborative approach to the irrigation design including maintenance staff, aquatic species experts, and a landscape architect will result in the most effective, efficient, and economical system possible as it will incorporate lessons learned from a variety of perspectives and past experience.

4.4.2 Sediment Deposition

Recent large flood events in 1983 and 1993 resulted in the deposition of enormous amounts of sediments in the river channel in the vicinity of Anza Park, and local farmers cooperated with the PCRFCFCD to remove excess sediments with bulldozers. In-channel restoration activities (plantings) at Anza Park, as well as those at the adjacent TAS sites, could be seriously impacted if bulldozing continues into the future. The TAS advocated



CONTROL VALVES

- 1 Emergency discharge
- 2 Effluent stream and ponds/wetlands
- 3 Drip irrigation for riparian plantings
- 4 Bubbler/flood irrigation for mesquite woodland
- 5 Bubbler/flood irrigation for ponded wetland

PIPING

- Existing piping from Marana WRF
- New mainline supply
- New irrigation distribution piping
- New emergency discharge piping

FIGURE 12
 Concept Plan for Distribution of Effluent to Support
 Aquatic and Riparian Restoration Elements

for the City of Tucson to create an alternate action plan in case future flood-deposition events result in public support for bulldozing sediment from the river channel (Macys et al. 2007). In addition, TAS supports the retirement of downstream parcels from agriculture, allowing the resulting fallow fields and open space to resume hydrologic function that does not conflict with public health and safety (Macys et al. 2007). The TAS specifically proposes to modify Trico Road north of the river and allow floodwaters to pass onto the North Simpson Farm site in an attempt to alleviate downstream impacts (Macys et al. 2007).

4.4.3 Invasive/Pest Species

A detailed Invasive Species Management Plan for Anza Park should be developed that addresses the full suite of invasive plant and animal species that could interfere with the restoration and recreation opportunities at Anza Park. A subset of those species is discussed below, as they were considered in the development of this concept-level document. These species and others warrant specific and detailed treatment prescriptions. Table 3 presents a list of species that should be included at a minimum in the Invasive Species Management Plan. This plan should be developed in coordination with restoration specialists who have been working at the adjacent TAS restoration sites. A coordinated invasive species management effort would increase the overall success of management actions.

**TABLE 3
INVASIVE SPECIES TO BE INCLUDED (AT A MINIMUM) IN THE INVASIVE SPECIES
MANAGEMENT PLAN FOR ANZA PARK**

Common name	Scientific name
Animals	
Brown-headed cowbirds	<i>Molothrus ater</i>
Crayfish	<i>Orconectes virilis</i>
Bullfrogs	<i>Rana catesbeiana</i>
Plants	
giant reed	<i>Arundo donax</i>
Bermuda grass	<i>Cynodon dactylon</i>
Lehman lovegrass	<i>Eragrostis lehmanniana</i>
Mexican paloverde	<i>Parkinsonia aculeata</i>
blue panicum	<i>Panicum antidotale</i>
buffelgrass	<i>Pennisetum ciliare</i>
Russian thistle	<i>Salsola tragus</i>
Mediterranean grass	<i>Schismus spp.</i>
London rocket	<i>Sisymbrium irio</i>
Johnson grass	<i>Sorghum halapense</i>
Athol tree	<i>Tamarix aphylla</i>
shrub tamarisk	<i>Tamarix ramosissima</i>

4.4.3.1 Brown-headed Cowbirds

Cowbirds prefer to forage in open rangeland and tend to choose nests to parasitize that are near the forest edge or in more open forests; they are less likely to parasitize nests that are deeper within riparian forests (USFWS 2002). The Riparian Habitat Joint Venture (2003) recommends that the maintenance and expansion of healthy riparian gallery forests and adjacent mesquite bosque habitats is the best option for improving passerine reproductive performance in the presence of cowbirds. Wilbor (2005) recommends that when there is a broad open river zone (>165 feet) present, as at Anza Park, that there should be at least 330 feet of riparian–bosque habitat on each side of the channel.

The habitat restoration elements proposed herein for Anza Park follow these recommendations for reducing the impacts of brown-headed cowbirds on reproductive success of passerine birds, PVS, and other sensitive species.

4.4.3.2 Bullfrogs, Crayfish, and Invasive Fishes

Open water at Anza Park should be carefully monitored for the presence of aquatic predators (bullfrogs, crayfish, and invasive fish species). Trapping of these animals as adults and/or egg masses may temporarily eliminate or reduce invasive species populations. Trapping may be used at Anza Park as part of invasive species management, but because it is expensive with likely temporary results, the emphasis should be placed on periodically draining the water features and prevention through public education.

4.4.3.3 Mosquitoes

Open water features at Anza Park will create habitat for mosquitoes, which could pose a public health concern if left unmanaged. The inclusion of native mosquito-eating fish into the aquatic elements of the plan will help to manage this issue. Mosquito management and abatement should be addressed in the invasive species plan for this project.

See RECON (2008b) for a discussion of how native amphibians can function in fishless waters to control mosquitoes.

4.4.3.4 Tamarisk and Giant Reed

Site preparation would include removal and/or herbicide treatment of tamarisk and giant reed. Plants along the effluent flow channel would be removed. Plants in the riparian corridor of the Santa Cruz River may be either removed or treated with herbicide, if removal would damage adjacent native species.

4.4.3.5 Trespass Grazing

Trespass cattle are currently an issue at Anza Park and could be potentially damaging to restoration activities through trampling and grazing of newly installed plant materials. The AGFD has designed a “wildlife-friendly” fence that allows wildlife to pass, but excludes cattle (Figure 13). The entire perimeter of the Anza Park, as well as any contiguous conservation easement area, should be enclosed with this fence, and its maintenance should be a management priority for Anza Park staff.

4.4.4 Continued Effluent Flow

Restoration activities in the Santa Cruz River at Anza Park (as well as at the adjacent TAS sites) would rely on effluent wastewater from Marana WRF, as well as the two upstream WRFs. Short-term interruptions in flow from Roger Road and/or Ina Road WRFs, due to flood events and increased downstream infiltration until the algal layer is replenished, are to be expected periodically. The re-location of the Marana WRF effluent outfall channel farther upstream would help to ensure survival of riparian plantings, as long as there is adequate flow to the river.

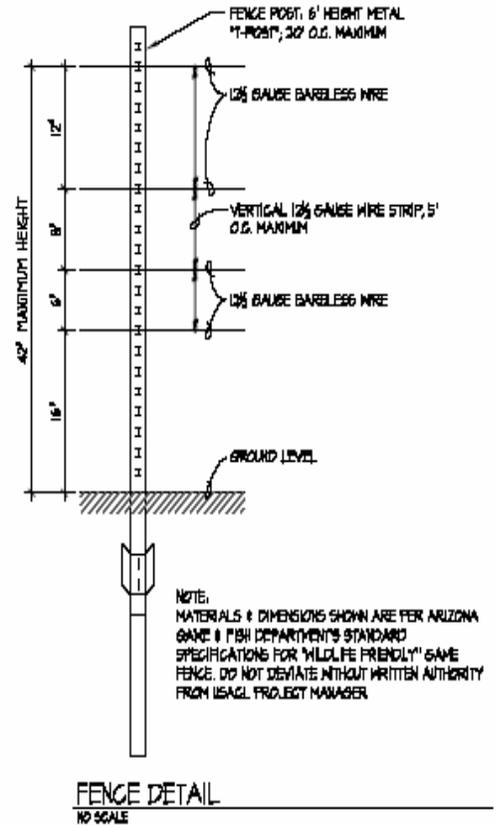


FIGURE 13
AGFD wildlife-friendly fence

On a more long-term basis, the continued discharge of an adequate volume of effluent from the upstream wastewater reclamation facilities is of concern. In the future, there are foreseeable competing demands for effluent, including increased use of reclaimed water for turf and landscape use as well as potential drinking water supply. In addition, upstream restoration efforts associated with the TRDN project may change the river characteristics, including increased infiltration, which could also reduce the amount of flow that makes it to the Anza Park site.

In general, effluent release from Marana WRF does not currently make it to the river channel; however, increased growth in Marana could result in increased flow volume, and the importance of this effluent source to the river channel plantings at Anza Park as well as at North Simpson Farm could increase.

4.4.5 Water Quality

Despite extensive fieldwork, Rosen (2005) observed few or no fish (native or non-native) in effluent flows in the Santa Cruz River. In addition, although adult bullfrogs are abundant, egg masses and tadpoles were not observed. These observations indicate that the current water quality of the effluent (from Roger Road WRF and Ina Road WRF) in the Santa Cruz River is not adequate to support native fishes and aquatic frogs. It is unknown whether Marana WRF’s recent upgrade in effluent quality would be adequate to sustain these animals. Known parameters for two of the aquatic species proposed for possible reintroduction are discussed in Table 4 below.

**TABLE 4
KNOWN WATER QUALITY PARAMETERS FOR THE GILA TOPMINNOW AND DESERT PUPFISH (PAG 2002B)**

Species	Temperature (degrees Fahrenheit)	pH	Dissolved Oxygen (mg/l)	Salinity	Dryness	Other
Gila topminnow	0–98, with short periods up to 109	6.6–8.9	2.2–11	Very dilute to seawater	Can burrow into mud for 1–2 days	Sensitive to chlorine
Desert pupfish	up to 113		as low as 0.1–0.4	as much as 2x seawater		Nitrate poisoning can occur with winter vegetation die-off.

In a review of available information regarding water quality and Pima County’s imperiled aquatic species, PAG (2002b) noted that although there is not specific water quality parameter data available for leopard frogs, studies of frogs in other regions showed that newly hatched larvae are very sensitive to elevated nitrite levels, and that in general frogs are known to be sensitive to heavy metal poisoning. The study noted a general paucity of available information, but stated that:

...Other threats aside, aquatic species generally thrive when the waterbodies in which they reside have water quality characteristics that are typical of ‘healthy’ waterbodies. For Pima County this includes physical characteristics as well as chemical characteristics such as pH ranging from 6.5 – 8.5, EC from 50 – 1500 micromhos per centimeter, and Do between 7.5 – 8.3 mg/L.

4.4.6 Desirable Species Colonization

Rosen (2005) points out that “ecologically functional floodplains in Avra Valley would require (1) active establishment or re-establishment of desirable species that cannot readily reach the area by dispersal, and (2) provisions for flood refugia for non-flying species.” Many of the species for which the habitat restoration would be intended would not be able to colonize or persist, if they are not actively re-introduced. This is generally not an issue for the many bird species that would benefit from restoration at Anza Park and that are the focus of the adjacent TAS restoration sites. Another challenge is the need for a system of refugia for species to be able to persist in times of no flow e.g., when the schmutzdecke layer has been scoured by floodwaters and downstream infiltration increases, reducing the linear extent of the surface water flow from over 20 miles to about 5 miles (Rosen 2005).

4.4.7 Create a New Recreation and Environmental Education Destination in Pima County

4.4.7.1 Story of Water Discovery Center

This discovery center will focus on the theme of water and will present an excellent educational opportunity for students and others to learn about nature and the habitat restoration efforts at Anza Park. Detailed plans for this center would be developed by PCNRPRD.

4.4.7.2 Interpretive Signage

Interpretive signage should be developed for Anza Park that is consistent with the values of the SDCP. It is likely that PCNRPRD would take the lead on this effort, collaborating with other departments and offices (e.g., PCRFCO, PCRWR, and Pima County Cultural Resources and Historic Preservation Office [PCCRHPO]). Appropriate topics for interpretive signs include:

- **PVS education.** Habitat-based signs along the trail system that describe benefits to specific PVS and other wildlife species.
- **Invasive species education.** Invasive plant and animal species can have ecologically disastrous consequences. Anza Park presents a good opportunity to educate the public about these issues. Interpretive signage should show specific invasive plants and animals, and emphasize the dangers of aquatic pet release. Such signage is especially important at aquatic and riparian areas that could become introduction points for unwanted pets and bait species.

- **Cultural resources.** PCNRPRD and the PCCRHPO could collaborate on the interpretation of cultural resources of the Lower Santa Cruz River. The new Oit Pars commemorative trailhead/staging area for the Anza Trail on the west side of the river at Trico Road is an ideal location for cultural resources interpretation.
- **Effluent water resources.** The Story of Water Discovery Center will present a good opportunity to provide environmental education about how Pima County is utilizing effluent water resources for habitat restoration.

4.4.7.3 Hiking, Biking, and Equestrian Use

The new Oit Pars commemorative trailhead/staging area for the Anza Trail on the west side of the river at Trico Road could serve as an important new attraction and access point for hikers, bikers, and equestrian users to enjoy. Details of this development need to be coordinated with National Park Service, PCCRHPO, and PCNRPRD. The Anza Trail section within Anza Park is approximately .06 mile in length. The concept plan presented in this document shows an additional 1.3 miles of trail connecting to the Anza Trail (east side of the river). Once complete, the Anza Trail along the Santa Cruz River will be an important spine trail for recreationists to access a multitude of other trails.

4.4.7.4 Wildlife Viewing

Wildlife viewing opportunities would be provided at locations of particular interest along the trail alignment (e.g., viewing platform near ponded area along the new effluent channel). Interpretive signage would enhance the learning experience.

4.4.7.5 Picnicking

Picnic tables and benches at the new Oit Pars commemorative trailhead/staging area for the Anza Trail and in the ponded wetland area south of the Marana WRF would provide picnicking opportunities for recreationists and environmental education interpretive areas if combined with signs and kiosks.

4.5 Future Studies

4.5.1 Cultural Resources Survey

The entire project area should be surveyed for cultural resources prior to the development of further plans for Anza Park. Identified cultural resources will be protected by avoidance to accomplish the SDCP goal of preservation-in-place of cultural resources wherever possible.

4.5.2 Detailed Restoration Work Plan

- **Landscape Plan.** Prepare a landscape site plan to achieve the goals described herein. This could be developed by holding one or more collaborative design workshops to gain perspectives from participating stakeholders. Include more detailed delineation of planting areas, trail(s) alignment, irrigation system components, grading and earthworks, signage, and visitor use elements (viewing platform, picnic facilities, parking, etc.). The landscape plan should include a detailed water budget that relates the amount of effluent water available to the plant materials and layout. Irrigation design should include specific input from PCNRPRD maintenance staff.
- **Specific design guidance.** Incorporate specific design guidance from Dr. Phil Rosen including:
 - Habitat and water quality requirements for native fish, amphibians, and snakes.
 - Protocols or design considerations necessary to preserve desirable native aquatic species during invasive species management.

4.5.3 Maintenance and Monitoring Plan

This should be developed in coordination with the TAS Restoration Team and should address at a minimum the following topics:

- **Baseline conditions.** Field measurements of vegetation, avifaunal diversity, and channel morphology to establish conditions prior to restoration activities. Baseline photographs are especially important in documenting a project's progress.
- **Invasive species.** A specific Invasive Species Management Plan that provides detailed treatments for the full suite of invasives of concern at Anza Park, including both plant and animal species.
- **Performance criteria and monitoring protocols.** These should address plant survivorship, avifaunal diversity, habitat condition (cover, density, diversity), and channel morphology. Repeat photography is usually an important component for monitoring changing conditions.

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APPENDICES

APPENDIX A

Pima County

COMMON NAME	SCIENTIFIC NAME	STATUS	DESCRIPTION	COUNTY	ELEVATION	HABITAT	COMMENTS
California Brown pelican	<i>Pelecanus occidentalis californicus</i>	Proposed delisted	Large dark gray-brown water bird with a pouch underneath long bill and webbed feet. Adults have a white head and neck, brownish black breast, and silver gray upper parts.	Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma	Varies	Coastal land and islands; species found around many Arizona lakes and rivers.	Subspecies is found on Pacific Coast and is endangered due to pesticides. It is an uncommon transient in Arizona on many Arizona lakes and rivers. Individuals wander up from Mexico in summer and fall. No breeding records in Arizona.
Chiricahua leopard frog	<i>Lithobates [Rana] chiricahuensis</i>	Threatened	Cream colored tubercles (spots) on a dark background on the rear of the thigh, dorsolateral folds that are interrupted and deflected medially, and a call given out of water distinguish this spotted frog from other leopard frogs.	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Navajo, Pima, Santa Cruz, Yavapai	3,300-8,900 ft	Streams, rivers, backwaters, ponds, and stock tanks that are mostly free from introduced fish, crayfish, and bullfrogs.	Require permanent or nearly permanent water sources. Populations north of the Gila River may be a closely-related, but distinct, undescribed species. A special rule allows take of frogs due to operation and maintenance of livestock tanks on State and private lands.
Desert pupfish	<i>Cyprinodon macularius</i>	Endangered	Small (2 inches) smoothly rounded body shape with narrow vertical bars on the sides. Breeding males blue on head and sides with yellow on tail. Females and juveniles tan to olive colored back and silvery sides.	Cochise, Graham, La Paz, Maricopa, Pima, Pinal, Santa Cruz, Yavapai	< 5,000 ft	Shallow springs, small streams, and marshes. Tolerates saline and warm water.	Critical habitat includes Quitobaquito Springs, Pima County, portions of San Felipe Creek, Carrizo Wash, and Fish Creek Wash, Imperial County, California. Two subspecies are recognized: Desert Pupfish (<i>C.m.macularis</i>) and Quitobaquito Pupfish (<i>C.m.ereumus</i>).
Gila chub	<i>Gila intermedia</i>	Endangered	Deep compressed body, flat head. Dark olive-gray color above, silver sides. Endemic to Gila River Basin.	Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Pima, Pinal, Santa Cruz, Yavapai	2,000 - 5,500 ft	Pools, springs, cienegas, and streams.	Found on multiple private lands, including the Nature Conservancy, the Audubon Society, and others. Also occurs on Federal and state lands and in Sonora, Mexico. Critical habitat occurs in Cochise, Gila, Graham, Greenlee, Pima, Pinal, Santa Cruz and Yavapai counties.
Gila topminnow	<i>Poeciliopsis occidentalis occidentalis</i>	Endangered	Small (2 inches), guppy-like, live bearing, lacks dark spots on its fins. Breeding males are jet black with yellow fins.	Cochise, Gila, Graham, La Paz, Maricopa, Pima, Pinal, Santa Cruz, Yavapai	< 4,500 ft	Small streams, springs, and cienegas vegetated shallows.	Species historically occurred in backwaters of large rivers but is currently isolated to small streams and springs.

COMMON NAME	SCIENTIFIC NAME	STATUS	DESCRIPTION	COUNTY	ELEVATION	HABITAT	COMMENTS
Huachuca water umbel	<i>Lilaeopsis schaffneriana ssp. recurva</i>	Endangered	Herbaceous, semi-aquatic perennial in the parsley family (Umbelliferae) with slender erect, hollow, leaves that grow from the nodes of creeping rhizomes. Flower: 3 to 10 flowered umbels arise from root nodes.	Cochise, Pima, Santa Cruz	3,500-6,500 ft	Cienegas, perennial low gradient streams, wetlands.	Species also occurs in adjacent Sonora, Mexico, west of the continental divide. Critical habitat in Cochise and Santa Cruz counties (64 FR 37441, July 12, 1999).
Jaguar	<i>Panthera onca</i>	Endangered	Largest species of cat native to Southwest. Muscular, with relatively short, massive limbs, and a deep-chested body. Usually cinnamon-buff in color with many black spots. Weights ranges from 40-135 kg (90-300 lbs).	Cochise, Santa Cruz, Pima	1,600 - 9,000 ft	Found in Sonoran desertscrub up through subalpine conifer forest.	Also occurs in New Mexico. A Jaguar conservation team is being formed that is being led by Arizona and New Mexico state entities along with private organizations.
Kearney blue star	<i>Amsonia kearneyana</i>	Endangered	A herbaceous perennial about 2 feet tall in the dogbane family (Apocynaceae). Thickened woody root and many pubescent (hairy) stems that rarely branch. Flowers: white terminal inflorescence in April and May.	Pima	3,600-3,800 ft	West-facing drainages in the Baboquivari Mountains.	Plants grow in stable, partially shaded, coarse alluvium along a dry wash in the Baboquivari Mountains. Range is extremely limited. Protected by Arizona Native Plant Law.
Lesser long-nosed bat	<i>Leptonycteris curasoae yerbabuena</i>	Endangered	Elongated muzzle, small leaf nose, and long tongue. Yellowish brown or gray above and cinnamon brown below. Tail minute and appears to be lacking. Easily disturbed.	Cochise, Gila, Graham, Greenlee, Pima, Pinal, Maricopa, Santa Cruz, Yuma	< 6,000 ft	Desert scrub habitat with agave and columnar cacti present as food plants.	Day roosts in caves and abandoned tunnels. Forages at night on nectar, pollen, and fruit of paniculate agaves and columnar cacti. This species is migratory and is present in Arizona usually from April to September and south of the border the remainder of the year.
Masked bobwhite	<i>Colinus virginianus ridgewayi</i>	Endangered	Males brick-red breast and black head and throat. Females are generally nondescript but resemble other races such as the Texas bobwhite.	Pima	1,000-4,000 ft	Desert grasslands with diversity of dense native grasses, forbs, and brush.	Species is closely associated with Prairie acacia (<i>Acacia angustissima</i>). Formerly occurred in Altar and Santa Cruz valleys, as well as Sonora, Mexico. Presently only known from reintroduced populations on Buenos Aires NWR.

COMMON NAME	SCIENTIFIC NAME	STATUS	DESCRIPTION	COUNTY	ELEVATION	HABITAT	COMMENTS
Mexican spotted owl	<i>Strix occidentalis lucida</i>	Threatened	Medium sized with dark eyes and no ear tufts. Brownish and heavily spotted with white or beige.	Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai	4,100-9,000 ft	Nests in canyons and dense forests with multi-layered foliage structure.	Generally nest in older forests of mixed conifer or ponderosa pine/gambel oak type, in canyons, and use variety of habitats for foraging. Sites with cool microclimates appear to be of importance or are preferred. Critical habitat was finalized on August 31, 2004 (69 FR 53182) in Arizona in Apache, Cochise, Coconino, Gila, Graham, Greenlee, Maricopa, Navajo, Pima, Pinal, Santa Cruz, and Yavapai counties.
Nichol Turk's head cactus	<i>Echinocactus horizontalonius var. nicholii</i>	Endangered	Blue-green to yellowish-green, columnar, 18 inches tall, 8 inches in diameter. Spine clusters have 5 radial and 3 central spines; one downward short; 2 spines upward and red or vasally gray. Flower: pink fruit: woolly white.	Pima, Pinal	2,400-4,100 ft	Sonoran desertscrub.	Found in unshaded microsites in Sonoran desertscrub on dissected alluvial fans at the foot of limestone mountains and on inclined terraces and saddles on limestone mountain sides.
Ocelot	<i>Leopardus (=Felis) pardalis</i>	Endangered	Medium-sized spotted cat whose tail is about 1/2 the length of head and body. Yellowish with black streaks and stripes running from front to back. Tail is spotted and face is less heavily streaked than the back and sides.	Cochise, Pima, Santa Cruz	< 8,000 ft	Humid tropical and subtropical forests, savannahs, and semi-arid thornscrub.	May persist in partly-cleared forests, second-growth woodland, and abandoned cultivated areas reverted to brush. Universal component is presence of dense cover. Unconfirmed reports of individuals in the southern part of the State continue to be received.
Pima pineapple cactus	<i>Coryphantha scheeri var. robustispina</i>	Endangered	Hemispherical stems 4-7 inches tall 3-4 inches diameter. Central spine 1 inch long straw colored hooked surrounded by 6-15 radial spines. Flower: yellow, salmon, or rarely white narrow floral tube.	Pima, Santa Cruz	2,300-5,000 ft	Sonoran desertscrub or semi-desert grassland communities.	Occurs in alluvial valleys or on hillsides in rocky to sandy or silty soils. This species can be confused with juvenile barrel cactus (<i>Ferocactus</i>). However, the spines of the later are flattened, in contrast with the round cross-section of the <i>Coryphantha</i> spines. 80-90% of individuals on state or private land.
Sonoran pronghorn	<i>Antilocapra americana sonoriensis</i>	Endangered	Buff on back and white below, hooped with slightly curved black horns having a single prong. Smallest and palest of the pronghorn subspecies	Pima, Yuma	500 - 2,000 ft	Broad intermountain alluvial valleys with creosote-bursage and palo verde-mixed cacti associations.	Typically, bajadas are used as fawning areas and sandy dune areas provide food seasonally. Historical range was probably larger than exists today. This subspecies also occurs in Mexico.

COMMON NAME	SCIENTIFIC NAME	STATUS	DESCRIPTION	COUNTY	ELEVATION	HABITAT	COMMENTS
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	Endangered	Small passerine (about 6 inches) grayish-green back and wings, whitish throat, light olive-gray breast and pale yellowish belly. Two wingbars visible. Eye-ring faint or absent.	Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma	<8,500 ft	Cottonwood/willow and tamarisk vegetation communities along rivers and streams.	Migratory riparian-obligate species that occupies breeding habitat from late April to September. Distribution within its range is restricted to riparian corridors. Difficult to distinguish from other members of the <i>Empidonax</i> complex by sight alone. Training seminar required for those conducting flycatcher surveys. Critical habitat was finalized on October 19, 2005 (50 CFR 60886). In Arizona there are critical habitat segments in Apache, Cochise, Gila, Graham, Greenlee, Maricopa, Mohave, Pima, Pinal, and Yavapai counties.
Acuna cactus	<i>Echinomastus erectocentrus</i> var. <i>acunensis</i>	Candidate	<12 inches high; spine clusters borne on tubercles, each with a groove on the upper surface. 2-3 central spines and 12 radial spines. Flowers pink to purple.	Pima, Pinal	1,300-2,000 ft	Well drained knolls and gravel ridges in Sonoran desertscrub.	Immature plants distinctly different from mature plants. They are disc-shaped or spherical and have no central spines until they are about 1.5 inches. Radial spines are dirty white with maroon tips.
Sonoyta mud turtle	<i>Kinosternon sonoriense longifemorale</i>	Candidate	Primarily a pond turtle, prefers mud or sandy bottoms. Body 3 1/2 to 6 1/2 inches. Head and neck mottled with contrasting light and dark markings. Found in Quitobaquito Springs.	Pima	1,100 ft	Ponds and streams.	Species also found in Rio Sonoyta, Sonora, Mexico.

COMMON NAME	SCIENTIFIC NAME	STATUS	DESCRIPTION	COUNTY	ELEVATION	HABITAT	COMMENTS
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	Candidate	Medium-sized bird with a slender, long-tailed profile, slightly down-curved bill, which is blue-black with yellow on the lower half of the bill. Plumage is grayish-brown above and white below, with rufous primary flight feathers.	Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paz, Maricopa, Mohave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma	< 6,500 ft	Large blocks of riparian woodlands (cottonwood, willow, or tamarisk galleries).	Yellow-billed cuckoos are a neotropical migrant, wintering in primarily South America and breeding primarily in the United States (but also in southern Canada and northern Mexico). As a migrant it is rarely detected, but can occur outside of riparian areas. Cuckoos are found nesting statewide in Arizona below 7000 feet in elevation, but are mostly found below 5000 feet in central, western, and southeastern Arizona. Concern for cuckoos are primarily focused upon alterations to its nesting and foraging habitat. Nesting cuckoos are associated with relatively dense wooded streamside riparian habitat, with varying combinations of Fremont cottonwood, willow, velvet ash, Arizona walnut, mesquite, and tamarisk. Some cuckoos have also been detected nesting in velvet mesquite, netleaf hackberry, Arizona sycamore, Arizona alder, and some exotic neighborhood shade trees.
Gooddings onion	<i>Allium gooddingii</i>	Conservation Agreement	Herbaceous perennial plant; broad, flat, rather blunt leaves; flowering stalk 14-17 inches tall, flattened, and narrowly winged toward apex; fruit is broader than long; seeds are short and thick.	Apache, Greenlee, Pima	> 7,500 ft	Forested drainage bottoms and on moist north facing slopes of mixed conifer and spruce fir forests.	Conservation agreement between the Service and the Forest Service signed in February 1998. In New Mexico on the Lincoln and Gila National Forests.
San Xavier talussnail	<i>Sonorella eremita</i>	Conservation Agreement	Land snail, less than one inch in diameter (about .75 inches), 4.5 whorls, round shell, white to pinkish tint.	Pima	3,850-3,920 ft	Deep, limestone rockslide with outcrops of limestone and decomposed granite.	Conservation agreement signed by the Service, Arizona Game and Fish Department, El Paso Natural Gas Company, and Arizona Electric Power Cooperative, Inc. in September 1998.

APPENDIX B

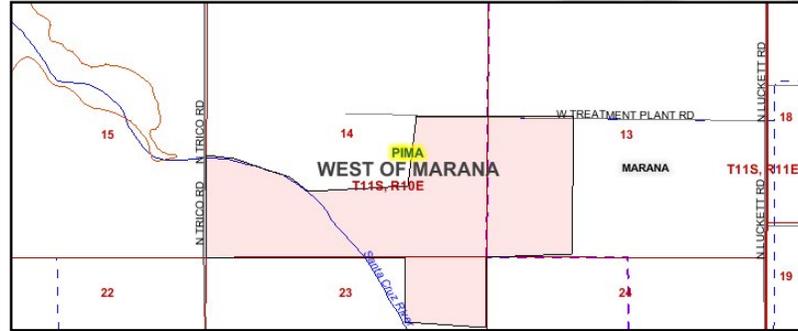
Arizona's On-line Environmental Review Tool

Search ID: 20080806006621

Project Name: Anza Park

Date: 8/6/2008 4:06:10 PM

Project Location



The Department appreciates the opportunity to provide in-depth comments and project review when additional information or environmental documentation becomes available.

Special Status Species Occurrences/Critical Habitat/Tribal Lands within 3 miles of Project Vicinity:

Name	Common Name	ESA	USFS	BLM	State
<i>Athene cucularia hypugaea</i>	Western Burrowing Owl	SC		S	
Bat Colony					
<i>Coccyzus americanus occidentalis</i>	Western Yellow-billed Cuckoo	C	S		WSC
<i>Myotis velifer</i>	Cave Myotis	SC		S	
<i>Tyrannus melancholicus</i>	Tropical Kingbird				WSC

Project Name: Anza Park

Submitted By: Carianne Funicelli

On behalf of: PIMA

Project Search ID: 20080806006621

Date: 8/6/2008 4:06:04 PM

Project Category: Habitat Conservation and Restoration, Upland habitat restoration

Project Coordinates (UTM Zone 12-NAD 83): 472621.968, 3592382.303 meter

Project Area: 353.023 acres

Project Perimeter: 6699.508 meter

County: PIMA

USGS 7.5 Minute Quadrangle ID: 1679

Quadrangle Name: WEST OF MARANA

Project locality is currently being scoped

Location Accuracy Disclaimer

Project locations are assumed to be both precise and accurate for the purposes of environmental review. The creator/owner of the Project Review Receipt is solely responsible for the project location and thus the correctness of the Project Review Receipt content.

Arizona's On-line Environmental Review Tool

Search ID: 20080806006621

Project Name: Anza Park

Date: 8/6/2008 4:06:10 PM

Please review the entire receipt for project type recommendations and/or species or location information and retain a copy for future reference. If any of the information you provided did not accurately reflect this project, or if project plans change, another review should be conducted, as this determination may not be valid.

Arizona's On-line Environmental Review Tool:

1. This On-line Environmental Review Tool inquiry has generated recommendations regarding the potential impacts of your project on Special Status Species (SSS) and other wildlife of Arizona. SSS include all U.S. Fish and Wildlife Service federally listed, U.S. Bureau of Land Management sensitive, U.S. Forest Service sensitive, and Arizona Game and Fish Department (Department) recognized species of concern.
2. These recommendations have been made by the Department, under authority of Arizona Revised Statutes Title 5 (Amusements and Sports), 17 (Game and Fish), and 28 (Transportation). These recommendations are preliminary in scope, designed to provide early considerations for all species of wildlife, pertinent to the project type you entered.
3. This receipt, generated by the automated On-line Environmental Review Tool does not constitute an official project review by Department biologists and planners. Further coordination may be necessary as appropriate under the National Environmental Policy Act (NEPA) and/or the Endangered Species Act (ESA).

The U.S. Fish and Wildlife Service (USFWS) has regulatory authority over all federally listed species under the ESA. Contact USFWS Ecological Services Offices: <http://arizonaes.fws.gov/>.

Phoenix Main Office
2321 W. Royal Palm Road, Suite 103
Phoenix, AZ 85021
Phone 602-242-0210
Fax 602-242-2513

Tucson Sub-Office
201 North Bonita, Suite 141
Tucson, AZ 85745
Phone 520-670-6144
Fax 520-670-6154

Flagstaff Sub-Office
323 N. Leroux Street, Suite 101
Flagstaff, AZ 86001
Phone 928-226-0614
Fax 928-226-1099

Disclaimer:

1. This is a preliminary environmental screening tool. It is not a substitute for the potential knowledge gained by having a biologist conduct a field survey of the project area.
2. The Department's Heritage Data Management System (HDMS) data is not intended to include potential distribution of special status species. Arizona is large and diverse with plants, animals, and environmental conditions that are ever changing. Consequently, many areas may contain species that biologists do not know about or species previously noted in a particular area may no longer occur there.
3. Not all of Arizona has been surveyed for special status species, and surveys that have been conducted have varied greatly in scope and intensity. Such surveys may reveal previously undocumented population of species of special concern.
4. HDMS data contains information about species occurrences that have actually been reported to the Department.

Arizona Game and Fish Department Mission

To conserve, enhance, and restore Arizona's diverse wildlife resources and habitats through aggressive protection and

management programs, and to provide wildlife resources and safe watercraft and off-highway vehicle recreation for the enjoyment, appreciation, and use by present and future generations.

Project Category: Habitat Conservation and Restoration, Upland habitat restoration

Project Type Recommendations:

All degraded and disturbed lands should be restored to their natural state. Vegetation restoration projects (including treatments of invasive or exotic species) should have a completed site-evaluation plan (identifying environmental conditions necessary to re-establish native vegetation), a revegetation plan (species, density, method of establishment), a short and long-term monitoring plan, including adaptive management guidelines to address needs for replacement vegetation.

During planning and construction, minimize potential introduction or spread of exotic invasive species. Invasive species can be plants, animals (exotic snails), and other organisms (e.g. microbes), which may cause alteration to ecological functions or compete with or prey upon native species and can cause social impacts (e.g. livestock forage reduction, increase wildfire risk). The terms noxious weed or invasive plants are often used interchangeably. Precautions should be taken to wash all equipment utilized in the project activities before and after project activities to reduce the spread of invasive species. Arizona has noxious weed regulations (Arizona Revised Statutes, Rules R3-4-244 and R3-4-245). See Arizona Department of Agriculture

website for restricted plants <http://www.azda.gov/PSD/quarantine5.htm>. Additionally, the U.S. Department of Agriculture has information regarding pest and invasive plant control methods including: pesticide, herbicide, biological control agents, and mechanical control: <http://www.usda.gov/wps/portal/usdahome>. The Department regulates the importation, purchasing, and transportation of wildlife and fish (Restricted Live Wildlife), please refer to the hunting regulations for further information http://www.azgfd.gov/h_f/hunting_rules.shtml.

Habitat and forage recommendations are community, location, and species specific. We recommend early and direct coordination with Project Evaluation Program to determine site-specific recommendations.

Minimization and mitigation of impacts to wildlife and fish species due to changes in water quality, quantity, chemistry, temperature, and alteration to flow regimes (timing, magnitude, duration, and frequency of floods) should be evaluated. Minimize impacts to springs, in-stream flow, and consider irrigation improvements to decrease water use. If dredging is a project component, consider timing of the project in order to minimize impacts to spawning fish and other aquatic species (including spawning seasons), and to reduce spread of exotic invasive species. We recommend early direct coordination with Project Evaluation Program for projects that could impact water resources, wetlands, streams, springs, and/or riparian habitats.

The Department's Landowner Relations Program works with the state's private landowners to promote and encourage incorporation of habitat creation and improvement for a variety of wildlife species. The program has grown significantly in recent years offering new alternatives and larger projects to all the cooperators. There are various options under this program to partner with the Department to enhance or restore wildlife habitat. To view specific program options and criteria, please refer to the following link: http://www.azgfd.gov/outdoor_recreation/landowner_relation.shtml

Arizona's On-line Environmental Review Tool

Search ID: 20080806006621

Project Name: Anza Park

Date: 8/6/2008 4:06:10 PM

Project Location and/or Species recommendations:

HDMS records indicate that one or more listed, proposed, or candidate species or Critical Habitat (Designated or Proposed) have been documented in the vicinity of your project (refer to page 1 of the receipt). Please contact:

Ecological Services Office
US Fish and Wildlife Service

2321 W. Royal Palm Rd.
Phoenix, AZ 85021-4951
Phone: 602-242-0210
Fax: 602-242-2513

HDMS records indicate that western burrowing owls have been documented within the vicinity of your project area (refer to the species list on page 1 of the receipt). Please review the relocation procedures recommended for burrowing owls found on the Environmental Review Home Page.

http://mirror-pole.com/burr_owl/bur_owl1.htm

Recommendations Disclaimer:

1. Potential impacts to fish and wildlife resources may be minimized or avoided by the recommendations generated from information submitted for your proposed project.
2. These recommendations are proposed actions or guidelines to be considered during **preliminary project development**.

3. Additional site specific recommendations may be proposed during further NEPA/ESA analysis or through coordination with affected agencies.

4. Making this information directly available does not substitute for the Department's review of project proposals, and should not decrease our opportunity to review and evaluate additional project information and/or new project proposals.

5. The Department is interested in the conservation of all fish and wildlife resources, including those Special Status Species listed on this receipt, and those that may have not been documented within the project vicinity as well as other game and nongame wildlife.

6. Further coordination requires the submittal of this initialed and signed Environmental Review Receipt with a cover letter and project plans or documentation that includes project narrative, acreage to be impacted, how construction or project activity(s) are to be accomplished, and project locality information (including site map).

7. Upon receiving information by AZGFD, please allow 30 days for completion of project reviews. Mail requests to:

**Project Evaluation Program, Habitat Branch
Arizona Game and Fish Department
5000 West Carefree Highway
Phoenix, Arizona 85086-5000
Phone Number: (623) 236-7600
Fax Number: (623) 236-7366**

Terms of Use

By using this site, you acknowledge that you have read and understand the terms of use. Department staff may revise these terms periodically. If you continue to use our website after we post changes to these terms, it will mean that you accept such changes. If at any time you do not wish to accept the Terms, you may choose not to use the website.

Arizona's On-line Environmental Review Tool

Search ID: 20080806006621

Project Name: Anza Park

Date: 8/6/2008 4:06:10 PM

1. This Environmental Review and project planning website was developed and intended for the purpose of screening projects for potential impacts on resources of special concern. By indicating your agreement to the terms of use for this website, you warrant that you will not use this website for any other purpose.
2. Unauthorized attempts to upload information or change information on this website are strictly prohibited and may be punishable under the Computer Fraud and Abuse Act of 1986 and/or the National Information Infrastructure Protection Act .
3. The Department reserves the right at any time, without notice, to enhance, modify, alter, or suspend the website and to terminate or restrict your access to the website.
4. This Environmental Review is based on the project study area that was entered. The review must be redone if the project study area, location, or the type of project changes. If additional information becomes available, this review may need to be reconsidered.
5. A signed and initialed copy of the Environmental Review Receipt indicates that the entire receipt has been read by the signer of the Environmental Review Receipt.

Security:

The Environmental Review and project planning web application operates on a complex State computer system. This system is monitored to ensure proper operation, to verify the functioning of applicable security features, and for other like purposes. Anyone using this system expressly consents to such monitoring and is advised that if such monitoring reveals possible evidence of criminal activity, system personnel may provide the evidence of such monitoring to law enforcement officials. Unauthorized attempts to upload or change information; to defeat or circumvent security measures; or to utilize this system for other than its intended purposes are prohibited.

This website maintains a record of each environmental review search result as well as all contact information. This information is maintained for internal tracking purposes. Information collected in this application

will not be shared outside of the purposes of the Department.

If the Environmental Review Receipt and supporting material are not mailed to the Department or other appropriate agencies within six (6) months of the Project Review Receipt date, the receipt is considered to be null and void, and a new review must be initiated.

Print this Environmental Review Receipt using your Internet browser's print function and keep it for your records. Signature of this receipt indicates the signer has read and understands the information provided.

Signature: _____

Date: _____

Proposed Date of Implementation: _____

Please provide point of contact information regarding this Environmental Review.

Application or organization responsible for project implementation

Agency/organization: _____

Contact Name: _____

Arizona's On-line Environmental Review Tool

Search ID: 20080806006621

Project Name: Anza Park

Date: 8/6/2008 4:06:10 PM

Address: _____

City, State, Zip: _____

Phone: _____

E-mail: _____

Person Conducting Search (if not applicant)

Agency/organization: _____

Contact Name: _____

Address: _____

City, State, Zip: _____

Phone: _____

E-mail: _____

