

KERP

Pima County's Urban Oasis



PIMA COUNTY

INTRODUCTION



We are standing on the edge of a vast basin that's nearly invisible from the surrounding streets. A 2.2-mile paved path for pedestrians and bicyclists hugs the perimeter and is often used by office workers from nearby government buildings as a place for lunch hour exercise.

A member of the Tucson Audubon Society looks into this giant basin near Kino Parkway and Ajo Way and remarks on the ponds and lush vegetation. Willow, ash, cottonwood and mesquite trees were planted in what was once little more than a barren mud flat.

The nearby office buildings belie the surrounding natural environment. It takes some effort to remember we are in the middle of the Sonoran Desert, where 12 inches of rain in a 12-month period is considered a wet year. The Audubon member is looking through the trees at a Great Egret standing motionless on the bank of the pond. A moment later a flash of red darts across his field of vision, and an Anna's Hummingbird settles lightly on a thin mesquite branch.

In less than an hour of wandering the periphery of this manmade flood control and environmental restoration project, the birder points out two Night Herons, a Neotropical Cormorant, a Yellow-rumped Warbler, a

Great Blue Heron, a Cooper's Hawk and two swallows.

This environmental restoration facility is the Ed Pastor Kino Environmental Restoration Project, or KERF for short. It is named for the Arizona congressman who was instrumental in shepherding the project through

Congress. It is a tranquil oasis where the practical and the aesthetic are perfectly blended.

KERF is the end result of a multi-purpose environmental restoration and stormwater harvesting project. The ponds are part of a carefully designed flood control project that collects and captures rainwater from a 17-square mile watershed that includes Davis-Monthan Air Force Base. The harvested stormwater is used to sustain the lush wildlife habitat within KERF. Extra stormwater irrigates Pima County's Kino Sports Complex and surrounding landscaping, providing a significant cost savings to taxpayers.

The lush habitat attracts a wide variety of wildlife and wildlife watchers. More importantly, KERF also protects down-

stream homes and businesses. These areas would be devastated by flooding if stormwater were to follow its natural path from the Eastside of Tucson to the Santa Cruz River.



Due to the high diversity of birds at KERF, it has become a popular birding location

WATER IN THE DESERT



If you stand today on the banks of the Santa Cruz River near downtown Tucson or the Rillito Creek at Craycroft Road, you would be forgiven if you didn't recognize that these now dry riverbeds used to provide year-round water for the lush forests and wildlife that once thrived there.

Some 15,000 years ago, the physical environment of the region was markedly different than it is today. With the wetter and cooler climate during the last Ice Age, large mammals that have long been extinct – the Pleistocene bison, mammoth and camels, for example – could be found grazing in grasslands and drinking from rivers and streams.

Evidence of this history was found at the KERF site in 1990, when a County employee inspecting erosion cuts found a Pleistocene mammoth tusk buried in a prehistoric stream channel along the edge of the earthen basin.

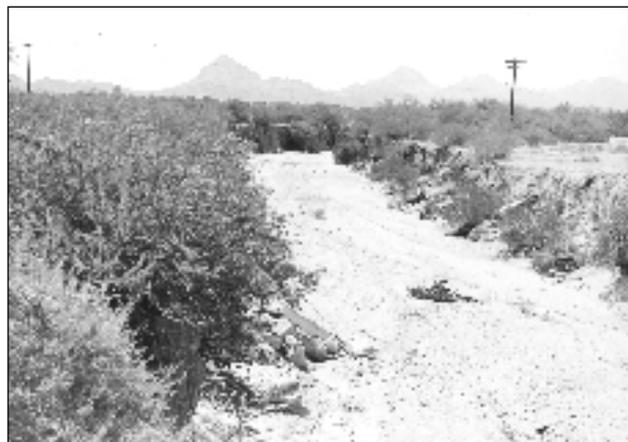
The reasons for the transition from lush aquatic areas to the dry arroyos we see today are numerous, but the rapid increase in the human population beginning in the 1880s and the subsequent urban expansion and groundwater pumping are the main culprits for the more recent drying.

By the year of Arizona's statehood (1912), the Santa Cruz River near downtown was no longer flowing year-round.

Nonetheless, intense rains – especially summer rains – turn the Santa Cruz River and other regional waterways and washes into raging rivers that can overflow their banks and cause flooding.



The Santa Cruz River at the base of "A" Mountain near downtown Tucson in 1904.



Picture of the old arroyo just downstream from present-day KERF, 1961.

Summer rains come fast and hard; and desert soils are incapable of absorbing more than a small percentage of the rainfall. Rain that is not absorbed into the soil very quickly begins to flow laterally across the ground surface, gathering speed and force as it flows downhill. Urban development – pavement in particular – aggravates the situation.



Less than 100 years ago, the area south of downtown Tucson was a broad mesquite-lined wash surrounded by creosote desert that stretched largely unbroken to the south, east and west of the city.

As Davis-Monthan Air Force Base grew and the city expanded to the east, rooftops and pavement covered larger expanses of the desert. Paved streets and runways offered less resistance to the rainwater that fell on the watershed; and stormwater began flowing downhill more rapidly.

A storm on August 9, 1945 was ranked by the National Weather Service (NWS) as one of the top ten weather/climate events to impact Tucson in the last century. The NWS described the destruction and



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deaths caused by the storm: *“The Thunderstorms with heavy rain overflowed the banks of an ordinarily dry wash and tore a 15-foot gap in the bridge on Benson Highway. Four automobiles plunged into the raging torrents where ten people were drowned while four others struggled out of the floodwaters”*

Following this event, flood control became a priority and in 1948 the area’s first major flood control project, the Tucson Diversion Channel, was authorized by the U.S. Congress. The long concrete and earthen channel collects rainwater beginning near the northwest edge of the Air Force Base at Alvernon Way and Golf Links Road. It crosses Tucson’s south side, dumping floodwaters into the Santa Cruz River southwest of the Interstate 10/Interstate 19 interchange.

In 1999, Congress authorized construction of the Tucson (Ajo) Detention Basin Environmental Restoration Project. The project's purpose was threefold: 1) to preserve flood control function, 2) to harvest stormwater for irrigation, and 3) to establish natural and riparian wildlife habitat.

Construction of KERP began in 2000 and was completed in 2001 at a total cost of approximately \$11 million. The project was funded by the U.S. Army Corps of Engineers and Pima County. Local contributions toward the project totaled \$6 million.

The final footprint of KERP covers 121 acres and includes constructed stream courses, five vegetation-lined ponds, restored native vegetation communities and a recreational path that surrounds the basin.



Aerial photograph of KERP looking south.

The project included installation of approximately 850,000 square feet of rubberized liner under the ponds and constructed stream courses. The project also includes a 6-acre, 50-foot-deep, cement-lined water harvesting basin. This basin collects and supplies the stormwater used for irrigation.

The streams are fed by an elaborate stormwater recirculation system, and these streams support over 30 acres of open water ponds, emergent wetlands, ephemeral cienegas, stream courses and mesquite

bosque (bosque is a Spanish term meaning forest). This riparian, or river-supported, area is surrounded by nearly 100 acres of upland vegetation communities.

Several Pima County departments play a role in KERP operations. Basin managers work closely with state and federal agencies to ensure KERP meets the state and federal guidelines set forth for water quality and stormwater detention.

The District performs routine monitoring for mosquitoes and applies a bacterial larvicide Bti (*Bacillus Thuringiensis israelensis*) as needed to protect public safety. Removal of non-native invasive plant and animal species (i.e.: buffelgrass, bullfrogs) helps to conserve urban native species diversity. Pima County can purchase reclaimed

water from the City of Tucson to supplement irrigation needs of wetland vegetation during extended drought.

KERP won the 2006 U.S. Army Corps of Engineers Chief of Engineers Award of Excellence for Environmental projects. According to the Corps, *"This is truly an exceptional project. It takes an existing mud flat in an arid area and creates aesthetic landscapes, recreation features, flood control, and is a prototype for water harvesting. It is technically sophisticated while appearing natural. It has proved sustainable over the recent drought years."*

THE BENEFITS





he goal of the KERP was to establish an ecosystem in a flood control basin.

However, the project also provides recreation and economic benefits.

Flood Control Benefits

On September 15, 2011, 2.64 inches of rain were recorded at Davis-Monthan Air Force Base. More than 16,000 gallons per second of stormwater flowed from the Tucson Diversion Channel into KERP. Because KERP is able to temporarily detain over 400 million gallons (1,230 acre-feet) of stormwater, the outflow westward into the Tucson Diversion Channel was reduced by over a third to less than 10,250 gallons per second.

KERP is designed to reduce the peak flow rate from 85,260 gallons per second to 35,840 gallons per second, during a 100-year storm.

Pima County’s investments in flood control infrastructure (KERP, Rodeo, Kolb Road, Arroyo Chico and Cherry Field detention basins) resulted in the prevention of mass flooding during a September 15, 2011 storm. In a September 22, memorandum to the Pima County Board of Supervisors, Pima County Administrator, Chuck Huckleberry described the value of the County’s flood control infrastructure. Huckleberry explained that if such infrastructure had not been in place on September 15, “...there would have been significant flood damage in developed Tucson, including the downtown area.”

Water Harvesting Benefits

Water harvesting is the collection of rain and surface water runoff. A sophisticated system of irrigation channels dating back to 1200 BCE was discovered on the site of Pima County’s Tres Rios Water Reclamation Facility. The discovery of this site, with at least eight canals and a series of agricultural fields, is evidence that ancient people in Southern Arizona manipulated water flow for their benefit.

KERP differs from most other water harvesting projects by capturing runoff from a stream channel, rather than directly from rooftops or open areas. It captures and directs runoff from a 17.7 square mile watershed into a large system of lined basins. KERP retains over 114 million gallons (350 acre-feet) of water in the constructed ponds. This harvested water is then available for irrigation needs.

Economic Benefits

KERP’S key objectives include the harvesting of stormwater to improve ecosystem function and to meet surrounding irrigation needs. Stormwater is harvested and re-circulated through the stream courses in the basin to support environmental benefits. Stormwater is also diverted and used to irrigate the Kino Sports Complex ball fields, other turf areas, and landscaping at University Medical Center South, Herbert Abrams Public Health Center, Sam Lena Park, and the Public Defenders, Juvenile Court and Adult Probation buildings along Ajo Way.

HARVESTED STORMWATER

Year	Gallons
2002	39,099,480
2003	28,349,074
2004	10,003,639
2005	21,147,758
2006	0*
2007	21,489,902
2008	31,234,361
2009	0**
2010	28,847,627
2011	16,363,011
2012	11,988,074
2013	41,322,247
2014	48,674,288
2015	61,181,975
2016	103,667,096
2017	38,604,462
2018	33,548,552

* Maintenance operation issues

** Lack of rain and stormwater

An annual average of 78 acre-feet of excess stormwater is harvested for the sports complex and other surrounding area landscape irrigation needs. In addition, the vegetation and habitat amenities in KERP are sustained by an annual average of 200 acre-feet of stormwater.

If not for the use of reclaimed water and stormwater that flows into the project, the KERP basin, sports complex and nearby landscape would be irrigated with potable water. Based on the value of potable water calculated at the commercial rate, the use of stormwater has provided taxpayers a cumulative savings of \$5.16 million dollars since project construction. It is projected that the \$6 million local share of the KERP construction cost will be paid off by 2018

Public Recreation Benefits

Proposals to add recreational features to the Ajo Detention Basin came within a decade of its completion. In 1986, Pima County constructed Sam Lena Park adjacent to the basin. Sam Lena Park has two lighted softball fields, a basketball court, nine ramadas with grills, public restrooms and drinking fountains. KERP included a 2.2-mile paved path encircling the basin for walking, jogging, bicycling and wildlife viewing.



Public access to the basin itself is prohibited. Those who are found fishing in the basin will lose their fishing licenses and will be fined.

The Kino Sports Complex, the largest professional sports and entertainment venue of its kind in Pima County, was constructed south of the basin in 1997. The complex uses KERP-harvested stormwater for irrigation of six soccer fields and other turf areas.

The Pima County Stadium District manages the Kino Sports Complex and Sam Lena Park. These facilities are available for youth, high school and collegiate sports, social gatherings, concerts and community events.

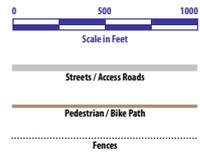
The Loop

KERP and Kino Sports Park are accessible from the Loop. The Loop is 100+ miles of motor vehicle-free maintained paths around the metropolitan area. It accommodates pedestrians, cyclists, skaters and equestrians. The Loop links the Tucson area with Marana and Oro Valley and connects the Rillito River Park, the Santa Cruz River Park, the Julian Wash Greenway, the Harrison Greenway and the Pantano River Park.





KINO SPORTS COMPLEX AREA MAP



KINO SPORTS COMPLEX AREA MAP

KERP is embedded within a complex of sports facilities, municipal service buildings, and health services facilities, most notably the UA Medical Center-South Campus, which serves residents south of downtown Tucson.

Environmental Benefits

KERP provides open water, riparian habitat and upland plant communities. A riparian habitat is made up of the plants and animals associated with streams and rivers. In the desert, these areas are important to many wildlife species. Eighty percent of Arizona's wildlife species depend on the resources of riparian areas. The terrain in KERP, visible from a paved walkway around the perimeter, has several different environments and plant communities.

Open Water

In ponds and lakes, open water is the habitat found beyond the shallow water and plants of the shore. Diving ducks feed in open water, seeking out water insects and aquatic plants. Three species of native toads utilize the ponds including the Great Plains toad, the Great Plains Narrow-mouth toad and the Sonoran Desert toad. Sustainable populations of native aquatic invertebrates provide natural mosquito control. Open water birds include the Mallard, the Northern Shoveler, the Ringnecked Duck and the Belted Kingfisher.

Marsh

Marsh vegetation communities are found in wetlands, where land meets water at the edge of a pond, lake or river. Wildlife thrives in wetland habitat because of the abundant water and the cover provided by wetland plants such as reeds and cattails. Migratory waterbirds rely on wetlands as stopover points during their long journeys in the spring and fall. Wetland birds in the area include the American Coot, Red-winged Blackbird, Great Blue Heron and the Black-necked Stilt.

Cottonwood Willow

Riparian trees like cottonwoods, ash and narrow-leaf willow depend on abundant near-surface water available in river bottoms and banks. Birds attracted to this lush habitat are the Wilson's Warbler, the Black Phoebe, the Song Sparrow and the White-winged Dove.

Mesquite Bosque

A dense stand or "forest" of mesquite trees is called a bosque. Mesquite trees are especially adapted to our dry climate, sending taproots down as deep as 150 feet to reach water during times of drought. Mesquite

bosques provide shade and shelter for wildlife and other plants. Mesquite seeds are rich in protein and are an important food source for many animals. Mesquite bosque birds to look for are the Gila Woodpecker, Ladder-backed Woodpecker, Vermilion Flycatcher and the White-crowned Sparrow.



Grassland

This habitat contains native grasses and small herbaceous plants. It provides forage, nesting and cover for reptiles, small mammals, birds and insects. Grassland birds in the area include Burrowing Owls and various finches and sparrows.

Arizona Uplands

Tucson is located in the Arizona Upland Subdivision of the Sonoran Desert where Palo Verde trees, saguaro, cholla and prickly pear cacti are common. Desert birds nest and forage within the protection of these thorny plants. Other animals such as javelina, jackrabbits and desert tortoises feed on the cactus pads and fruit. Arizona Upland birds include the Red-tailed Hawk, the Gambel's Quail, the Curve-billed Thrasher, the Cactus Wren and the Greater Roadrunner.

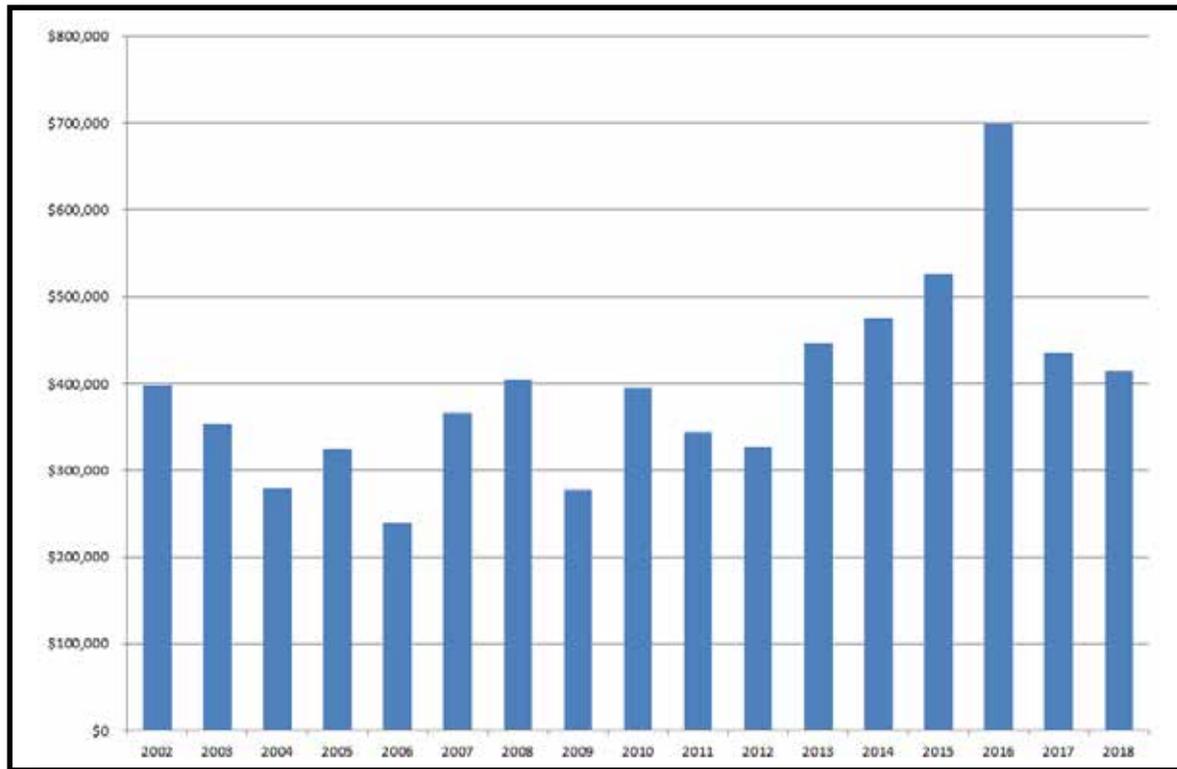
CONCLUSION



After its completion in 2001, the KERP had effectively modified the existing Ajo Detention Basin by integrating a harvested stormwater storage component capable of sustaining native habitats for wildlife, plus providing irrigation for Kino Sports Complex and other landscaping needs. So successful are KERP's water harvesting and restoration features that they serve as an example for future stormwater harvesting projects.

The vision of KERP's planners resulted in the realization of multiple goals: flood control, wildlife habitat, recreation, cost savings and environmental steward-

ship. These multiple objectives were an important departure from earlier visions such as the Ajo Detention Basin with its single purpose (flood control). Like The Loop trail, which connects multiple sections of recreational paths throughout the greater Tucson area into a single path, KERP has proven that integration and connection can create something that is much larger than the sum of its parts. Given limited space within an urbanized environment, projects that meet multiple needs such as KERP will become increasingly needed and successful, greatly benefiting our community and our environment.



Stormwater used in and harvested from the KERP basin has saved taxpayers an average of \$394,400 per year in irrigation costs (calculated at the commercial potable rate).



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