



MEMORANDUM

Date: August 14, 2014

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

From: C.H. Huckelberry
County Administrator 

Re: **Kino Environmental Restoration Project**

Attached is a recently completed brochure for this project. There has and continues to be public interest in the Kino Environmental Restoration Project (KERP). The KERP has become an urban oasis that provides significant environmental and monetary benefits to Pima County.

This project was a cooperative effort between the Regional Flood Control District and the US Army Corps of Engineers. The project transformed a conventional, flat-bottomed detention basin surrounded by a chain link fence and barbed wire to an environmental and water resource community asset.

KERP is the single largest large-scale urban water harvesting project in the state. Stormwater captured that would otherwise evaporate provides irrigation water for the Kino Sports Complex. Today, KERP is full of harvested stormwater that will last well past the winter for irrigating the turf at the Kino Sports Complex. The project was completed in 2001 and has consistently reduced the County's irrigation cost for the Kino Sports Complex every year. It is estimated that since completion, over \$2.5 million in irrigation costs have been saved.

In addition, KERP provides significant public recreational benefit in the form of walking, jogging, cycling, bird watching and a variety of other public uses.

The KERP serves as a model as to what can be accomplished in riparian restoration, river park development and natural river system improvements designed to promote both the environment and the economy.

CHH/anc

Attachment

The Honorable Chair and Members, Pima County Board of Supervisors

Re: Kino Environmental Restoration Project

August 14, 2014

Page 2

- c: John Bernal, Deputy County Administrator for Public Works
- Hank Atha, Deputy County Administrator for Community and Economic Development
- Nanette Slusser, Assistant County Administrator
- Suzanne Shields, Director, Regional Flood Control District
- Linda Mayro, Director, Office of Sustainability and Conservation
- Chris Bartos, Director, Stadium District
- Julia Fonseca, Environmental Planning Manager, Office of Sustainability and Conservation
- Kathleen Chavez, Water Policy Manager, Regional Wastewater Reclamation Department

KERP

Pima County's urban oasis



INTRODUCTION



We are standing on the edge of a crater-like basin that's 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 the 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, including willow, ash, cottonwood and mesquite trees that were planted in what was once little more than a barren detention basin.

The nearby office buildings disguise 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 man-made flood control and environmental restoration project, the birder points out two Night Herons, a Neotropic Cormorant, a Yellow-rumped Warbler, a Great Blue Heron perched on an iron rail, a Cooper's Hawk and two swallows.

The giant basin is the Ed Pastor Kino Environmental Restoration Project, or KERF, named for the Arizona congressman instrumental in shepherding the project through Congress. It is a tranquil oasis where the practical and the aesthetic are perfectly blended.

Its practical value is no more obvious than the fact that most of Tucson is built on sedimentary deposits that generally slope downhill from the southeast to the west. Were this not true, the ponds where birdwatchers

congregate would not exist. The ponds are there because of a carefully designed flood control project that collects and captures in a series of detention basins the rainwater from a 17-square mile area extending downhill from the vicinity of Davis-Monthan Air Force Base.

KERF is the end result of a multi-purpose environmental restoration and storm water harvesting project. The harvested storm water is used to sustain the lush wildlife habitat within KERF, and extra storm water is utilized to irrigate Pima County's Kino Sports Complex and surrounding landscaping, saving taxpayers \$170,000 a year based on the current cost of reclaimed irrigation water.



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

The lush wildlife habitat attracts a wide variety of birdlife and natural history buffs. Most important, the detention basin that contains KERF also protects homes and businesses downstream from the devastating flooding that would result were water allowed to flow unchecked from the East Side of Tucson to the Santa Cruz River.

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 thought these usually dry riverbeds have been a feature of this landscape for hundreds of years. In fact, for thousands of years the Santa Cruz River and Rillito Creek were anything but dry. Indeed, they provided year-round water for the people and plants and animals 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 the grasslands and drinking from the rivers and streams. Evidence of this history was found at the KERP 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 recent drying. By the year of Arizona's statehood (1912), the Santa Cruz River near downtown was no longer flowing year-round.

But heavy desert rains – especially the summer rains – still cause flooding and turn the Santa Cruz and other area waterways and washes into raging rivers.

Summer rains come fast and hard, and desert soils are incapable of absorbing more than a small percentage of any heavy rainfall. Rain that's not absorbed into



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 KERP, 1961.

the soil very quickly begins to run 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, more of the desert floor was inevitably paved. Paved streets and runways offered less resistance to the rainwater that fell in the east and began flowing downhill more rapidly.

For example, the National Weather Service ranks an August 9, 1945, storm as one of the top 10 weather/water/climate stories to impact Tucson in the last century:

Thunderstorms with heavy rain overflowed the banks of an ordinarily dry wash on Tucson's South Side. Floodwaters washing down this normally dry wash 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.

Flood control became a priority and in 1948 the area's first major flood control project, the Tucson Diversion Channel, was authorized. The long concrete and earth channel collects rainwater beginning near the north-west edge of Davis-Monthan, northwest of Alvernon Way and Golf Links Road, and along its length across Tucson's South Side, dumping it into the Santa Cruz River southwest of the Interstate 10/Interstate 19 interchange.



**US Army Corps
of Engineers®**

The channel did an effective job of collecting and directing water from the Air Force base, but significant flooding downstream from the base led to the next major project in the area. The U.S.

Army Corps of Engineers constructed the Ajo Detention Basin in 1966 in the present-day site of KERP to collect water from the diversion channel northwest of Country Club Road and Ajo Way. The \$6 million project resulted in a bare, flat-bottomed pit about 90 acres in size – essentially a mud flat with volunteer scrub trees and grasses growing along the edges.

In 1999, Congress authorized construction of the Tucson (Ajo) Detention Basin Environmental Restoration Project to 1) continue flood control, 2) harvest and store for irrigation use storm water that would have previously seeped or evaporated from the unlined basin, and 3) establish or reestablish natural habitat representing Arizona's southwest riparian environment throughout the detention basin.

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 (\$5 million federal share) and Pima County Regional Flood Control District.

The final footprint of KERP covers 141 acres and includes constructed stream courses, five vegetation-lined ponds, restored native vegetation communities, flood control structures, and a recreational path that surrounds the basin.

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 used to collect and supply the storm water used for irrigation.

The streams are fed by an elaborate storm water 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.

Kino Sports Complex/Stadium District maintains the basin in partnership with Pima County Flood Control District and the Regional Wastewater Reclamation Department. Basin managers work closely with state and federal agencies to ensure KERP meets the state and federal guidelines set forth for the reestablishment and restoration of natural habitat.



Aerial photograph of KERP looking south.

Routine monitoring and treatment of mosquitoes is done to protect public safety. Management to remove invasive plant and animal species (e.g. buffel-grass; bullfrogs) helps to conserve urban native species diversity. Treated ef-

fluent is purchased from the City of Tucson to supplement irrigation needs of riparian vegetation when storm water is unavailable.

The project 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

Flood Control Benefits



In Sept. 15, 2011, 2.64 inches of rain was recorded at Davis-Monthan.

More than 16,000 gallons of storm water were flowing from the Tucson Diversion Channel into KERP per second. KERP was filled to the highest level on record. But because KERP is able to detain more than 612 million gallons (1,880 acre-feet) of water, the flow south and west out of KERP and into the diversion channel was reduced by almost a third to less than 11,000 gallons per second.

KERP is designed to reduce the peak flow rate of a 100-year storm from nearly 115,000 gallons per second to less than 70,000 gallons per second.

Had KERP and a series of other detention basins constructed over the years, including the Rodeo, Kolb Road, Arroyo Chico and Cherry Field detention basins, not been in place on September 15, "there would have been significant flood damage in developed Tucson, including the downtown area," Pima County Administrator Chuck Huckelberry said in a September 22, 2011, memo to the Board of Supervisors.

Water Harvesting Benefits

Water harvesting involves collecting runoff for productive purposes. It is an ancient practice: native people used water harvesting techniques to capture runoff for farming in southern Arizona at least a thousand years ago.

Today, most urban water harvesting systems are small scale; they collect runoff from rooftops and roadways, primarily to irrigate vegetation. Small amounts of water storage may be provided by cisterns either above or below ground level, but many systems pass water directly onto the soil to irrigate plants. As many Tucsonans have learned, when droughts occur, small cisterns are rapidly exhausted.

HARVESTED STORM WATER

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

KERP may be the largest water harvesting facility in southern Arizona. It differs from most other water harvesting projects by capturing runoff from a stream channel, rather than directly from rooftops or paved areas.

KERP was designed to capture and direct runoff from a 17.7 square mile watershed into a large system of lined basins.

Economic Benefits

KERP'S key objectives include the harvesting of storm water to improve ecosystem function and meet surrounding irrigation needs. Storm water is harvested and recirculated through the stream courses in the basin to support environmental benefits.

Storm water is also diverted and used to irrigate Kino Sports Complex ball fields and turf and landscaping at University Medical Center South, Herbert Abrams Public Health Center, and the Public Defenders, Juvenile Court, and Adult Probation buildings along Ajo Way.



If not for the storm water harvesting, the basin, sports complex, and other landscape irrigation would have to be supplied by reclaimed or potable water. Typically, potable water is not used for environmental and recreational irrigation needs due to its superior quality and high cost, with a commercial rate of roughly 220 times the cost of reclaimed water.

Through 2013, the vegetation at KERP has consumed an average of 213 acre-feet of harvested storm water annually, saving taxpayers more than \$1.56 million that reclaimed irrigation water would have cost. In addition, the excess storm water diverted for sports complex and other landscape irrigation has provided savings of \$425,000 compared to the cost of reclaimed water. Based on these savings, the cost of constructing KERP will be paid for by the year 2025.

Public Recreation Benefits

Proposals to add recreational features to the Ajo Detention Basin came within a decade of its completion. A proposal to retrofit the basin for a 70-acre lake was made in 1976. The vision for that project, known as the Ajo Way Detention Basin Wet Park, was to provide recreational opportunities such as boating and fishing, but the project was never realized.

In 1981, recreation was once again the theme of a master plan prepared by Pima County and the U.S.

Army Corps of Engineers. Sam Lena Park was the only element of this plan that was realized through its completion in 1986.

Sam Lena Park has two lighted softball fields, nine ramadas with grills, public restrooms and drinking fountains.

In 1995, the master plan was updated once again to include trails from Sam Lena Park to Interstate 19 and additional recreational facilities around the Ajo Detention Basin. A 2.2 mile multi-use, paved path around the KERP basin is available to the general public for walking, jogging, bicycling, and wildlife viewing including bird watching.

In 1997, Kino Sports Complex, the largest professional sports and entertainment venue of its kind in Pima County, was constructed around the basin. It includes the 11,000-seat Kino Veterans Memorial Stadium. In 2012, Pima County began converting the complex north of Ajo Way to soccer and other grass sports. The North Complex includes the 2,900-seat North Stadium, which is home to the FC Tucson soccer club, and five more fields. Kino Sports Complex facilities are available for youth, high school and collegiate sports; and social gatherings, concerts, and community events.

The Loop

KERP and Kino Sports Complex are also on The Loop, more than 100 miles of car-free paths being developed around metropolitan Tucson, with links to Marana and Oro Valley, for Pima County residents and visitors on foot, bikes, skates and horses. The Loop 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



- Parking
- Gravel Parking
- Buildings
- Exercise Stations
- Ponds & Channels
- Kino Environmental Restoration Project
- Fields
- Complex Buildings
- Pima County Stadium District Administration Offices

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 plus both riparian 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 utilize or depend upon 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, snails and aquatic plants. Four species of native toads utilize the ponds including the Great Plains toad, the Great Plains narrow-mouth toad, Couch's spadefoot toad, and Sonoran Desert toad. Sustainable populations of native aquatic invertebrates provide natural mosquito control. Open water birds to look for are Mallard, Northern Shoveler, 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 like reeds and cattails. Migratory waterbirds rely on wetlands as stopover points during their long journeys in the spring and fall. Wetland birds to look for are 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 the river bottoms and banks. Birds to look for in this lush habitat are the Wilson's Warbler, Black Phoebe, 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 to look for include burrowing owls plus 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, and other animals like javelina, jackrabbits and desert tortoises feed on the cactus pads and fruit. Arizona Upland birds to look for are the Red-tailed Hawk, Gambel's Quail, Curve-billed Thrasher, Cactus Wren and the Greater Roadrunner.

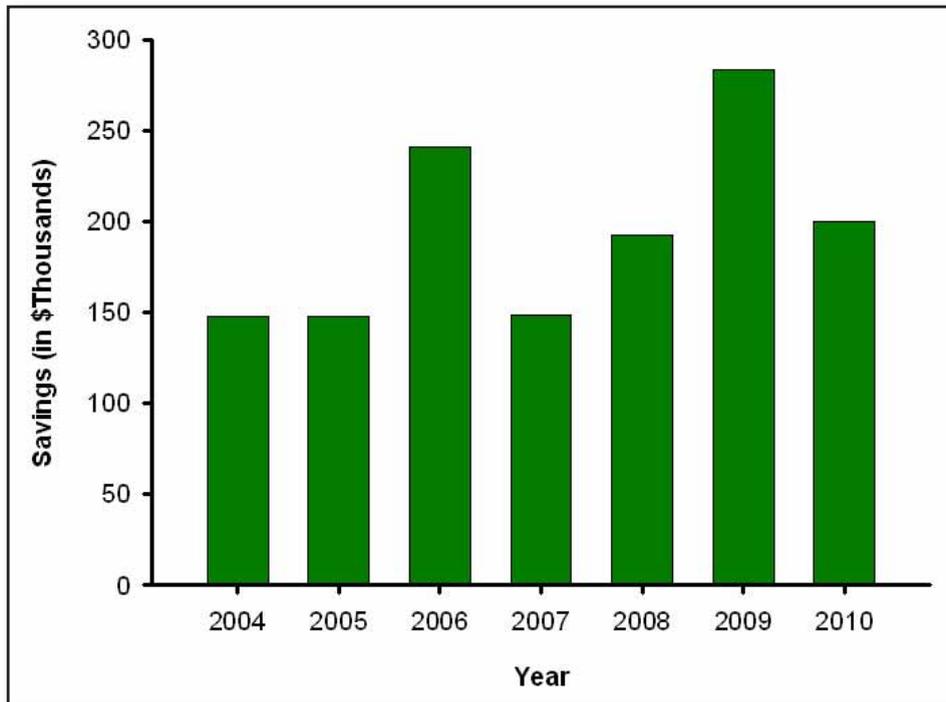
CONCLUSION



After its completion in 2001, the Ed Pastor Kino Environmental Restoration Project had effectively modified the existing Ajo Detention Basin by integrating a harvested storm water 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 storm water harvesting projects.

In many ways, KERP reflects the changing needs, vision and sophistication of the citizens of eastern Pima County and planners who brought together the multiple goals of flood control, wildlife habitat,

recreation, sports, cost savings and environmental stewardship. Realizing these multiple objectives was an important departure from earlier visions such as the Ajo Detention Basin with its single purpose (flood control). Like The Loop trail that is connecting multiple sections of recreation paths throughout the greater Tucson area into a single path, KERP, too, has proven that integration and connection can create something that is much larger than the sum of its parts. Given limited space within an increasingly urbanizing environment, projects that meet multiple needs such as KERP will become increasingly needed and successful, greatly benefiting our community and our environment.



Using a combination of storm water and reclaimed water at the Kino Sports Complex has saved an average of \$195,000 per year since 2004.



PIMA COUNTY

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