



Tucson Water revitalizes Santa Cruz River

The Santa Cruz River Heritage Project in Arizona, United States (US) has replenished the local aquifer and restored flow to the riverbed – creating a wildlife oasis in downtown Tucson, Arizona, according to authors **Dick Thompson** and **Valerie Herman** at Tucson Water.

Starting in Southern Arizona, the Santa Cruz River flows south across the Mexican border, curves north, and continues back through the US, through Tucson, and finally toward the Gila River – a tributary of the Colorado River. The river's original course stretched approximately 388 kilometers (km) (241 miles [mi]), and historical records indicate that the Santa Cruz River did flow most months of the year through the Tucson area until the mid-1900s.¹

Until then, the river supported lush woodlands of cottonwood, willow, and mesquite – as well as communities. Indigenous people created an extensive system of irrigation canals, supporting an agricultural society that lasted thousands of years. From the 1600s and through the 19th century, first Spanish explorers and then Anglo immigrants all depended on the river. Yet, since the 1940s, as

Tucson expanded a combination of groundwater pumping, surface-water diversions, and erosion has left the channel of the Santa Cruz River dry.

The Santa Cruz River Heritage Project

Tucson and the surrounding community are in a semiarid environment. Approximately one million people reside in this part of the Sonoran Desert. Most natural rivers no longer flow year-round due to groundwater mining which dropped the water depth from 8 meters (m) (25 feet [ft]) below surface in some areas, to more than 91 m (300 ft) below surface in the last century.

Tucson Water, a department of the City of Tucson government, serves more than 731,000 people with an average demand of 379 million liters per day (mld) (100 million gallons per day [mgd]). In

the 1980s, Tucson Water developed a separate reclaimed water system to deliver recycled wastewater, which helped offset potable water use for turf irrigation. In the early 2000s, Tucson Water began storing and recovering potable water from the Colorado River via the Central Arizona Project canal – further alleviating aquifer overdraft from the well fields that served most customers.

Starting in 2016, Tucson Water Director Timothy Thomure guided a team of experts to take the Santa Cruz River Heritage Project from concept into planning, design, community engagement, permitting, and construction. The Heritage Project was fully implemented and celebrated on June 24, 2019, with the support of the community and stakeholders. For the first time in almost 80 years, water traveled the Santa Cruz again when the project introduced a ribbon of flowing



Views of the Santa Cruz River showing first release of reclaimed water on June 24, 2019 (above) and (top) post-release river flow. Photos by Placido Dos Santos

reclaimed water to the riverbed near the heart of downtown.

This project is integral to Tucson Water's One Water approach to managing water resources in a holistic way. Its beneficial use of part of the city's recycled water provides a continuous channel flow of up to 3,150 acre (ac)-ft, sometimes extending several km downstream from the point of discharge. The flow has revitalized a section of the waterway that now supports an urban riparian habitat with the return of native plant species and endangered wildlife. The water also replenishes the local aquifer, which supplements the area's groundwater reserves.

The Heritage Project releases 11 mld (2.8 mgd) of reclaimed water into the Santa Cruz River. It is the first effort by Tucson Water – or anyone – to return a sustained supply of water to the river in the downtown area. The utility, together with other regional partners, discharges flows to two other points on the waterway further north of the project. By discharging recycled water in the riverbed near the heart of downtown, Tucson Water strategically ensures more recharged water remains under local control while providing a riparian area in the heart of the community.

Reclaimed water system

Pima County's Regional Wastewater Reclamation Department treats local wastewater and sends a large portion of the finished water to Tucson Water for distribution. The City of Tucson's reclaimed water facility is located next to Pima County's Agua Nueva water treatment facility.

Tucson Water adds chloramine as a biological control for the reclaimed water system. For the Heritage Project, Tucson Water began releasing Class A-treated recycled water into the Santa Cruz River from a newly constructed valve station built onto existing reclaimed water infrastructure. Sodium bisulfite is added at the valve station to remove any residual traces of chlorine.

Designed inhouse by Tucson Water, this cost-effective project maximizes existing reclaimed infrastructure – reflected in the US\$760,000 construction cost and short build schedule. Less than 1,600 m (1 mi) of new pipeline was added. A small treatment facility near the bank of the river dechlorinates flows and is metered to provide real-time monitoring of water quality. Using existing infrastructure and not only tempered capital costs, it also helped

Tucson Water experience lower operational costs.

Tucson Water's reclaimed water system distributes approximately 17 billion liters (l) (4.5 billion gallons [gal], or 13,810 ac-ft), per year through a system of interconnected mains separate from the potable system. Nearly 257 km (160 mi) of reclaimed pipes (purple pipes) provide irrigation water to schools, parks, medians, golf courses, and residential customers. With an abundance of reclaimed water available each day, Tucson Water is able to store unused recycled water using natural infiltration at recharge basins in the winter when customer demand is low.

Recycled water represents about 10 percent of the utility's resource portfolio. The Heritage Project offers additional means to recharge the local groundwater basin and receive groundwater storage credit. The Drought Contingency Plan, passed by Arizona legislators in 2019, increased storage credit for reclaimed water in managed river projects from 50 percent to 95 percent. This change propelled the Heritage Project to its finish.

Tucson is one of the earliest cities to use reclaimed water for turf irrigation. The city's conservation ethic has made water demands modest enough for operational flexibility. This allows the utility to not only store water for the future, but to implement projects such as Sweetwater Wetlands and the Santa Cruz River Heritage Project, which protect and restore the environment.

Ecological diversity

According to University of Arizona School of Natural Resources and Environment Assistant Professor Michael Thomas Bogan, "We expected that species would return to the river downtown, but not quite as rapidly as they have! Within four months of flow being released into the river, over 30 percent of the dragonfly and damselfly species known from the entire state of Arizona had colonized the new stretch of river. We also found several species of native toads and a native garter snake within a couple months. It's been exciting to see all the birds returning to the river too – such as herons, egrets, and kingfishers. The Heritage Project is really providing a wildlife oasis for downtown Tucson."

By providing a reliable input of water to the Santa Cruz River, this project also directly supports the growth of native plant species and return of endangered wildlife. Sonoran Mud Turtles and endangered Gila Topminnows have been



Tucson Water Director Timothy Thomure and John Kmiec at the Santa Cruz River on June 24, 2019. Photo by Placido Dos Santos

found residing in the Santa Cruz River further north, downstream of Pima County's treatment facilities, where treated wastewater has been released into the river for decades.

Discharging water upstream elevates the possibility of these and other species returning to Tucson's urban center. Environmental assessments forecast positive impacts from increased flows on native plant species and wildlife. Within hours of the initial release, coyotes, cottontail rabbits, and roadrunners were seen approaching the flow.

Public and nonprofit engagement

Over four decades, Tucson Water has led Arizona's second largest city from 100-percent groundwater dependency to 95-percent reliance on diverse, primarily renewable water resources such as imported Colorado River water. The introduction of the Heritage Project is a result of long-range efforts to educate customers and encourage efficiency.

Tucson Water and Pima County Regional Flood Control District partner to ensure that the river is managed for environmental and recreational benefits, and also for public health and safety. Engagement and collaboration among local, regional, and state agencies and public, private, and nonprofit interests were critical to making the Heritage Project a reality.

Tucson Water developed a strategic outreach and communication plans around the Heritage Project that included one-on-one briefings and progress reports with stakeholders, community leaders, and elected officials, as well as newsletter articles sent to over

230,000 water account holders (and made available in Spanish). Media releases, short videos, social media posts were created. Presentations were given to community groups, HOAs, neighborhood associations, interest groups, and at conferences. Information was made available for access online. Event invitations were sent via email and social media as well as in flyer form and door hangers. Fact sheets, displays, and maps were created for hand out and download. And, ongoing updates were offered to the public on changes and maintenance.

The official release party and community celebration for the Santa Cruz River Heritage Project was held on June 24, 2019, in partnership with the 22nd Annual El Día de San Juan Fiesta, which celebrates the traditional start of Tucson's summer monsoon season and the birthday of Tucson's patron saint of water, St. John. The Chairman for the San Xavier District of the Tohono O'odham Nation Austin Nuñez offered a blessing in the Arizona heat that morning in the arizona to the Santa Cruz River. A jar of the newly released reclaimed water was collected by the El Día de San Juan Coalition, blessed by Catholic priests, and displayed at an altar during the fiesta.

Financial considerations

Revitalizing the Santa Cruz River with recycled water has had a multiplier effect on overall quality of life through its impact on the environment, economic development, and water resources. The Heritage Project reconnects residents and visitors to a sense of place, history, and culture at the foot of Sentinel Peak in the Tucson Mountains, Tucson's birthplace. Recharging the local aquifer in the area's groundwater basin provides a safety net of water to recover, if needed. The river brings together the public sector, community groups, area businesses, neighborhoods, and environmental groups while improving trust and communication for future projects.

Authors' Note

Dick Thompson is the lead hydrologist and Valerie Herman is a public information specialist at Tucson Water, a municipal water utility that serves residents in the City of Tucson and surrounding communities.

References

1. Web, R.H., Betancourt, J.L., Fontana, B.L., Turner, R.M. (2014). *Requiem for The Santa Cruz: An Environmental History of an Arizona River*. Tucson, AZ: University of Arizona Press.