

RECYCLED WATER INNOVATION AT SAN JOSÉ STATE UNIVERSITY

FOCUS ON EFFICIENCY

Over the course of 20 years, San José State University has worked with public agencies to engineer and install a recycled water system, which both supplies the university and serves as a model for other such projects.

San José State University was the first California State University and one of the first organizations in the state to convert their cooling towers from potable to recycled water. In 2000, when SJSU received approval to undergo this conversion, the City of San José and the San José/Santa Clara Water Pollution Control Plant commissioned guidelines for businesses and organizations for converting their cooling towers to recycled water using the SJSU cooling towers as the case study.

This project has spanned two decades, and South Bay Water Recycling – the agency created to oversee the recycled water system in the south Bay Area – continues to use the university’s system as a case study and the SJSU cooling towers for site visits with potential new customers, who include other colleges and universities, commercial buildings, industrial sites, and data centers.

The objectives of this project included:

- Switching the boiler water feed from potable water to recycled water for more sustainable use of water resources.
- Testing the boiler make-up water (fresh water added to the process to augment water lost through a variety of ways, like evaporation, leaks or humidification) system using a recycled water feed to determine if the current reverse-osmosis pretreatment steps and reverse-osmosis system can provide reliable treatment to meet SJSU’s water quality goals.
- Evaluation and leverage of new technology to reduce energy use and operations costs.
- Increasing the system recovery to reduce the volume of waste streams.
- Maintaining a high level of water quality to meet the boiler feed requirements.

MILESTONES

2000

- Recycled water use is approved at SJSU’s central plant. It is used as make-up water for the campus chiller plant’s cooling tower and replaces the softened potable water used previously.
- Recycled water use for general irrigation of playing fields at SJSU’s South Campus is approved by South Bay Water Recycling and San José Water Company.

2003

- The first dual-plumbed building is constructed on campus at the Martin Luther King Jr. Library.

2005

- SJWC installs an 18-inch recycled water main running east-west on San Fernando Street from 12th Street to just beyond 9th Street to serve San Jose City Hall and King Library.

2011

- Main campus irrigation is converted to reclaimed water.

2014

- The Student Union undergoes a major retrofit and expansion, including the addition of a dual-plumbed system.

QUANTIFICATION AND RESULTS

Total water savings annually is almost 100 million gallons.

Recycled water for irrigation averages more than 70,000 hundred cubic feet (HCF, the most common unit of water measurement and represents 100 cubic feet, which is equivalent to 748 gallons).

Recycled water for indoor non-potable use currently averages more than 8,500 HCF annually. With the addition of new buildings in the next two to three years, the university's recycled water usage will increase by approximately 12,000 HCF.

Recycled water for the cooling towers averages more than 22,000 HCF annually.

Recycled water steam make-up saves approximately 29,000 HCF annually in potable water usage.

IMPACT AND BENEFITS

The use of recycled water for boiler feed at the Central Plant eliminates the single remaining largest potable water usage at San José State University. Use of reclaimed water as a source for steam make-up is an ambitious technical challenge due to the high purity required. SJSU saves almost \$850,000 every year by using recycled water instead of potable water.

Water savings allows the potable water to remain as groundwater, which is particularly valuable when surface water supplies are limited during drought.

The San José/ Santa Clara Water Pollution Control Plant discharges treated wastewater into the surrounding San Francisco Bay salt marsh habitat. This prevents converting the saltwater marsh to a fresh-water marsh and protects the habitat, including two endangered species native to the area.

Gaylord Nelson was one of the most prominent environmental stewards, founder of Earth Day, and graduate of SJSU. In the present day, as more and more of the approximately 35,000 students are becoming concerned about the environment, having recycled water for irrigation, chilling, heating and dual plumbing sets an example for environmental stewardship. Students in majors from engineering to environmental studies are learning about water conservation in their classrooms, from local and state governments, and can see it in practice on campus.

The Central Plant staff gives student tours each semester to show how innovation and teamwork can bring positive and lasting environmental change.

2015

- SJSU begins installation of a new recycled-water main running east-west on San Carlos Street from 10th Street to 4th Street to serve the rest of the campus. The project is financed by the campus with the intention of donating the main to South Bay Water Recycling at the completion of the project.

2016

- Campus Village 2 is completed and is the first building on the main connection. The main will service the Spartan Complex, Student Health and Counseling, and the Student Recreation and Aquatic Center.

2017

- Make-up water is converted to the university's existing boilers, which generate steam from potable water to recycled water, using the university's existing reverse-osmosis equipment.

2018

- A new reverse-osmosis system is designed and implemented; it includes duplex media filters and reclaimed water pre-treatment complete with coagulant mix tank, filtered water tank, chemical feed system, pumps and pipelines within the central plant, and improvements to the plant's mixed bed softener and reverse-osmosis/direct-input membrane system.

2019

- The remaining new buildings with dual plumbing are connected to the completed recycled water main pipeline.

LESSONS LEARNED

1

The most important lesson learned is to coordinate early and often with the local jurisdiction of recycled water. Each application of recycled water SJSU deployed on campus required a new permit. Each permitting process was different, but constant and clear communication with the permitting agency helped avoid delays.

2

A holistic, complete plan to incorporate recycled water throughout all facets of the campus requires a decision made at the campus planning level and solid coordination with the local reclaimed water jurisdiction.

3

SJSU's Boiler Feed Recycled Water Conversion Project required coordination and collaboration with both the off-campus and on-campus community. The use of recycled water for boiler feed make-up required more collaboration than prior uses because of the strict water quality requirements of the boiler as well as the need to minimize the downtime of the Central Plant facilities.

FURTHER REFERENCES

Guidelines for Managing Water in Cooling Systems for Owners, Operators, and Environmental Managers:

<https://www.sanjoseca.gov/home/showdocument?id=37061>

King LEED 2 Water Resources:

http://www.sjsu.edu/fdo/departments/eus/sustainability/king_lib_leed/kingleed2wr/

Water Information:

<https://www.sanjoseca.gov/home/showdocument?id=37061>

SJSU Facilities Development & Operations Information:

http://www.sjsu.edu/adminfinance/about/newsletters/2016/2/fdo_2/index.html

SJSU 2017-2020 Sustainability Report:

<http://www.sjsu.edu/sustainability/docs/Sustainabilityreport2020.pdf>

San José Water Department Information:

<https://www.sjwater.com/our-company/news-media/water-blogged/san-jose-state-university-award-winning-recycled-water-star>

2019 WaterReuse California Annual Conference Program:

<https://watereuse.org/wp-content/uploads/2019/03/2019-CAC-Onsite-Program-Book-FINAL-Single-Pages.pdf>

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San José Water Company

Santa Clara Valley Water District

South Bay Water Recycling



SJSU central plant.



SJSU King Library indoor recycled-water equipment.



The SJSU Cesar Chavez Memorial fountain uses recycled water.



Landscape signage at San José State.



SJSU cooling towers



SJSU's first converted fountain includes signage touting its use of recycled water.



SJSU reverse-osmosis equipment for steam make-up water.