



TEXAS
WATER
TRADE

CASE STUDY: REUSING AIR CONDITIONING CONDENSATE AT RICE UNIVERSITY

Turning an untapped byproduct into a reliable water supply for campus cooling.



Ralph S. O'Connor building on Rice University Campus in Houston, TX.

Photo Dave Burk © SOM

Abstract

Rice University is proving that growth and water conservation can go hand in hand. On campus, in Houston's hot, humid climate, air conditioning systems remove large amounts of moisture from the air, producing a **steady stream of clean water as a byproduct**. This water, called condensate, is typically sent to the sewer system, but can serve as a well matched and reliable source of water to use in place of treated drinking water in evaporative cooling systems. Reusing condensate locally reduces strain on potable water resources and can be a low cost retrofit that **saves millions of gallons and thousands of dollars** for a campus.

Project Description

The Ralph S. O'Connor Engineering and Science Building is a 250,000-square-foot research and classroom facility completed in 2024. The building was retrofitted in August 2025 to capture the large amounts of **condensate produced from the building's heating and ventilation systems**. Drain lines collect condensate from air handling equipment into a storage tank located in the mechanical room where it is treated and pumped to a district cooling plant. At the plant, the condensate is used as make-up water for the evaporative cooling tower, with municipal drinking water serving as a backup supply when additional water is needed.

This system **saves more than 3.4 million gallons of drinking water each year** and paid for itself in 15 months through reduced utility expenses. Rice's condensate reuse project at the Ralph S. O'Connor building demonstrates how facilities within the built environment can function as distributed water resources by transforming an overlooked byproduct into a reliable local water supply. The result is a scalable strategy that can be replicated across campus to reduce potable water demand, lower operating costs, and improve long-term water resilience.

WATER BY THE NUMBERS

- **3.4 million gallons** saved annually
- **15 months** to recover project costs from utility savings
- **64 Houston area homes** can have their annual water needs met through the project's water savings

ABOUT TEXAS WATER TRADE

Founded in 2018, Texas Water Trade is the state's leading nonprofit organization focused on providing scalable, market-based solutions that are addressing Texas' interconnected water needs today and for the future.

ABOUT RICE UNIVERSITY

Rice's goal to become more sustainable in its use of critical resources, including water, is evident in the improvements and investments made across the University's operations. Rice's Office of Sustainability and the WaTER Institute are both key institutions advancing water sustainability on the campus and internationally.

CONDENSATE HARVESTING POTENTIAL

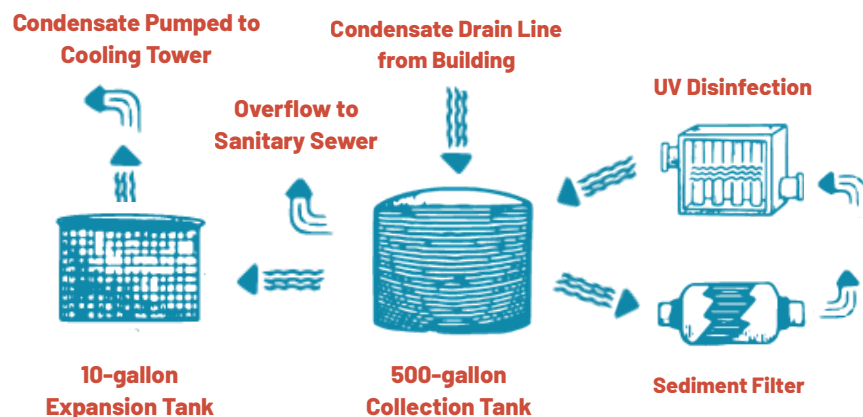
Gallons per year per ton of air conditioning



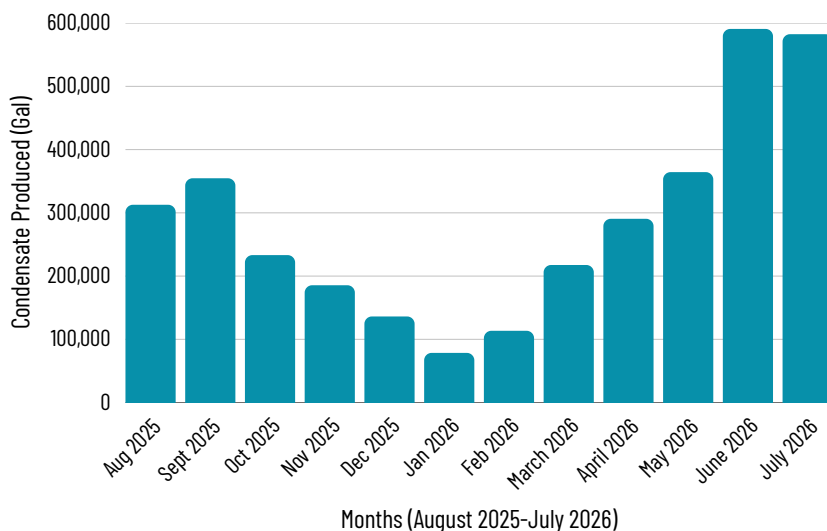
Briones and Mace (2025)

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Simplified Process Flow Diagram of System:



Monthly Condensate Production Chart at Ralph O'Connor Since Installation August 2025:



Lessons Learned At the Ralph O'Connor Building

- 1. Use gravity to simplify condensate collection.** Where practical, condensate should be conveyed by gravity from air handling equipment to a centralized collection tank to reduce the number of pumps and mechanical failure points.
- 2. Use centralized pumping for long-distance conveyance.** When condensate is collected centrally within a building, use a properly sized transfer pump to deliver the water to the final reuse point. Small individual condensate pumps may be appropriate for local collection but should not be relied upon for long-distance conveyance back to a cooling plant.
- 3. Size conveyance infrastructure for future expansion.** The pressurized piping that transfers condensate to a cooling plant should be sized to accommodate future increases in condensate volume. Providing excess pipe capacity during initial construction allows additional condensate collection sources to be connected later without replacing the main conveyance piping. This foresight will reduce future retrofit costs and allow for system scaling without disruption.

Condensate Water Quality Sample Results

- **Temperature:** 57 degrees F
- **Conductivity:** 5.45 microsiemens
- **Resistance:** 150 kilo-ohms
- **Total Dissolved Solids:** 3.89 ppm
- **Oxidizing-Reduction Potential:** 285 millivolts
- **pH:** 10

Project Cost and Return on Investment

Total project cost of \$90,000 included:

- Design of conveyance and treatment
- Installation of equipment and piping
- Integration with existing equipment
- Flow metering and control systems

Total project costs recovered in 15 months through reduced utility expenses.

Next Investigations to Explore:

- Conduct long-term water quality monitoring and a life cycle cost analysis to better understand system performance, maintenance requirements, and the economic value of condensate reuse.

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