THE UNIVERSITY OF ARIZONA
Sustainability & Climate Action Plan

Construct a Wastewater Treatment Plant on Campus

SUSTAINABILITY COMMITMENT(S) THIS INITIATIVE SUPPORTS

- **2 - Water Reduction**
- 10 - Sustainability Research Funding

INITIATIVE ALIGNMENT WITH THE CHARGE

- Eliminate Emissions: This initiative is primarily focused on reducing water use on campus and adding a new alternative water source to offset well water use. If an onsite wastewater treatment plant is built and powered using renewable energy sources, then the plant may reduce a portion of our scope 3 emissions associated with wastewater.
- Build Community: Conserving water on campus by reducing our well pumping while infiltrating more stormwater could have a positive impact on our local aquifer. In the not-so-distant future of water cuts from the Colorado River, this may become a crucial step to ensuring the resilience of our community.
- Be Actionable: There is clear action that could be taken with this initiative, but it requires significant infrastructure investments and long-term planning.
- Be Data Informed: The production and use of onsite reclaimed water would contribute to measurable changes to our current water use and water portfolio makeup, using the current water data monitoring infrastructure. Expanding our existing water data collection methods would help to provide a more complete picture of the different water uses on campuses and could help to focus infrastructure investment efforts to support this initiative.
- Inspire Adaptive Management: The implementation and operation of an on-site water treatment plant could offer several opportunities for collaborative efforts between the academic and research arms of the university, and the operational facilities arm of the university. The University of Arizona is home to dozens of water resource and management experts and researchers, who could assist the university in the implementation of this project while benefiting from future research opportunities.
- Demonstrate Leadership: There are only a handful of other universities around the country who are committing to a goal as ambitious as a net zero water campus, and fewer universities who are treating wastewater on-site. Tucson has been known for decades as a leader in the field of water resource management and conservation efforts in arid environments, and the construction of a wastewater plant on campus to offset millions of gallons of groundwater would continue to set Tucson and the University of Arizona apart as leaders in the field.

INITIATIVE DETAILS

Initiative Summary

This initiative proposes to build an onsite wastewater treatment facility at the University of Arizona to recycle water for non-potable uses, significantly reducing dependency on well water. By treating wastewater on campus, the university can enhance its One Water Program, aiming for a Net Zero Water Campus by managing all water as a valuable resource. This approach will diversify the University's water portfolio and improve resilience against droughts and water scarcity. Actionable items include:

- Develop a facility to treat and recycle campus wastewater for non-potable uses, including utility cooling towers.
- Recognize and manage all water sources (grey water, stormwater, HVAC condensate) as valuable resources to reduce overall water demand.
- Track reductions in water purchased from Tucson Water and sewage flow to Pima County, adjusting strategies to meet net zero water goals.

Proposed Initiative & Background

This initiative builds upon initiative 2.2, “Increase the Use of Non-Potable Water Resources”, and therefore much of the background on the status of water use on campus is covered in those initiatives. In those initiatives, the case is made that achieving a Net Zero Water Campus relies heavily on diversifying our campus’ water portfolio by investing in infrastructure that allows us to capture as many different water sources as possible on campus and in infrastructure that allows us to keep and reuse that water on site. Essential to this diversification of our water portfolio would be to adopt the recommended One Water Program, where the University recognizes the immense value of our water resources, and that all water should be managed as an asset and no water is considered waste. A One Water management approach includes all water sources on campus as potential resources including grey water, wastewater, stormwater, condensate from HVAC systems, passively and actively harvested rainwater, and more. This is the water management style that Tucson Water has adopted for their One Water 2100 Plan, recognizing that in the arid Southwest, we should value all water sources for their potential to help us reduce our demand for water from our aquifers and the Colorado River.

The University of Arizona has the unique advantage of operating several of its own utilities systems and therefore it has control of how different utilities are managed. This makes large-scale projects such as the construction of an on-campus wastewater treatment plant more viable, and possibly even cost-effective. Most campuses and buildings that are striving to reach net zero water status are turning to onsite wastewater treatment as a valuable resource for meeting their water needs with a sustainable water source. The University is already buying reclaimed water from Tucson Water for use in landscape irrigation. This water is wastewater that has been treated by Pima County through its Wastewater Reclamation Program and is then distributed through Tucson Water’s “Purple Pipe” utility system where it is sold to customers around the city. This water is treated to a very high level of quality so that it can be used for irrigation and other non-potable uses. The City of Tucson uses this water to irrigate grass at city parks and they also use it in several city-owned buildings for non-potable appliances (toilets and urinals).

To achieve a true Net Zero Water Campus, the University must begin treating its own wastewater onsite to keep that resource on site. This water could be treated to standards like those of the county (or potentially better) to be used in non-potable water uses, including the campus utility cooling towers. As technologies improve, the university should evaluate elevating the level of water treatment to potable water standards to further offset potable water uses and reduce groundwater pumping.

Onsite wastewater treatment is not a new idea, and many other universities around the country have realized the benefits of maintaining their own wastewater treatment utility on campus, for many of the same reasons the University of Arizona should consider this opportunity. Investing in a campus wastewater treatment plant would expand our options for sustainable water sources and therefore reduce our reliance on well water and other regional water resources, creating a more resilient campus infrastructure that is prepared to handle the prolonged droughts and water scarcity issues that we are already facing.

The University of Arizona should build an onsite wastewater treatment facility to recycle water used on campus for non-potable uses to reduce our dependency on pumped well water. The treated wastewater could then be used in several non-potable water applications that currently use well water. Treating wastewater onsite would also help the University's One Water Program achieve a net zero water goal, by keeping water consumed on campus, on-site.

Feasibility and Anticipated Challenges

Excluding cost as a primary challenge, the other primary areas of concern are water quality and infrastructure requirements. Additional research needs to be done to verify that an onsite water reuse plant of any type could treat the reclaimed water to an acceptable quality level for use in cooling towers and other applications. The well water that is currently used in the cooling towers is recycled 6-8 times before dissolved solids become too concentrated for continued use and is then sent to the municipal sewer system.

In the past, when the University attempted to use Tucson Water reclaimed water, the water was only recycled 2-3 times before it became too saturated with dissolved solids. In this case, using well water might be the more sustainable option as it is recycled and used more efficiently than reclaimed water. Any onsite water reclaim plant must either produce a high enough quality product that can be recycled more frequently through the cooling towers, or it must produce enough quantity of reclaimed water to make up for the lack of recycled water turnover in the cooling towers.

The impacts of on-site water treatment will need to be evaluated in terms of changes in the water bought from Tucson Water as well as reductions in sewage flow to the Pima County wastewater system.

Once a suitable recycled water plant facility has been selected, the next hurdle to overcome is ensuring the infrastructure exists to bring all campus wastewater to a central location and treated, reclaimed water back to all of campus. The University has the benefit of using a district utility system. If the Decarbonization Subplan is fully realized, significant infrastructure work will have to be done to electrify and decarbonize campus. The university could take advantage of this construction to update or build any infrastructure required to support a closed-loop onsite wastewater and reclaimed water system.

Finally, engineering and analysis need to be done to determine the energy demands of an onsite water reclamation facility. The Water Hub system relies heavily on biological digesters and hydroponic systems

which may require less energy use than traditional reverse osmosis or similar models, but total energy demand should be considered when deciding on the best wastewater treatment plant type.

Data Analyses to Support Initiative

In 2022, the University of Arizona purchased 68,897,000 gallons, 211 acre-feet of reclaimed water from Tucson Water at a rate of $3.20 per 1,000 gallons. This amounts to an estimated $220,500 in costs for reclaimed water purchased from Tucson Water. Reclaimed water made up 13% of our consumed water on campus in 2022, but most of our water use is still provided by onsite well water which is considerably cheaper. Once water is used on campus, it is sent to the domestic sewer system, leaves campus, and is then treated by Pima County. The University, like any other utility user, pays the County for its sewage water treatment. In 2022, the University paid approximately $1,017,000 in wastewater treatment utility bills. Since 2012, this annual bill has hovered between $1.0 – 1.25 million.

If the University were to invest in its own onsite water treatment plant, there could be potential long-term savings by reducing how much we pay to Tucson Water for reclaimed water, and how much we pay to Pima County for our wastewater treatment.

In the past, the University had successfully used reclaimed water purchased from Tucson Water in the cooling towers, but this came with two primary disadvantages: reclaimed water is much more expensive compared to well water, and the water quality was much lower than onsite well water which led to excessive water use as more reclaimed water had to be used to get the same cooling benefits. If the University were to invest in an onsite wastewater treatment plant, there would be greater control over the water quality for optimal use in our campus cooling towers. The cooling towers currently use 220,000,000 gallons, 675 acre-feet of water per year or 120,000,000 gallons, 368 acre-feet, if the Decarbonization Plan is fully implemented by 2040.

Similar onsite wastewater treatment plants at other universities have been installed to help offset potable water use, including use in cooling towers. Emory University in Georgia is the most notable example, partnering with a few public and private partners to build a Water Hub treatment plant that can treat up to 146,000,000 gallons, 448 acre-fee, a year of wastewater, to then be reused at several campus steam and chiller plants. The plant at Emory would have enough capacity to meet the University of Arizona's cooling tower needs and then have additional water that could then be recharged into the aquifer or sent to other reclaimed water use applications on campus. A Water Hub project was also proposed for the University of Texas (UT) Austin to treat over one million gallons of water per year to use in their cooling towers, with a plant footprint of just 15,000 square feet. There are other water treatment plant options, but the Water Hub examples are the most common that we have found for a college campus application.

Emory Water Hub Resources:

https://betterbuildingssolutioncenter.energy.gov/implementation-models/reusing-site-water-at-emory-university

https://www1.appa.org/membershipawards/documents/2016_EMORYUNIVERSITY_EFFECTIVEANDINNOVATIVE.pdf

UT Austin Water Hub Proposal:

https://www.nowra.org/Customer-Content/www/CMS/files/SALVATELLI_NOWRA2021_final.pdf

If the University did not want to build an onsite treatment plant, we could increase our purchases and use of reclaimed water from Tucson Water, but this would also require additional infrastructure investments. This water would still need to undergo additional water quality treatments to make it a viable water source for the campus cooling towers. The amount of reclaimed water that would need to be purchased from Tucson Water to offset the water demands of just the cooling towers would cost an estimated $625,000 per year (https://www.tucsonaz.gov/Departments/Water/Commercial-and-Multifamily-Customers/Apply-for-Reclaimed-Water-Service/Reclaimed-Water-Rates-and-Charges). This option should be explored, but it is not an ideal solution if the goal were to become a true Net Zero Water Campus.

Resource Requirements & Return on Investment

Resource Requirements

- Any conversation on water savings at the University of Arizona should start with a conversation that most water conservation projects will never see the same level of return on investment as an energy conservation project would since the University has already invested in the infrastructure to pump groundwater at a very low annual cost to the University.
- There are grant opportunities at the state and federal levels that the University could seek to offset the cost of water conservation infrastructure projects. The Arizona Water Infrastructure Finance Authority (WIFA) offers a Water Conservation Grant Fund for utility-scale water conservation projects and programs up to $3,000,000. The University should also look for wastewater-related grants through federal sources such as the EPA, the Inflation Reduction Act, or the Infrastructure Investment and Jobs Act.
- The Water Hub treatment plants are the product of Sustainable Water, and the capital costs to buy and build a facility are not publicly available online. Additional research and conversations would have to be had to establish any financial feasibility. The Water Hub at Emory was built by Sustainable Water with no upfront cost to Emory. Instead, a water purchase agreement was put in place ensuring that Emory purchased reclaimed water from Sustainable Water. A public-private partnership like this could be explored for the University, but all economic avenues should be explored.

Return on Investment

- It is unlikely that this initiative will ever break even or become cost-effective compared to current water supply pricing.

Potential Funding Sources

- There could be opportunities for partnering with Pima County on grants to build a plant on campus, to reduce the University's contribution to the local sewer system and therefore reduce stress to the system.

Accountable Division(s) & Department(s)

- University Facility Services

Partners & Collaborators

- Office of Sustainability
- All units/departments who are looking to renovate a building, or build a new one
- Tucson Water
- Pima County Wastewater Reclamation

Implementation

Length of Time to Implement

- Less than one year
- One to five years
- More than five years

Difficulty of Implementation

- Low
- Medium
- High
- Extremely High

Relative Timing

- Begin within two years
- Begin in three to five years
- Begin in six years or later

Metrics for Success

- Like initiative 2.2, “Increase the Use of Non-Potable Water Resources,” the primary measurables would revolve around the University’s water portfolio. Building an onsite wastewater treatment facility should allow the University to significantly reduce the amount of potable water that we pump from our wells, while significantly reducing how much wastewater that leaves campus. Instead, it would allow the campus to retain water onsite and reuse it. This would be an important component of a One Water Program and supports the goal of a Net Zero Water Campus.

- Other measurables would be water quality. Active water quality monitoring would need to comply with any state and local requirements for operating a water reclamation site. Additional water quality research should be done on any water that is actively recharged into the aquifer from the plant.