WATER UTILITY CLIMATE ALLIANCE
ENGINEERING CASE STUDIES

TARRANT REGIONAL WATER DISTRICT

PUMP STATION COOLING SYSTEMS

Dallas/Fort Worth, Texas

PREPARING FOR EXTREME HEAT

The Tarrant Regional Water District (TRWD) uses lake pump stations to move water from its water supply reservoirs to its service area in Dallas/Fort Worth. In the past the pump stations used raw water to cool the pumps, but the cooling systems were vulnerable to failure from extreme heat, rising lake temperatures, invasive species and abrasive lake sediment. In 2011, extreme heat days and high lake water temperature caused failure of TRWD's lake water-cooled pumping stations. In 2015, TRWD completed a redesign of its pump station cooling systems. The redesign means that TRWD no longer relies on lake water temperatures for cooling, and the equipment is more resilient to higher temperatures during future drought or extreme heat events.

CLIMATE CHANGE CHALLENGES

In 2011, record drought and multiple high heat days over 100°F led to failure of some of TRWD's drinking water cooling pumping systems. Lake water temperatures in a system supply reservoir exceeded 90°F, making it too hot for pump station cooling systems to function. The district had to cycle pumps on and off as they got too hot, and the multiple starts and stops put additional hydraulic stress on the pipelines and mechanical stress on the pumps. The 2011 event, paired with concern about the increased likelihood of future heatwaves, motivated TRWD to redesign its pump station cooling systems.

CLIMATE-READY DESIGN

Engineers from TRWD and mechanical engineering firm AACE, Inc. explored how to redesign the cooling systems to be more resilient. They chose a closed-loop glycol system which uses an "air-cooled" not "lake-cooled" heat exchange process, similar to air conditioning in a house. This system can more easily cope with very high heat days and is not dependent on the temperature of the raw lake water to operate. An added benefit from this redesign is that it allowed TRWD to add a filtration system to the pump stations, making them less vulnerable to damage from zebra mussels, abrasive sediment and aquatic plants. TRWD's Capital Improvement Program budget funded this project.

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INNOVATION FOR FUTURE EXTREMES

Past experiences combined with increasing concern about the extent and severity of future drought and extreme heat days exceeding 100°F motivated TRWD to make pump cooling systems more resilient to warmer lake and air temperatures and other environmental stressors. With system failure already occurring, it was clear that a redesign was needed for this critical drinking water asset. The innovative approach of designing a closed-loop glycol system occurred in partnership with a mechanical firm who helped assess and identify the current and future risks to the cooling system motors and bearings. This approach enabled TRWD to design a system that would be less exposed to multiple impacts including increasing air and water temperatures, abrasive sediment, aquatic plants and invasive species. TRWD's innovative cooling system design allows the system to tolerate a high range of extreme air temperatures. The cooling towers can reject heat from the glycol system to the air for ambient air temperatures up to 115°F, while providing cooling water at a consistent 78°F all year long. In recent hot summers, the cooling systems have maintained 78°F and have kept the pump stations running.

THE ROLE OF ENGINEERS & STAKEHOLDERS

Following the cooling system failures in 2011, TRWD's engineering managers and the mechanical firm were active and forward-thinking in identifying ways to redesign TRWD's cooling systems to be more resilient to environmental stressors, including drought and extreme heat. Several engineers and the external mechanical firm, which provided critical outside perspective and creativity, were key influencers in this process. Importantly, the redesign process involved support from the Director of Engineering, the lead project manager and the project engineer. This level of engagement meant that the redesign was addressed vertically and laterally within and outside of the organization, with the mechanical firm serving as a trusted partner in the process.

KEY TAKE-AWAYS

Redesign of assets and infrastructure can offer opportunities to address multiple environmental or operational stressors at once. The redesign allowed TRWD to address several impacts on the cooling system including invasive species and abrasive sediment, but to also specifically build resilience to extreme heat and drought. These co-benefits often make it easier and more cost effective to take on these types of system upgrades. Importantly, the motivation for the project was clear across TRWD and included active participation and engagement with senior leadership. Partnership with an outside mechanical firm was also key for integrating new thinking and creativity into the redesign process.

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