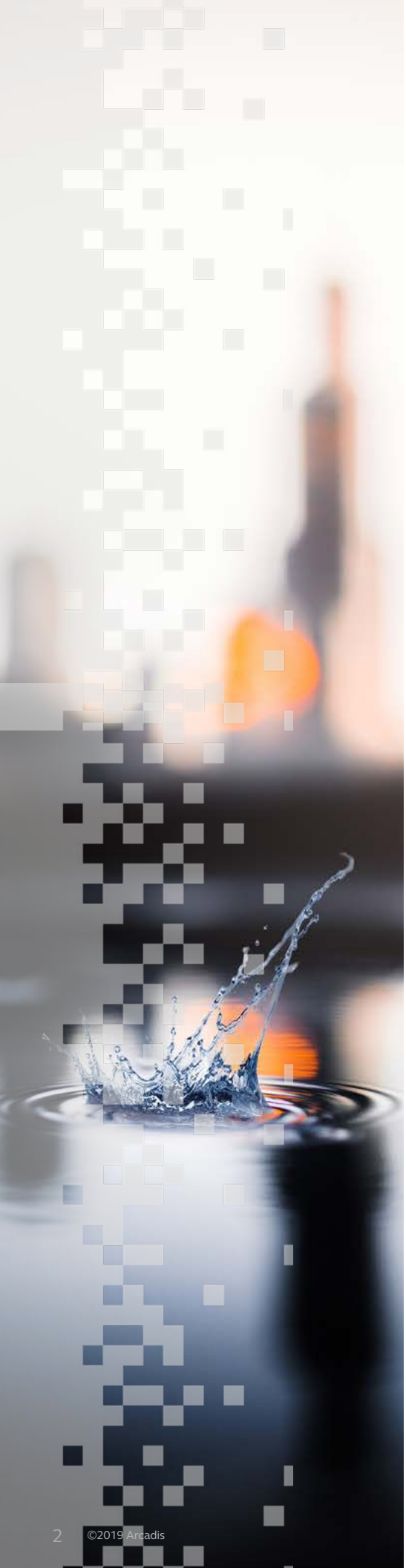
ARCADIS

DEMYSTIFYING INTELLIGENT WATER

Advancing the One Water movement with intelligence

This paper is the second in our Demystifying Intelligent Water series. It examines the importance of One Water and how combining its principles with the advantages of Intelligent Water can be a cornerstone of water sustainability.

Improving quality of life



Water is precious—less than 1% of the world's freshwater is readily accessible.[1] Climate change, prolonged drought, urbanization and population growth are making water scarcer, intensifying the call to make the most of every drop.

Answering the call starts by shifting our thinking to evaluate water based on quality, not origin.

Enter the One Water movement: Strategic action fueled by utilities, cities, industries, legislators and citizens working to create a future where all water—drinking water, wastewater, stormwater, greywater and beyond—is used to improve lives without compromising the ecosystems that depend on it.

Some U.S. cities and communities are already embracing the shift. For example, El Paso (TX) is diversifying its water portfolio with a plan for direct potable reuse, and San Diego County (CA) and Santa Monica (CA) are taking strategic action to reduce dependence on imported water with desalination and sustainable infrastructure.

These forerunners, and others like them, want more reliability and local control. Solutions such as water reuse and desalination, are critical components of the One Water movement. And, as the relationship between technology and the people using it continues to evolve, we can leverage this momentum to ensure that we have enough water in the future.

One Water: Creating a sustainable future with purpose

A recent executive order in California challenged the water sector to think differently and act boldly by developing a comprehensive strategy to build a climate-resilient water system.[2] This call to action, which resonates beyond California, aligns with the game changers who are creating sustainable water futures through innovative, human-centric treatment methods.

Piloting the country's first direct potable reuse plant

El Paso Water

The challenge

Historically, the city of El Paso has relied on a combination of groundwater and surface water from the Rio Grande to meet its potable water demand. However, as population increases and surface water supply remains unreliable, the city has committed to increasing the use of more sustainable supplies.

The solution

El Paso Water (EPWater) is developing a direct potable reuse project to recycle 10 million gallons per day of treated secondary clarifier wastewater effluent. EPWater's Advanced Water Purification Facility (AWPF) will use a direct-to-distribution approach, with the purified water flowing directly into the drinking water distribution system.

EPWater hired Arcadis to establish design criteria for the full-scale facility and obtain regulatory approval from the Texas Commission on Environmental Quality for the concept. A 9-month pilot test of the selected technologies, including reverse osmosis, followed.

The impact

Thousands of water samples were analyzed at state-certified laboratories and successfully demonstrated that highly purified water can be consistently produced with the AWPF process.[3] These results have played an important role in EPWater receiving federal grant funding to move the full-scale project forward. Once complete, the purified water will further diversify El Paso's supply portfolio and make the city more resilient to water scarcity.

Designing the largest, most technologically advanced and energy-efficient seawater desalination plant in the nation

San Diego County

The challenge

Most portions of Southern California rely on imported water from the Colorado River and Bay Delta. Conveying this water uses high amounts of energy, and the supply often falls short during dry seasons. In order to ensure water supplies are available for communities now and in the future, water officials are turning to more sustainable solutions such as desalination.

The solution

The Claude "Bud" Lewis Carlsbad Desalination Plant was built to expand San Diego County's water portfolio during a period of great strain on the region's resources. Owned by Poseidon Water, the plant supplies more than 50 million gallons of drinking water per day to 400,000 residents as part of a purchase agreement with the county. As a project partner, Arcadis provided design and engineering services for the plant, which became operational in just 36 months from notice to proceed using a fixed price design-build delivery method.

Innovative elements that minimized the environmental impact of the new plant included: Reusing an existing seawater intake/discharge conduit for connection to the plant and for concentrated brine disposal, optimizing construction duration and plant reliability with detailed analysis and modeling, and utilizing seawater-friendly construction materials for all piping and equipment.

The impact

The Carlsbad Desalination Plant is a sustainable solution to San Diego County's water challenges and provides a model for desalination plants in areas prone to drought conditions. By providing a locally controlled, drought-resilient supply of water that meets or exceeds all state and federal drinking water standards, the plant can improve quality of life for years to come.

Credit Poseidon Water

Designing a Sustainable Water Infrastructure Project

City of Santa Monica

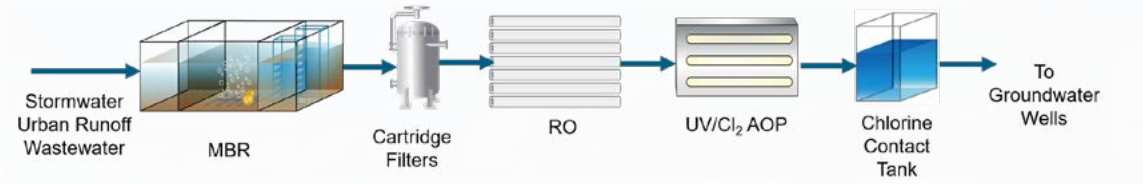
The challenge

The city of Santa Monica projected that, based on existing water sources and infrastructure, there would be a demand gap of approximately 2,300 acre-feet by 2030.[4] As a result, the city council established a goal to be independent from imported water by 2020.

The solution

The city took a major step toward water self-sufficiency by hiring Arcadis, a sub-consultant to Kiewit and design and engineering partner with PREC Water, to develop a solution for treating and reusing brackish groundwater, wastewater and stormwater runoff as part of its Sustainable Water Infrastructure Project (SWIP). An underground Advanced Water Treatment Facility (AWTF) was designed and installed to treat up to 1 million gallons per day of municipal wastewater and stormwater for non-potable reuse.

The AWTF's treatment train includes a membrane bioreactor (MBR), reverse osmosis (RO) system, advanced oxidation and ultraviolet (UV) disinfection capabilities, as illustrated below.



Credit: PREC Water

The team is in the process of receiving the first pathogen credits in California for MBR-based advanced treatment of groundwater augmentation, as outlined in the table below.

Process	Virus	Cryptosporidium	Giardia
MBR[1]	1.5	2.0	2.0
Cartridge Filters[2]	-	2.0	2.5
RO	1.5	1.5	1.5
UV Advanced Oxidation Processes	6.0	6.0	6.0
Free Chlorine	6.0	-	-
Total	15.0	11.5	12.0
Minimum Required	12.0	10.0	10.0

[1]MBR log reduction values based on Australian Tier 1 MBR Validation Protocol as accepted in California State Water Board Division of Drinking Water (DDW) letter to Metropolitan Water District of Southern California dated 5/31/2017 (Review of MWD's MBR LRV Acceptance Protocol)

[2]Cartridge filters approved with California Surface Water Treatment Rule

The impact

SWIP bolsters the city's defenses against climate change, fluctuating precipitation levels and other potential disruptions in water supply. Specific anticipated outcomes include:

- Reduce energy use and greenhouse gas emissions associated with importing drinking water.
- Harvest up to 4.5 million gallons of water from any storm for treatment and reuse.
- Improve beach water quality at Santa Monica Bay by reducing stormwater discharges.
- Comply with stormwater pollution discharge regulations of the State Water Board.
- Recycle up to 1 million gallons per day of municipal wastewater for reuse, including for future indirect potable reuse (IPR) via aquifer recharge.
- Treat up to a 0.5 million gallons per day of stormwater and/or brackish/saline-impaired groundwater for reuse.
- Conserve more than 1,680 acre-feet (about 550 million gallons) of groundwater or imported water per year.

How Intelligent Water can help utilities advance the One Water movement

Water is water—managing it in silos can minimize its value and potential. Intelligent Water is about using advanced technologies and approaches to widen the lens utilities use to make insight-driven decisions that optimize investments of limited resources. Combining Intelligent Water's advantages with One Water's principles creates boundless opportunities to improve quality of life in the near and long term, especially for cities and communities investing in water reuse.

Proactive monitoring and treatment

Utilities and regulatory agencies are embracing advanced monitoring tools and realizing that discrete sampling doesn't capture the water quality fluctuations required to make informed decisions for potable reuse systems. Real-time system monitoring and advanced analytics can provide clear views and control over the water entering, exiting and flowing within the treatment system. With more comprehensive insights at their fingertips, utilities can predict system conditions, prepare for action and ultimately build their resilience.

For example, Artificial Intelligence (AI) can consider contaminant levels, rainfall totals, saturation information and other data to predict when a water source such as stormwater may impact water quality. This insight can help operators isolate the degraded portions of water to prevent it from entering the potable reuse train.

Insight-driven asset plans

Water reuse plans must fit within a utility's overall asset management plan. Implementing advanced asset management tools, including those powered by AI and predictive analytics, can optimize investments in infrastructure rehabilitation and improvements—potentially saving U.S. water utilities $17.6 billion by 2027.[5]

Intelligent Water can help utilities weigh the costs and benefits of adopting reuse solutions in terms of their ability to meet demands and potential impact on levels of service or existing assets. Many utilities are already using lower-cost water sources, and analyses might reveal a reuse plan isn't as financially viable as traditional monitoring and treatment.

Ultimately, Intelligent Water delivers data-driven insights that enable executive stakeholders to identify the optimal approach, one that considers the human-centric elements of resilience and affordability.

Public trust

Convincing the public to embrace reused water can be a high hurdle to clear. It's a matter of perception. Uninformed citizens might fret about the "yuck factor" of reuse, but technology is closing the trust gap by giving people access to information that builds their acceptance of innovative solutions.

Demonstration plants act as living proof

Seeing new treatment methods in action removes the mystery. It serves as living proof that reuse can work, but it's also a public outreach opportunity. Demonstration forums can expedite acceptance, reduce legal challenges, and expand community engagement beyond the reuse discussion.

Data sharing soothes customer concerns

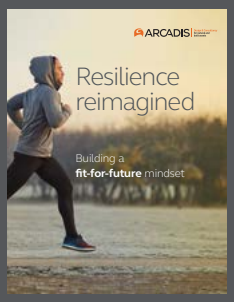
Providing customers with real-time data on advanced treatment effluent and distribution system water quality gives them confidence that what's flowing through the tap is clean and not inferior to other sources. This empowerment might be the best way utilities can demonstrate the value of reuse.

Holistic principles, innovative advantage

More cities and communities are seeing water sources run dry, and shocks and stressors such as climate change and urbanization are magnifying conditions that threaten water quality. Diversifying water supply portfolios with local sources such as reused water now will help utilities create sustainable water futures.

Related Content

Demystifying Intelligent Water: Creating a human-centric future with artificial intelligence and predictive analytics



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About Arcadis

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