CLIMATE CORNER

“Extreme weather events are making water more scarce, more unpredictable, more polluted or all three.”
United Nations.[1]

Water is a Design & Equity Opportunity

How can architects respond to water crises in our communities and beyond?

Water scarcity and inundation are challenges our communities urgently need to address. Currently, there is a 40% gap between global water supply and demand by 2030. Potable water is becoming scarcer and more precious.

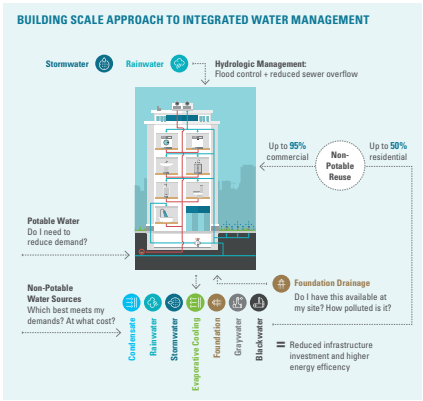
25% of the global population does not have access to potable water. Universal access to clean freshwater is a major concern impacting human health and hindering economic growth.

This crisis manifests in an exacerbation of climate change. 10% of global greenhouse gas emissions come from water extraction, processing, use, and distribution. Excessive extraction causes subsidence and more volatile water vapor in the atmosphere means more intense storms and droughts.

Finally, communities worldwide will be responding to this issue. 90% of natural disasters are water related. The increase in extreme weather events is having a global effect, but impacts are felt at the community level and create long-term vulnerability and change.

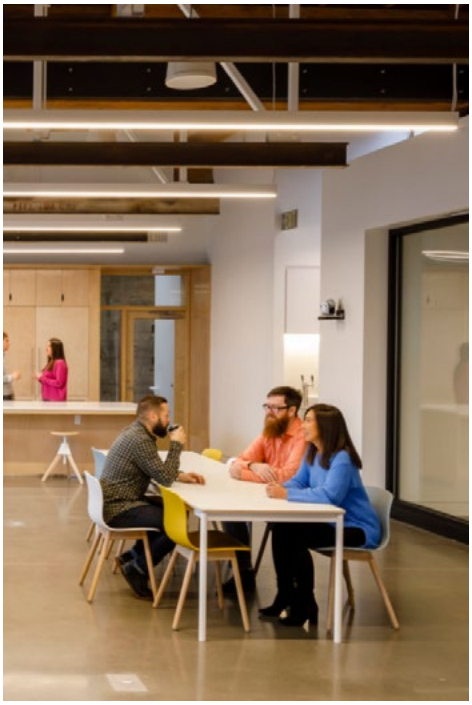
90%+ of water demands in commercial buildings are for non-potable (non-drinkable) uses.

... and about 50% of water demands in residential buildings are for non-potable uses. Designers can make an immediate impact to reduce potable water demand by incorporating rainwater capture and greywater treatment for appropriate uses like toilet flushing, some HVAC process water uses, and irrigation. The free William J Worthen Water Reuse Practice Guide has multiple guidelines and best practices to incorporate reuse strategies.[2]



[1] https://www.unwater.org/water-facts/water-and-climate-change

[2] https://worthenfoundation.org/water-reuse-practice-guide



Mahlum Office, Portland OR
Mahlum

All projects, even interior TIs, can make an impact on embodied water with thoughtful material specifications. Gypsum wallboard selections in Mahlum’s office saved 25% of embodied water, saving 7,837 gallons (equivalent to 4,898 toilet flushes).

The Dixon Foundation Josey Pavilion, Decatur TX
Lake|Flato Architects

This example illustrates a rigorous and holistic response to water cycles, from collection, storage, sewage conveyance, on-site treatement, and visitor education. The adjacent constructed wetland cleanses and returns all of the water used in the pavilion back to the aquifer.

AIA

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Site & Community Strategies

- Designing towards water-efficient systems can provide outsized impacts to low income communities, where water cost impacts are felt the most. The EPA estimates the country needs to spend $655 billion over the next 20 years to upgrade water and sewer systems. Around 240,000 water mains break a year, contributing $2.6 billion in lost drinking water.
- When possible, design for non-potable water systems. We can be more vigilant about and advocate for technologies, policies, and building codes which decrease our use of potable drinking water. Using potable water for non-potable needs like irrigation, toilets and HVAC is a luxury. Because of this, in the coming years, we will see rainwater capture in building codes, which is already happening in Canada and Europe.
- In larger complexes and masterplans, architects can educate clients and advocate for grey and blackwater treatment strategies, which can provide resilience and cost benefits for whole communities.

Beyond Fixtures

- Architects can design for water beyond specifying low-flow toilets. By simply providing a low-EUI building, designers can reduce freshwater use (the "water-energy nexus").
- 100 gallons of potable water — the amount used daily by the average person at home in the U.S. — takes about 1.1 kWh of energy to treat and distribute, according to a 2011 study by researchers at the University of South Florida. That's a lot more energy than an efficient refrigerator uses in a day.
- We have influence of water in the construction phase, by advocating for certification systems, like LEED and the Living Building Challenge, which address water and encourage the collection of data about how much water – usually potable – is actually being used on site.
- We also can work with our structural engineers and contractor teams to select concrete admixtures that have low embodied water.
- A "net zero water" building design may seem out of reach, but the strategies exist today and will pay off in the near future. Make sure your team discusses simple strategies like infiltration, rainwater capture, and wastewater treatment.

How to Track Progress

The AIA Framework For Design Excellence[3] offers several measurable criteria to help designers assess the water impacts of designs.

Under Design for Water, the following topics are explored:

- Equitable access to water systems
- Water system resilience
- Scale & equity
- Potable water efficiency
- Outdoor water use reduction
- Process water reuse
- Evaporative cooling equipment or
- cooling towers
- Boiler and steam systems
- Greywater and/or blackwater reuse
- Net zero water buildings

A number of references are found in the "Resources" section that can provide specific guidance, best practices, and tools to help with goal-setting with clients.

Arch | Nexus SAC, Sacramento, CA

Holli Adams, Architectural Nexus

Adaptive reuse projects with site constraints also have leverage to respond to water demands. This example sought to help reform water reuse policy and regulation in California. In this example, ground conditions were not receptive to stormwater infiltration; the design incorporated cisterns to capture rainwater onsite for reuse; overflow stormwater is then treated before flowing into the Sacramento river.

Anticipating Future Water & Design Challenges

Evolutions in codes. Many local states and jurisditions are incorporating more stringent stormwater regulations to address stormwater management challenges. Massachusetts has proposed stormwater regulations that would require developments with more than five acres of impermeable surfaces to treat the results of rainwater runoff. (For developments in certain watershed districts, that amount would be reduced to three acres.) And that includes roofs, as well as sidewalks and parking lots.

Fixtures & technology advancements. Vacuum toilets, which employ suction to remove solid waste, consume only about 1 liter per flush, which is approximately 75 percent less than typical water-efficient toilets. The smaller volume of flush water diluting urine and feces makes it cheaper to turn human wastes into biogas – an energy-rich substance that can replace natural gas.

Water reuse payback. Estimates are that onsite water systems would increase the construction costs of typical multi-family dwellings by 6-12 percent. However, accounting for operations, maintenance, and safety monitoring, the researchers estimated that net zero water systems would pay for themselves after only a few years in most parts of North America and Western Europe.

3 https://www.aia.org/design-excellence/aia-framework-design-excellence