The Water Report

Water Rights, Water Quality & Water Solutions in the West

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UNDERSTANDING ONE WATER

A TUCSON WATER CASE STUDY

by Jamie Galayda, Tucson Water (Tucson, AZ)

Editor's Introduction: What is One Water?

This issue of The Water Report offers two articles that help define frameworks that are growing in popularity across the nation—One Water and One Health—using Arizona as a case study.

One Water is a philosophy that is spreading, maturing, and reaching new communities and diverse people. According to the US Water Alliance, One Water is a transformative way of viewing, valuing, and managing water (*see* https://uswateralliance.org/). The One Water approach considers all management of water—whether from the tap, a stream, a storm, an aquifer, or a sewer—in a collaborative, integrated, inclusive, and holistic manner. As the movement and its impact grows, there is hope that One Water methods can be used to solve water challenges. In November 2023, the One Water Summit took place in Tucson, Arizona. This article describes Tucson Water's approach to implementing and integrating the One Water philosophy.

Tucson Water Background

"If there is magic on this planet, it is contained in water." — Loren Eiseley

Water in the desert is precious. Tucson Water, a proud department of the City of Tucson, has always taken its role as a steward of this resource seriously. Tucson is one of the most water-resilient cities in the Southwest due to the community's strong conservation ethic, a diverse water resource portfolio, and ongoing adaptive management and proactive planning efforts. Tucson Water is the largest water provider in the region, and One Water 2100 is the latest update to the long-range water resource planning efforts. Tucson Water updates its water resource plan every decade or so to ensure projected supplies can meet projected demands.

The water challenges being faced require out-of-the-box thinking and collaboration across disciplines. The One Water approach to water management was used for this planning update because it focuses on equity and sustainability to ensure water resilience for decades to come. The Water Research Foundation's *Blueprint for One Water* (2017) defines One Water as an integrated planning and implementation approach to managing finite water resources for long-term resilience and reliability, meeting both community and ecosystem needs.

It can be difficult to understand One Water without specific examples. This article uses Tucson's unique water management history combined with the One Water initiative to illustrate the benefits of integrated water resource management.

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One Water

Demand

Recharge & Recovery

Tucson's One Water Story

Careful management of water resources is critical to Tucson's long-term sustainability. Tucson's water resource portfolio includes surface water, groundwater, recycled water, and rain and stormwater harvesting, as shown in Tucson's historical water production graph (Figure 1).

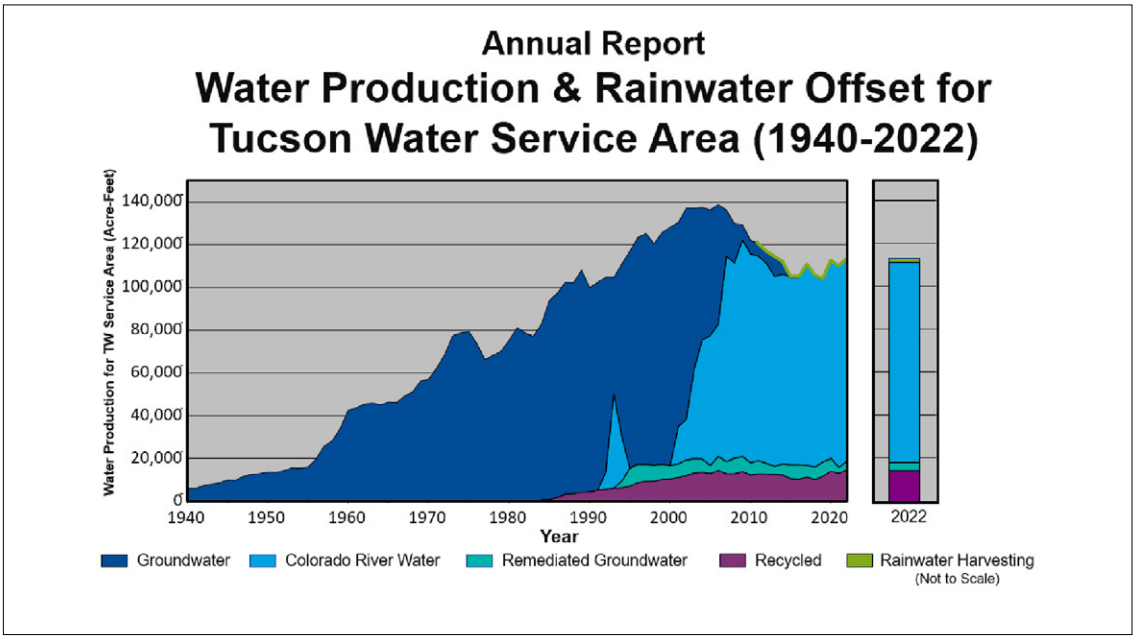

Figure 1. This graph shows the evolution of Tucson's water supply dating back to the 1940s. In the mid-80s, Tucson Water began to diversify its supply beginning with recycled water and then by adding groundwater storage in the 90s. Stormwater capture is a small, but growing source of today's portfolio.

Decades of proactive planning and policymaking have increased supply diversity, groundwater savings, and aquifer levels. Renewable Colorado River water delivered via the Central Arizona Project is the primary source of drinking water. Colorado River water is recharged in Avra Valley and recovered through wells as needed to meet demand. Because consumption levels are low, about a third of Tucson's Colorado River water allotment is saved every year. Additional access to groundwater supplies will last for several decades. In 2023, Tucson's mayor and council agreed to keep some of this allocation in Lake Mead in a coordinated effort to keep the reservoir levels up (*see* https://content.govdelivery.com/accounts/AZTUCSON/bulletins/3683a73).

Tucson was one of the first communities in the country to reduce potable water consumption with a reclaimed system. Recharged recycled water provides another back up to Colorado River water supplies. Using harvested rain and stormwater to irrigate trees and plants increases the ability to adapt to climate change and further reduces demand for both Colorado River water and reclaimed water.

A common way to measure demand for water utilities is **g**allons **p**er **c**apita per **d**ay (GPCD). Tucson's residential GPCD has consistently been among the lowest in the Southwest. Tucson has a relatively low residential GPCD, due in large part to the water conservation program which was established in the early 1970s. Conservation programs continue to promote more efficient use of existing water resources. Tucson Water offers rebates for high-efficiency toilets, washing machines, and urinals. Training opportunities and incentives to use water more efficiently are also available.

SURFACE WATER

Tucson Water's share of Colorado River water is just over 144,000 acre feet per year. Tucson began receiving Colorado River water via the Central Arizona Project (CAP) canal in the 1990s. This renewable surface water source goes through a process known as recharge and recovery. There are large, shallow basins at delivery points along the canal in Avra Valley and just south of Tucson. When Colorado River water fills these basins, it infiltrates the pores between bits of sand and rock and eventually settles down on top of the aquifer. This is known as groundwater recharge. The amount of water needed to satisfy customer demand is pumped back out through wells during the recovery process.

One Water

Like any other surface water resource, the availability of Colorado River water depends on precipitation, especially snowpack, in the Colorado River watershed. Drought has impacted the amount of snowpack in the Rockies and, thus, water in the Colorado River. Tucson Water's Drought Preparedness and Response plan describes how the Colorado River water allocation will be impacted and how Tucson will respond (https://www.tucsonaz.gov/Departments/Water/Water-Resources-and-Drought-Preparedness/Drought-Preparedness).

GROUNDWATER

Before the early 2000s, Tucson was the largest metropolitan area in the United States completely dependent on groundwater. Recovered Colorado River water now supplies the vast majority of drinking water needs. This shift can be seen in Figure 1.

Finite v. Renewable

Groundwater is considered a finite water resource because the aquifer developed on a geologic time scale and does not receive much natural recharge each year. In contrast, Colorado River water delivered through the CAP is considered a renewable resource because it is fed by snowmelt each year and replenished in a human timescale.

Assured Supply

The Arizona Groundwater Management Act was established in 1980 to better manage groundwater withdrawals. This law laid out the Assured Water Supply (AWS) rules, which govern the amount of groundwater that water utilities can pump or produce with wells. Ever since Tucson Water transitioned to renewable water supplies, aquifer levels have been rising in some areas, especially in the vicinity of the Avra Valley recharge and recovery projects. Balancing groundwater recharge and withdrawals is the main goal of the Groundwater Management Act.

RECYCLED WATER

Recycled water resources in Tucson include both reclaimed and gray water. Reclaimed water is wastewater that has been treated to high quality standards and is used primarily for irrigation. Gray water comes from bathroom sinks, showers, baths, or washing machines and can also be used for irrigation. Using reclaimed and gray water for irrigation reduces the demand for potable water thereby stretching renewable water resources further out into the future.

IGAs

In 1984, Tucson was one of the first cities in the country to begin recycling water by treating wastewater for irrigation and other non-potable water uses. The first customer was a golf course, but now the reclaimed system serves the vast majority of parks, schools, municipal properties (via **i**nter**g**overnmental **a**greements or IGAs), and golf courses throughout the region in addition to some residential customers.

Demand Cycles

Demand for reclaimed water increases during the hotter, drier summer months. This is known as the peak-demand period. Tucson Water's reclaimed system reaches capacity during the peak-demand period, but it has excess capacity during the winter months. Reclaimed water produced during the off-peak period that isn't being used by customers is used to replenish the aquifer through recharge projects like the Southeast Houghton Area Recharge Project, Santa Cruz River Heritage Project, and the Sweetwater Recharge Facility.

STORMWATER

Rain and stormwater harvesting contributes a small but growing component of Tucson's water supply. Although it is unmetered, the estimated amount of rain and stormwater collected is represented by the green band in Figure 1.

Active & Passive

There are two general categories of rainwater harvesting: active and passive. Active rainwater harvesting refers to a tank or cistern storing rainwater collected from roofs, which provides a means to store the rainwater for later use. Passive rainwater harvesting refers to directing and retaining water in the landscape using site appropriate practices such as basins, berms, terraces, swales, and infiltration trenches.

Storm to Shade

Stormwater harvesting refers to rainwater collected from non-roof surfaces, such as streets, parking lots, hardscapes, and landscapes. Strategies to capture and utilize this water include landscaping design to retain water in soil, semiporous hardscape material, curb cuts, and detention/retention basins. The City of Tucson's Storm to Shade program builds green infrastructure on City property to harvest stormwater and support vegetation (for more information *see* https://climateaction.tucsonaz.gov/pages/gsi).

One Water

Timeline

Engagement

Plan Alignment

Outcomes

Projections

Tucson's One Water Approach

Tucson's One Water story explains the origins of the community's conservation ethic and diversified water supply portfolio, but adaptive management and proactive planning are also essential aspects of water resilience. Tucson Water's One Water 2100 plan is the most recent version of the long-range water resource plan. Mayor and Council adopted the plan in October 2023 and implementation of many of the strategies identified in the plan have begun.

Figure 2. One Water 2100 replaces Water Plan: 2000 – 2050 with a new existing conditions analysis and water use projections. The scenario projections in One Water 2100 demonstrate that there are enough water resources to serve a growing population throughout the plan's 80-year timeline.

Previous water resource planning efforts had limited public engagement, but that is now a central aspect of One Water 2100. This update began in 2019 and targeted stakeholders were invited to participate in the initial phases of the plan's development. Mayor and council, as well as members of the Citizens' Water Advisory Committee, were interviewed and workshops were held to develop conservation projections and scenario planning.

During the COVID-19 pandemic, the engagement campaign was put on hold for the safety of the community and staff. A broader campaign was developed during the pandemic pause to ensure statistically significant and equitable community engagement.

The community engagement campaign began in the spring of 2022. Tucson Water developed goals and objectives for the campaign as well as key messages for the target audience. The community engagement plan came to Mayor and Council for review in July 2022. The major achievements and initial outcomes of the campaign were presented to Mayor and Council in January 2023.

The development of the One Water 2100 plan was carefully aligned with Tucson Resilient Together—the City of Tucson's Climate Action and Adaptation Plan—to ensure that both plans address the community's concerns about climate change and water resilience. The recommendations and strategies in both of these plans will inform the stakeholder sessions currently being organized for Plan Tucson—The City of Tucson's General Plan update.

The key outcomes of the community engagement campaign were four future scenarios and 16 prioritized strategies that are designed to ensure water resilience well into the future. Water resources and demand management were identified as the two primary areas of concern, so the strategies focus on making the best use of Colorado River water, finding more ways to use reclaimed water, expanding the beneficial uses of stormwater, and continuing to reduce the community's overall demand.

Over 80 people and organizations submitted hundreds of comments during the public comment period. Many comments were supportive of the plan and its content. Specific edits and numerous suggestions were incorporated into the final draft that was adopted by Mayor and Council in October 2023.

Planning Scenarios

A comparison of projected supply and demand changes through the year 2100 was completed for the four scenarios created during the stakeholder workshops. These scenario projections attempt to characterize the uncertainty related to changes in water supplies and demand. The four scenarios, created with stakeholder input, are labelled as follows: Sustainable Oasis, Desert Oasis, Counting Buckets, and Thirsty Desert. Each scenario considers a different combination of projected water demand, measured by

One Water

Demand Scenarios

GPCD, and water supplies, measured in **a**cre **f**eet per **y**ear (AFY). The water use projections include two plausible scenarios of future water use through 2100:

Increasing Demand: This scenario assumes that water demand will continue to increase into the future. It is based on an increasing population with a potable per capita water use that is held constant at the recent average value of 120 GPCD. Under the increasing demand scenario, potable water use is expected to increase by 29 percent, or just under 29,000AFY, to an estimated total of 127,000 AFY by 2100.

Decreasing Demand: This scenario assumes that water demand will remain relatively flat into the future. It is based on an increasing population with a potable per capita water use that reduces by 20 GPCD to 100 gpcd by year 2100. A gradual long-term reduction in GPCD was assumed. Under the decreasing demand scenario, potable water use is expected to increase by 8 percent, or just under 8,000 AFY, to an estimated total of just under 106,000 AFY by 2100.

Supply Scenarios

The supply assumptions in the One Water 2100 plan test Tucson Water's resilience against long-term shortage conditions for the City's Colorado River allocation. Two scenarios looking at Tucson Water's future supply availability under different estimated reductions to Tucson Water's CAP allocation were considered and are defined below:

Increasing Supply Availability: This scenario assumes that the shortages to Tucson Water's CAP allocation will be no greater than existing shortage-sharing agreements on the Colorado River. It is based on a long-term Tier 3 drought declaration under the Lower Basin Drought Contingency Plan from 2019. Under this scenario, it is estimated that the City's CAP allocation would be cut to 124,000 AFY.

Decreasing Supply Availability: This scenario assumes that the shortages to Tucson Water's CAP allocation will be significantly greater than existing shortage-sharing agreements on the Colorado River. It assumes a long-term 50-percent reduction in Colorado River water supplied by the CAP starting in 2026. Under this scenario, it is estimated that the City's CAP allocation would be cut to 72,000 AFY.

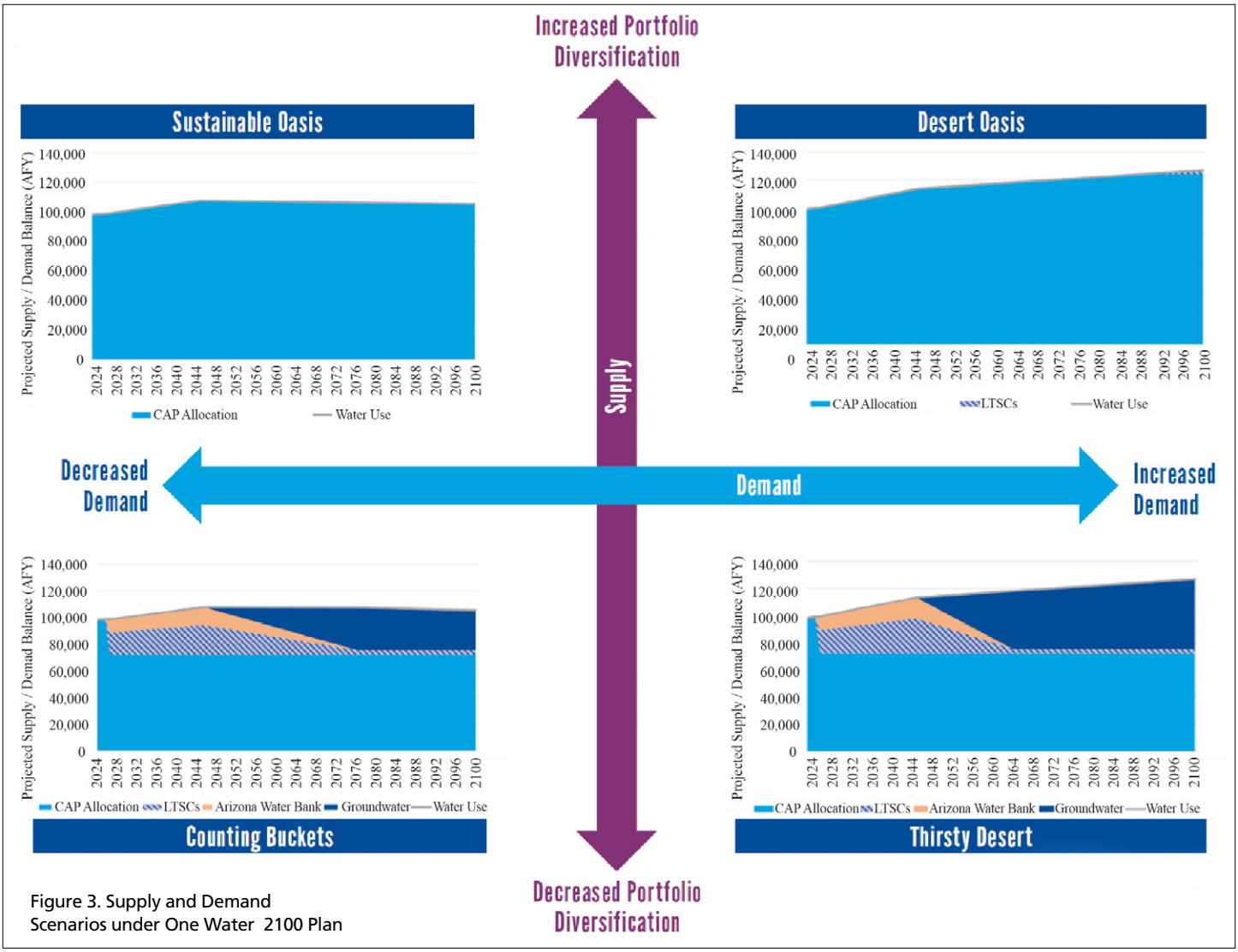

Figure 3. Supply and Demand Scenarios under One Water 2100 Plan

One Water

LTSCs

Beyond its CAP allocation, Tucson Water has access to several other classes of water. These include Colorado River water and effluent stored by Tucson Water as underground **l**ong-**t**erm **s**torage **c**redits (LTSCs), as well as additional institutional safeguards such as CAP firming of LTSCs stored by the Arizona Water Bank Authority and the Central Arizona Groundwater Replenishment District. Tucson Water also has access to additional groundwater rights identified in the City's 2023 application to modify its Designation of Assured Water Supply.

Best Case Scenario

SUSTAINABLE OASIS

In the Sustainable Oasis scenario, renewable Colorado River water exceeds projected potable demands and Tucson Water can continue saving that water as LTSCs in the aquifer. If projected demands decrease and supply availability increases, Tucson Water's potable demand is within the CAP allocation through 2100. The total available CAP allocation (124,000 AFY) is estimated to exceed the projected water demand (106,000 AFY) by approximately 18,000 AFY in the year 2100. This is the best-case scenario, and all of the strategies in the plan were developed to guide supply and demand management decisions in a way that aligns with this scenario.

DESERT OASIS

In the Desert Oasis scenario, Colorado River water exceeds projected potable demands well into the future and Tucson Water can continue saving that water as LTSCs, until those supplies are used to meet customer demands from the 2080s to 2100. If both demand and supply availability increase, the total projected potable water demand (127,000 AFY) is estimated to exceed the City's CAP allocation (124,000 AFY) by approximately 3,000 AFY in year 2100.

COUNTING BUCKETS

In the Counting Buckets scenario, potable demands exceed the available Colorado River water and Tucson Water relies on LTSCs and other groundwater accounts to meet customer demands. If projected demands and supplies both decrease, potable water demand exceeds the available CAP allocation in year 2026. The projected potable water demand (106,000 AFY) exceeds the CAP allocation (72,000 AFY) by approximately 34,000 AFY in the year 2100. Tucson Water has sufficient available groundwater supplies through LTSCs, CAP firming by the AWBA, and other groundwater resources to meet the demands through the year 2100.

THIRSTY DESERT

In this scenario, potable demands exceed Colorado River water and Tucson Water relies heavily on LTSCs and other groundwater accounts to meet customer demands. If demand increases while supply availability decreases, Tucson Water's potable demand exceeds the CAP allocation in 2026. The total projected water demand (127,000 AFY) exceeds the CAP allocation (72,000 AFY) by approximately 55,000 AFY in the year 2100. Tucson Water has sufficient available groundwater supplies through LTSCs, CAP firming by the AWBA, and other groundwater resources to meet the demands through the year 2100.

Strategies

Priorities

Through the community engagement process, Tucsonans identified water supply and demand changes as the areas of greatest concern. Through a series of workshops and public surveys, community members have shown the greatest support for water supply strategies that maximize the beneficial use of existing water supplies and provide opportunities to expand the amount of locally controlled supplies in Tucson's supply portfolio, and demand strategies that expand conservation opportunities through innovation and technology, while promoting equitable solutions. The following 16 strategies were prioritized by a representative sample of Tucson Water customers through a statistically significant survey (specific implementation actions for each strategy can be found in the full One Water 2100 Plan; *see* tucsononewater.com):

Surface water strategies

Collaboration

- Maximize the benefits of current Colorado River water.
- Work with the State of Arizona to explore additional water supplies for the Central Arizona Project.
- Advocate for Tucson's allocation of Colorado River water through the Central Arizona Project in state and federal negotiations.

One Water

Treatment

Maximize Reuse

Regional Efforts

Incentives & Data

Planning

Monitoring

Groundwater strategies
- Partner with regional water organizations to protect the aquifer.
- Accelerate groundwater cleanup efforts to make local supplies more available.
- Explore and invest in new treatment technologies to address unregulated, emerging water quality issues.

Recycled water strategies
- Adopt new policies for water reuse in buildings.
- Implement treatment technologies to address unregulated, emerging water quality issues.
- Begin purifying recycled water to drinking water standards.

Stormwater strategies
- Explore opportunities for large-scale stormwater projects with multiple benefits.
- Integrate and align stormwater standards, policies, and practices across the region.

Demand management strategies
- Improve outreach for low-income assistance programs for homeowners and renters.
- Increase water savings opportunities through incentive programs for residential and commercial customers.
- Install "smart meters" that monitor water use in real time, provide leak alerts, and inform water use habits.
- Conduct research on new technologies and approaches.
- Provide landscape training to reduce outdoor water use, with emphasis on the creation of resilient, desert-adapted landscapes.

Conclusion

As the uncertainties and vulnerabilities around supply and demand conditions evolve over time, Tucson Water has the opportunity to take actions to mitigate the risks of the Thirsty Desert scenario and plan for a Sustainable Oasis where the water supply portfolio is increasingly diversified and water demands are well managed.

The implementation of identified strategies must adapt to changing conditions, such as ongoing drought conditions, population growth, climate change, regulatory changes, economic environments, and other factors that may continue to impact regional water availability. While near-term policies can be implemented now to address immediate needs, the mid-term and long-term strategies will be regularly reevaluated as conditions change and new information becomes available and as community priorities evolve. This approach allows for adaptive management in response to evolving conditions, while still maintaining a long-term vision for a resilient and sustainable water supply. Overall, these strategies seek to guide Tucson Water toward the Sustainable Oasis scendario while avoiding the risks of a Thirsty Desert scenario.

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Jaimie Galayda is the Lead Planner with Tucson Water's Conservation and Stormwater Resources Division. She led Tucson Water's One Water 2100 integrated water resource planning effort over the past four years. The plan was adopted in 2023 by Mayor and Council. It will guide the City's long range water supply and demand management strategies well into the future. Before joining the water department, she was appointed as Mayor Jonathan Rothschild's Planning, Transportation & Sustainability Policy Advisor. She previously served as a Research Project Manager with the Institute of the Environment at the University of Arizona and with Yudelson Associates, a sustainability planning and consulting firm. Ms. Galayda earned a Ph.D. in Ecological Economics from Rensselaer Polytechnic Institute in Troy, NY in 2006. She is also certified as a LEED AP in Existing Buildings.

One Health

Contaminants of Concern

UNDERSTANDING THE IMPACT OF PFAS IN ARIZONA

USING THE ONE HEALTH APPROACH

by Taylor Simmons, Amanda Trakas, and Dr. Susanna Eden
University of Arizona (Tucson, AZ)

Introduction

Perfluoroalkyl and polyfluoroalkyl substances (PFAS) are a family of over 4,000 synthetic chemicals that have been widely produced and used since the 1940s (Figure 1).[1,2] They are commonly used in domestic, industrial, and agricultural products to repel water, oil, and dirt and withstand high temperatures.[1] They have received global recognition as contaminants of concern, having been listed in the Stockholm Convention on Persistent Organic Pollutants.[2] Studies have shown that they are ubiquitous in our water, air, and soil across the nation and globe.[1]

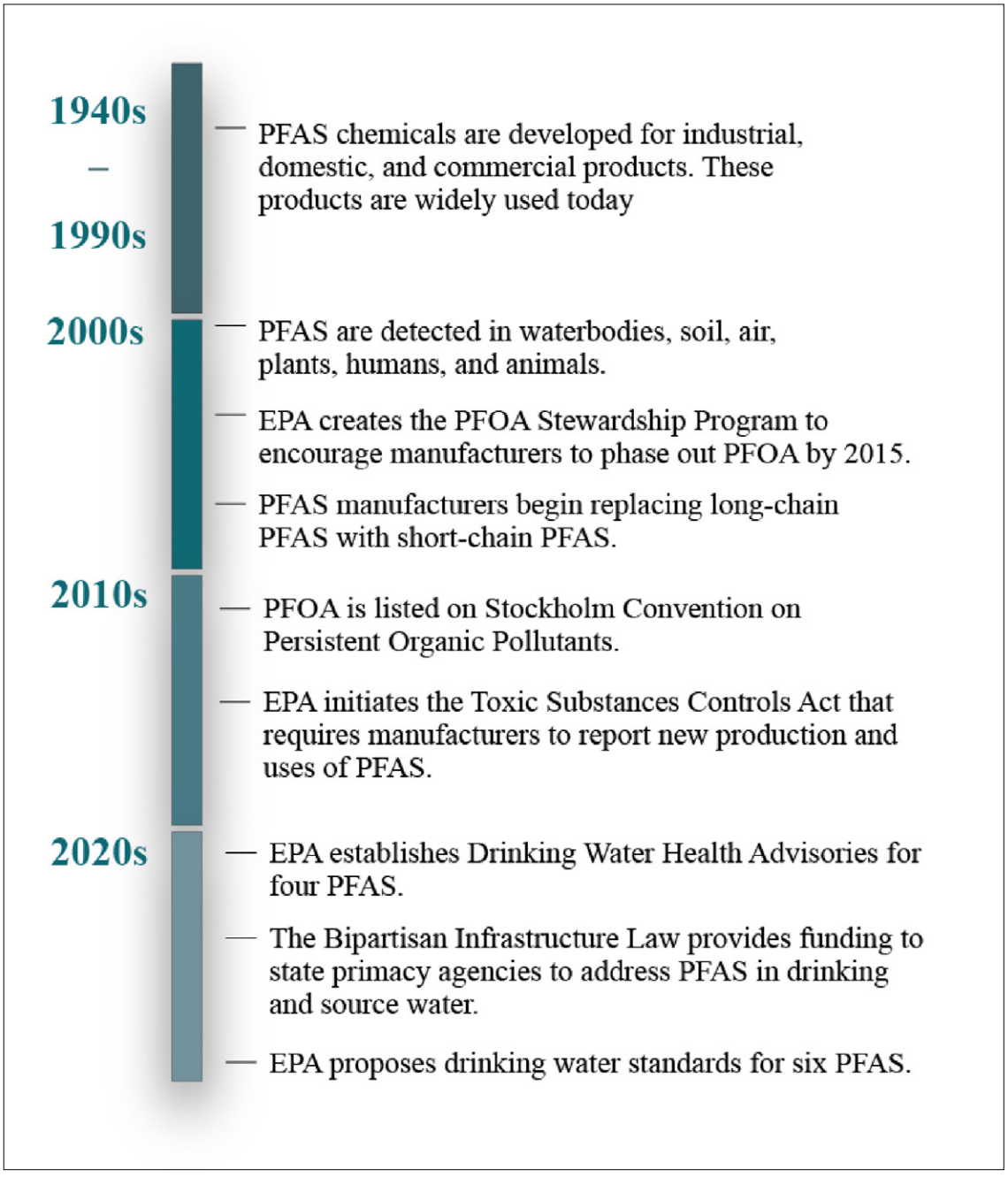

Figure 1. Timeline of per- and polyfluoroalkyl substances (PFAS) and Perfluorooctanoic Acid (PFOA) production, use, and regulation in the United States.[1,2,4,5]

One Health

One way to understand the impact of PFAS is by using the One Health approach. According to the Centers for Disease Control and Prevention (CDC),[3] One Health acknowledges the interconnection between people, animals, and our shared environment (Figure 2)[3,4] As the human population continues to grow, so does the opportunity to introduce pollutants, like PFAS, into the environment, with significant impacts on natural systems, including plants and animals—both wild and domestic.[3] Utilizing the One Health approach to understand how PFAS affect humans, animals, and our shared environment will allow a more wholistic consideration of regulatory standards and limiting exposures—not just for drinking water systems but also for natural waterways, groundwater, and surface water used for irrigation and animal watering.[3]

Using a One Health approach and Arizona as a case study, this article will provide an overview of PFAS compounds, their prevalence in the environment, how they affect humans and animals, current regulations, and it will provide suggestions regarding how to minimize exposure.

Figure 2. One Health diagram developed by the Centers for Disease Control and Prevention (CDC).[3,4]

Overview of PFAS

Forever Chemicals

Long v. Short Chain

Because PFAS are constructed with one of the strongest bonds in chemistry—carbon and fluorine—they decompose very slowly in the environment and within animals and humans.[5] According to the Agency for Toxic Substances and Disease Registry (ATSDR), some PFAS last up to 35 years in humans.[1] In the early 2000s, as more information was gathered on the environmental persistence of these "forever chemicals," producers began replacing long-chain PFAS (8 of more carbons) with short-chain PFAS (less than 8 carbons) in the hopes of avoiding negative impacts.[1,6–8] This change occurred in response to clear evidence that long-chain PFAS, such as perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS), are carcinogenic.[6] However, serious concerns remain because the health effects of short-chain PFAS are largely unknown.[6] Additionally, it has been discovered that short-chain PFAS are more mobile in water (hydrophilic) than long-chain PFAS, facilitating the movement and spread of pollution.[6]

PFAS Sources

Though there are no large PFAS manufacturing facilities in Arizona, advanced detection technologies have shown PFAS compounds are more prevalent than previously thought. For instance, Arizona's agricultural areas (36% of Arizona's land area),[9] 92 airports, and seven military bases can contribute to PFAS environmental releases (Table 1).[1] Widespread use of products containing PFAS, such as cosmetics, cleaning products, and fast food packaging can lead to repeated personal exposure (Table 1).[10] A recent study found that PFAS are more likely to be present in urban areas than rural areas, and Arizona is highly urbanized, with more than 90% of the population residing in urban areas.[1,9]

One Health

Industrial Uses	Domestic Products	Agricultural Uses	Environmental Releases
Metal manufacturing	Flame-retardant furniture	Insecticides	Biosolid applications
Automotive	Water-resistant clothing	Pesticides	Landfill leachate
Construction	Stain-resistant carpets	Herbicides	Industry discharges
Firefighting foam	Non-stick cookware	Dairy products	Agricultural runoff
Electronics Airports Paper manufacturing	Food packaging (pizza boxes, microwavable popcorn bags, fast food wrappers)	Meat products	Wastewater treatment plant runoff
Photography Military installations	Personal care products (shampoo, dental floss, cosmetics)	Plants	Septic discharges Stormwater runoff

Table 1. Per- and polyfluoroalkyl substances (PFAS) containing products and processes as well as common environmental releases of PFAS.[10]

Prevelance

PFAS in the Environment: Water

Water is the main environmental vehicle of PFAS, directly threatening drinking water quality (Figure 3).[11,12] PFAS are resistant to many common municipal water treatments, including biodegradation, chlorination, photo-oxidation, direct photolysis, and hydrolysis.[1,13–15] Experts estimate that at least one type of PFAS can be detected in 45% of tap water in the United States (US).[16] According to the Environmental Working Group (EWG)—an organization that has been conducting PFAS assessments for over 20 years—PFAS contaminates drinking water for up to 110 million Americans.[11]

A study published in 2023 found PFAS in 716 residential tap water sources—269 private wells and 447 public supplies—tested from 2016 to 2021.[16] They detected at least one PFAS in 20% of private and 40% of public supply wells, and concentrations exceeded proposed Environmental Protection Agency (EPA) standards by nearly 50%-70% (*see* Federal Regulations and Efforts section).[16] In this study, PFAS concentrations correlated with land development, with an 8% detection probability in rural areas and 70% in urban areas.[16]

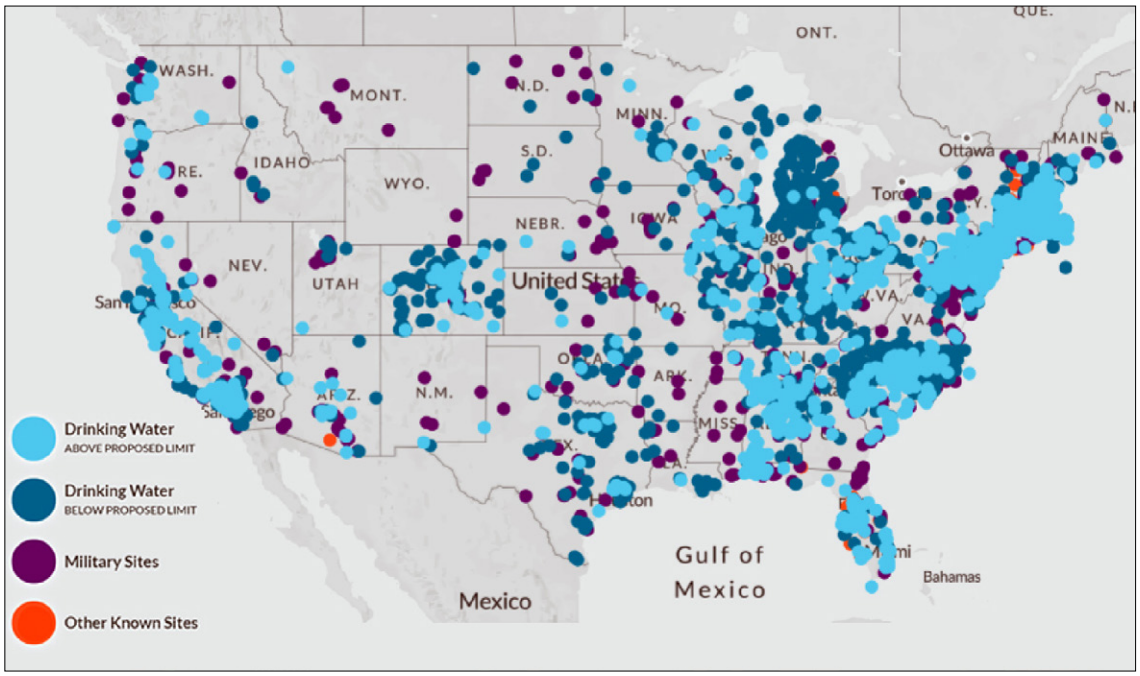

Figure 3. Environmental Working Group maps displaying per- and polyfluoroalkyl (PFAS) in public water system supply and other sites in the contiguous United States, respectively. The maps were updated in November of 2023.[11]

One Health

Persistence

PFAS persist in water for 40–90 years, impairing the quality of not only drinking water, but also water used for livestock watering, crop irrigation, and wildlife.[10,12,16] Once discharged into water, PFAS compounds can be transported long distances and have been found in polar oceans and even polar bears.[17–23] Water links all organic life, and as more animals (Figure 4) and plants are exposed to PFAS through water, humans can expect repeated, chronic exposure.

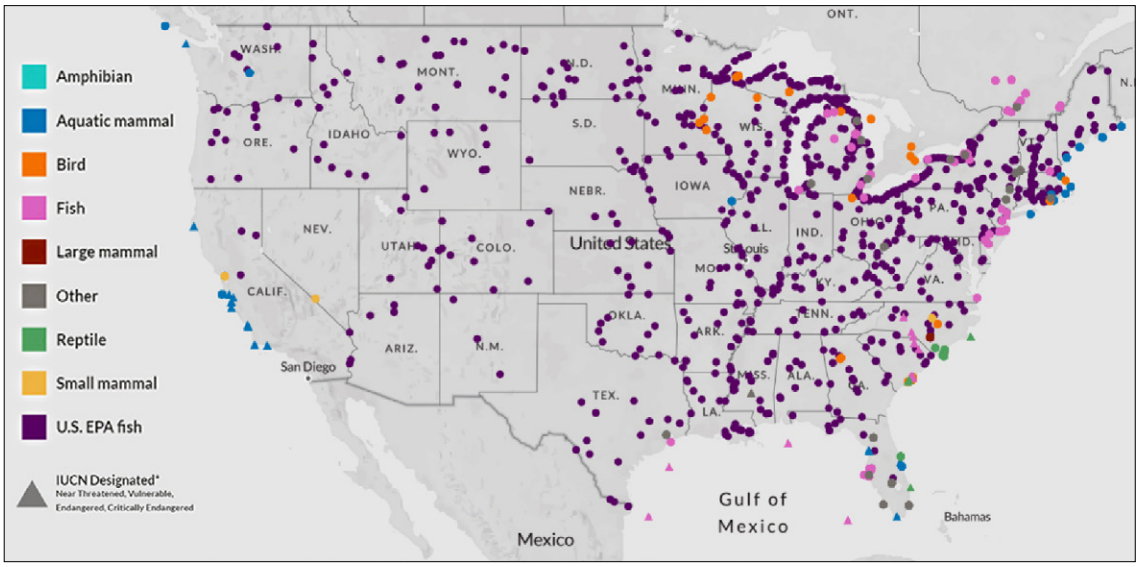

Figure 4: Environmental Working Group maps displaying per- and polyfluoroalkyl (PFAS) detected in wildlife in the contiguous United States, respectively. This map can also be adapted to show PFAS contamination in wildlife globally. The maps were updated in September of 2023. [24]

Public Health Effects

Accumulation

Due to their persistence, biotoxicity, and bioaccumulation characteristics, PFAS pose a global public health threat.[1] Because PFAS chemicals break down slowly, PFAS accumulate in humans over time.[1] Long-chain PFAS exposure has been linked to increased risk of developmental, metabolic, and immune disorders, as well as testicular and kidney cancers.[25(p201),26,27] [23] It has been determined that production and manufacturing workers, communities near PFAS manufacturing and processing facilities, and individuals with prolonged use of PFAS-containing products are the most vulnerable to the adverse health effects of PFAS.[1] Industries suspected of PFAS discharges include chemical manufacturing, paper mills, paint coating, plastic production, petroleum refineries, textile and fabric finishing mills, soap and detergent production, electrical manufacturing, firefighting facilities, airports, cleaning services, and mines.

Exposure & Risk

Children are at greater risk of adverse health outcomes after exposure to PFAS due to their underdeveloped biological systems, rapid growth rates, and reduced ability to detoxify chemicals.[1] In the US, it has been estimated that young children drink seven times more water per kilogram than the average adult and therefore are at increased risk of exposure.[28] The CDC has estimated that most individuals in the US have been exposed to PFAS,[1] and the potential for additional exposure through plants and animals is high.

Animal and Plant Effects

Fish

Wild animals are an integral part of natural ecosystems and are important to recreation and tourism in Arizona. The fact that water is the main environmental vehicle of PFAS explains their detection in aquatic animals—including fish—which introduces another exposure route for humans. A study published in 2023 assessed concentrations of PFAS in 500 freshwater fish in streams of the contiguous US.[29] They discovered that wild, stream-caught fish had PFAS concentrations 278 times higher than concentrations found in commercial fish bought at supermarkets and grocery stores.[29] One serving of stream-caught fish was equivalent to one month of drinking water with PFAS concentrations 12 times over the proposed drinking water standard.[29] Recreational fishing contributes more than $240 million to Arizona's economy. Given current knowledge about the probability of PFAS in Arizona's waterbodies, PFAS bioaccumulation in fish poses significant public health and economic risks, especially for those reliant on wild-caught fish for food. [29,30]

One Health

Livestock

Livestock also play an important role in our lives, whether for food, fiber, or other uses.[3] In 2017, livestock and their products contributed $1.6 billion to Arizona's economy.[31] Current studies show that PFAS have been detected in livestock animals, likely due to contamination from widespread use of herbicides, pesticides, and insecticides.[12,32] Although few studies have assessed the health effects of PFAS in animals, PFAS have been found in muscle tissue, organs (kidney, liver), and fetuses of livestock animals such as chicken, cattle, and sheep.[1,33–41] PFAS are transmissible through lactation as well, thus potentially contaminating milk and other dairy products.[34,42] A study published in 2007 attributed 90% of human dietary intake of PFOS, a common long-chain PFAS, to beef products.[43]

Plants

Plants are integral to ecosystem health and to Arizona's economy. Agriculture alone contributed over $2.2 billion in 2017.[31] In addition to nourishment for animals and humans, plants also filter air, clean water, decompose waste, and provide raw materials for clothes, construction, and medicine. However, their environmental services may be inhibited by PFAS exposure. PFAS can disrupt key metabolic plant functions, such as photosynthesis, protein synthesis, and organelle expression, with negative plant health results that affect the health of ecosystems.[44,45] The use of biosolids in agriculture can contribute to PFAS accumulation in soils; and though biosolids must comply with metal and chemical standards before application on agricultural lands, as of May 2023, Arizona does not require testing biosolids for PFAS.[46] A recent study in southern Arizona suggested that irrigation may contribute the most to PFAS in soils, with over 90% of PFAS residing within the top six feet of soil after irrigation with contaminated water.[47] In addition to irrigation and biosolid application, plants can be exposed to PFAS through landfill leachate, aerosols, and pesticide applications.[45] Commonly consumed plants such as spinach, tomato, corn, lettuce, and strawberry have demonstrated root uptake of PFAS.[44,48,49]

Federal Regulations and Efforts

TSCA

The EPA works to protect human health and the environment. Their efforts to identify and limit PFAS exposure are ongoing. Under the Toxic Substances Control Act (TSCA) that authorizes the EPA to assess and regulate chemicals in the environment, the EPA has restricted some PFAS production, importation, use (notably in coatings, pesticides, containers, and carpeting), and disposal methods since 2002.[50] Under the TSCA, toxic substances are categorized as "inactive" if they have not been utilized in commerce since 2006.[51] In addition, the EPA created the PFOA Stewardship Program in 2006 that encouraged eight major PFAS-producing companies to reduce PFOA production by 95% from 2000 (baseline year) to 2010 and to eliminate all PFOA emissions and products by 2015.[50] In 2024, the EPA finalized a significant new TSCA rule to ensure that over 300 inactive PFAS could not reenter commerce streams without the agency's approval.[51] Though the participation of companies such as 3M, Dupont, and Daikin significantly reduced PFOA emissions, alternative PFAS—particularly short-chain forms—are still used in some domestically produced and imported products.[1,50]

PFOA Program

Health Advisories

In accordance with the Safe Drinking Water Act (SDWA) and their PFAS Strategic Roadmap,[52] the EPA has also established Drinking Water Health Advisories (DWHA) and proposed drinking water standards for PFAS chemicals. The DWHA are non-regulatory, non-enforceable recommendations meant to inform federal, state, tribal, and local officials of contaminants with human health effects likely to be present in drinking water.[53] These advisories provide technical guidance and health-based standards with margins of safety that acknowledge the lack of technical information on the contaminant.[53] In June 2022, the EPA issued DWHA recommendations for four PFAS chemicals in the **p**arts-**p**er-**t**rillion (ppt) range.[53] For reference, one ppt is equivalent to one drop in 20 Olympic-sized swimming pools.[54] In other words, the EPA determined that very small concentrations of PFAS can have significant adverse effects on human health.

Adverse Impacts

Mandatory Standards

In March 2023, after the EPA had gathered enough information on PFAS toxicity, environmental fate, and the technological feasibility of identifying and treating them, the agency proposed mandatory drinking water standards for six PFAS chemicals: PFOA, PFOS, PFBS, PFNA, PFHxS, and GenX (Table 2).[53] The proposed drinking water standards—also known as **m**aximum **c**ontaminant **l**evels (MCLs)—were projected to be finalized by the end of 2023, but nothing had been established by January 2024.[53] MCLs are legally enforceable standards that **p**ublic **w**ater **s**ystems (PWS) must follow to provide safe, clean drinking water to their customers.[52] Though the MCLs are tailored to human health, removing PFAS from drinking water systems could have ameliorative effects on waterbodies and the plants and animals that rely on them.

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Type of PFAS	Proposed Standards	Long/Short Chain	Uses
Perfluorooctanoic acid (PFOA)	4 ppt	Long-chain	Non-stick and stain-resistant coatings; firefighting foams; surfactant in industrial processes
Perfluorooctane sulfonic acid (PFOS)	4 ppt	Long-chain	Stain-resistant fabrics; firefighting foams; food packaging; surfactant in industrial processes
Perfluorononanoic acid (PFNA)	10 ppt*	Long-chain	Lubricating oil additive; surfactant; cleaning, polishing and textile finishing agent; processing aid in the manufacture of other PFAS
Perfluorobutane sulfonate (PFBS)	2000 ppt*	Short chain	Water-resistant and stain-resistant coatings on consumer products such as fabrics, carpets, and paper; surfactant in industrial processes
Perfluorohexanesulfonic acid (PFHxS)	9 ppt*	Short chain	Stain-resistant fabrics; firefighting foams; food packaging; surfactant in industrial processes
Hexafluoropropylene oxide (HFPO) dimer acid and its ammonium salt (GenX chemicals)	10 ppt*	Short chain	Processing aid in the manufacture of other PFAS (without the use of PFOA)

Table 2. Drinking water standards proposed by the United States Environmental Protection Agency for six per- and polyfluoroalkyl substances (PFAS) compounds, and their historical uses.[13,55,56]
*Standards for PFBS, PFHxS, PFNA, and GenX chemicals are measured in a Hazard Index. The proposed standard is dependent on Health-Based Water Concentrations mixtures.[13]

State Regulations and Efforts

Lawsuits

As evidence grows about the adverse effects of PFAS, federal, state, and local officials are becoming more concerned about exposure. In May 2023, Arizona's Attorney General Kris Mayes joined a bipartisan coalition of now 27 Attorney Generals to sue more than 25 chemical companies for manufacturing, distributing, marketing, and selling products containing PFAS.[57] Mayes and others allege that large companies like 3M and Dupont were aware of the health and environmental effects of PFAS as early as the 1950s, and yet PFAS continue to pollute the state's natural resources.[57]

State Regulations

As has been demonstrated historically with other environmental pollutants (e.g., DDT), one of the most effective ways to control contaminants is through regulations, which state agencies with primacy over the relevant federal environmental program can initiate.[58] State agencies that have been granted primacy by the EPA are called state primacy agencies and have jurisdiction over land, water, and air quality regulations within their states.[52] The SDWA primacy agencies must ensure PWS within their state comply with federally established MCLs, though the state-initiated drinking water standards can be more stringent.[52] To date, state primacy agencies in California, Vermont, New Hampshire, Delaware, Maine, and Rhode Island have established state MCLs for PFAS.[59]

Compliance

Though the Arizona state primacy agency—the Arizona Department of Environmental Quality (ADEQ)—has not established a state MCL for PFAS, it is actively working to characterize and mitigate PFAS exposure. From 2016 to 2018, ADEQ assessed 5% of the state's PWS deemed at risk for PFAS contamination because of proximity to known PFAS sources, such as industrial, firefighting, airport, biosolid, or military facilities.[60] Of the 109 samples taken, ADEQ identified six wells yielding water with PFAS concentrations above the 2016 DWHA (70 ppt for PFOA and PFOS combined). When compared to the drinking water standards proposed in 2023, 18 Tucson samples would have been out of compliance.[60]

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Funding

In the US, PFAS treatment will require an estimated $47 billion initial investment, with ongoing annual costs of $700 million.[61] Recognizing the financial barriers to infrastructure upgrades, federal and state agencies are continuing to invest in PWS capacity. In partnership with the Arizona Water Infrastructure Finance Authority (WIFA), the ADEQ announced in 2022 that $3 million would be available to PWS in need of technical or financial support to test for PFAS.[62] Additionally, in 2023, the ADEQ was awarded $42 million through the Bipartisan Infrastructure Law to address PFAS in drinking and source water and assist rural PWS in underserved areas in meeting PFAS monitoring goals.[63] These investments will help the ADEQ better characterize PFAS prevalence and sources throughout the state of Arizona and prioritize areas for remediation.[63]

Data

The ADEQ makes efforts to keep the public informed. The agency created and hosts an interactive map that displays PFAS data they collected between 2013 and 2023, including data provided by PWS (2018 to 2023) and EPA (2013 to 2015).[62] The EPA data was collected from 75 Arizona PWS.[64] In Pima County, EPA detected PFAS in 47 samples, six of which were above the non-regulatory monitoring rule standards for PFOS (40 ppt) and PFHxS (30 ppt).[64] Of these six samples, two from wells serving the City of Tucson were 14 times (56 ppt) over the proposed 2023 drinking water standard for PFOS (4 ppt).[64] Though no federal or Arizona state MCLs for PFAS have been established, local municipalities are setting voluntary standards for PFAS and are proceeding to mitigate exposure risks within their capacity.

Voluntary Standards

Case Study: PFAS in Tucson, Arizona

PFAS pollution directly threatens One Health in Tucson, Arizona's second largest metropolitan city. Several PFAS direct and indirect pollution sources have been discovered in the city. Historically, military establishments and airports have extensively used **a**queous **f**ilm **f**orming **f**oams (AFFF) to control petroleum fires since the 1970s.[64,65] In Tucson, PFAS contamination has been linked to the Tucson International Airport, the Morris Air National Guard, the Air Force Plant, and Davis Monthan Air Force Base (DMAFB).[66] PFAS have also been associated with non–point source pollution in the greater Tucson area.[67] A recent study detected PFOA and PFOS above the 2022 DWHA standards in roof-harvested rainwater in Tucson.[67] This pollution was not directly linked to specific PFAS sources.[67]

Internal Standards

In accordance with their Sentry Water Quality Monitoring Program, Tucson Water (TW) has been voluntarily monitoring PFAS and other unregulated contaminants since 2009.[68] TW, one of the largest water providers in the city, has detected several PFAS-contaminated wells within their service area.[68] Annually, the water provider assesses 1,500 samples for PFAS.[68] In response to the EPA's DWHA guidelines, in 2022, TW set more stringent internal standards for PFAS: non-detect or less than 2 ppt for PFOA and PFOS; 7 ppt for PFHxS; 420 ppt for PFBS; 10 ppt for GenX, and; 200,000 ppt for PFHxA.[64] As of June 2022, TW shut down 25 municipal wells as a result of adopting these voluntary standards, which affects water availability.[64]

Reduced Well Capacity

PFAS contamination from the DMAFB alone has reduced the TW well capacity by 10%.[66] The air force base was originally designated a Water Quality Assurance Revolving Fund Site (WQARF) for petroleum hydrocarbons, BTEX, methane, volatile organic compounds, and metals in soil; however, recent site investigations identified PFAS in soil, sediment, surface water, and even in groundwater below the vadose zone (~300 feet below the surface).[63] When PFAS-monitoring wells were established at the at the northern edge of the site in 2019, PFAS concentrations in groundwater were 14,400 ppt (combined PFOA and PFOS).[65] Site investigations identified more than 270 private and public drinking water wells within four miles of the site that could be impacted by PFAS migration.[65] Several TW wells downgradient of the DMAFB are a primary water source for 65,000 Tucson residents.[65] Considering the socioeconomic characteristics of the affected communities, concerns surrounding **e**nvironmental **j**ustice (EJ) arise (*see* Environmental Justice section).

Environmental Toxicity

In addition to threatening drinking water quality and quantity for humans, DMAFB pollution has also raised concerns about environmental toxicity. In 2001, the unlined Tucson (Ajo) Detention Basin was reconstructed and expanded to enhance vegetative ecosystems, build stormwater recharge capacity, and control flooding.[69] Now known as the Ed Pastor Kino Environmental (KERP), the site covers 141 acres and includes a 5.6-acre pond and 21 acres of grassland, marsh, and mesquite forests.[69] Due to the resulting lush wildlife habitat, it has become a popular destination for bird watching.[69] Seemingly beneficial for wildlife, the KERP riparian ecosystem is fed by DMAFB stormwater runoff. According to DMAFB investigations, surface water runoff continues to contaminate deliveries to KERP (176 ppt of combined PFOA and PFOS identified in 2019) and potentially to the neighboring Santa Cruz River.[65] This widespread contamination increases the likelihood of groundwater contamination and exposure for the wetland and migratory birds that depend on the KERP and the Santa Cruz River.

Habitat Impacts

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Treatment

ADEQ and TW are partnering to control PFAS migration near the DMAFB. In 2020, ADEQ invested $3.3 million in the Central Tucson PFAS Project (CTPP) to isolate and remove PFAS pollution using ion exchange technology.[66,70] Located just north of the DMADB, the CTPP treatment operation managed by TW has the capacity to treat 360,000 gallons of groundwater per day.[70] The treated water is released into a stormwater sewer.[70] As of 2022, the agency installed seven monitoring wells to monitor the project efficacy and protect vital drinking water sources.[70]

Limiting Personal Exposure

Exposure Routes

Few studies have quantified human exposures routes for PFAS. However, scientific modeling conducted by Egeghy et al. suggests that the primary route of PFAS exposure is ingestion, including food (72%), water consumption (22%), and dust ingestion (6%).[1,64,71] The greatest level of exposure comes from food ingestion.[1,64,71] Thus, regardless of the regulatory status of PFAS, individuals can limit personal exposure by shopping carefully and reading labels when available. Individual actions can include avoiding non-stick cookware and reducing consumption of packaged food. Some animal products may also contain PFAS. Other routes of exposure can be limited by avoiding such commodities as stain-resistant carpets and water-resistant clothing, as well as some common domestic products, such as floss, shampoo, cosmetics, nail polish, cleaning products, and even toilet paper containing PFAS.

Individual Actions

An estimated 22% of human exposure to PFAS comes from water.[1,64,71] Per the SDWA, PWS must be transparent about the quality of the water they provide;[52] therefore, residents concerned about the quality of water can ask their PWS how PFAS are being addressed. Because the SDWA only applies to PWS, private well owners—an estimated 5% of Arizona's population (350,000 residents)—are encouraged to test their water at an EPA-approved laboratory or use the ADEQ Monitoring Assistant Program.[64,72]

In-Home Treatments

In-home treatments that remove other substances from water can also remove PFAS. Though PFAS are resistant to many water treatments—including boiling[73]—they can be removed by granular activated carbon, ion exchange, and/or reverse osmosis systems.[1,13–15] Prices for these at-home treatment systems vary depending on the system size and type.[74] It is imperative that at-home treatment systems are well maintained and serviced for optimal filtration, which could be an added expense.[64] Currently, it is uncommon for refrigerator water filters to be able to remove PFAS.[64,74]

Avoiding PFAS

Reducing the circulation of PFAS-contaminated goods can have supplemental benefits not only for humans, but also for animals, plants, and the environment. Decreasing demand for PFAS products may reduce production, industrial releases, and improper disposal of these chemicals. Products likely to contain PFAS include non-stick cookware, grease-resistant fast-food packaging, stain-resistant carpeting, water-resistant clothing, and some personal care products. Avoiding these products may involve lifestyle changes such as substituting iron or stainless-steel cookware, avoiding fast food, and reading labels. Individual efforts like these to reduce PFAS exposure requires financial autonomy. Some individuals, however, may not have the resources or capacity to choose where they live,[75] what they eat,[76] or what they drink[77] due to socioeconomic limitations.

Environmental Justice

Increased Risk

These lifestyle changes to limit PFAS circulation and exposure may be challenging, especially for EJ communities. EJ communities are defined as non-white or Hispanic communities below the poverty line disproportionately exposed to environmental hazards. A recent study found that communities of color (Hispanic and non-Hispanic blacks) have statistically higher exposures to PFOS and PFOA in drinking water in the US.[77] In this study, PFAS concentrations in PWS also correlated with exposure from industrial facilities, military fire training areas, airports, and waste facilities.[77] This is consistent with other studies that have found EJ community location to be a positive predictor of industrial site location.[78] The cost of in-home PFAS water treatment can be a barrier. EJ communities may be disproportionately exposed to PFAS through food and environmental exposures as well. Studies have demonstrated that underserved communities have significantly increased access to fast food restaurants[76] and are exposed to more indoor toxins (e.g., carpeting in multi-housing units)[77] than non-Hispanic white counterparts.

With mostly Hispanic (72%) and Native American (13%) residents,[79] South Tucson is a prime example of an EJ community in Arizona that has been disproportionately impacted by PFAS and other pollutants. In 2022, approximately 36% of South Tucson residents were living below the poverty line, which is more than double the Arizona state average of 13%.[79] South Tucson is within a 10-mile radius of the previously mentioned PFAS source areas, such as the Tucson International Airport that shares land with the Morris Air National Guard, the Air Force Plant, as well as DMAFB. Though local, state, and federal agencies have started to address pollution in South Tucson, some criticize the timeliness of remediation efforts.[80] The widespread groundwater contamination—and potential exposure—commenced over 50 years ago.[65] Limitations of EJ communities should be considered to ensure equitable PFAS policy and exposure mitigation.

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Ecosystem Health

Addressing PFAS

Conclusion

Water is the main environmental vehicle for PFAS, and as drought and climate change impact the Colorado River Basin, people, plants, and animals in Arizona must cope with a reduced water supply. Limits on water supplies intensify concerns about water quality. Humans are exposed to PFAS not only through water, but also through the plants and animals exposed to PFAS-contaminated water. In an arid climate, every clean drop is precious**.**

Assessing the effects of PFAS through a One Health lens captures their extensive impacts on the health of ecosystems in which humans exist. Human and environmental health are interdependent. Fauna and flora provide an array of environmental services humans depend on for health and well-being. These include food, fiber, and medicine, in addition to supporting ecosystem functioning. As has been demonstrated with climate change,[81] human actions and pollution can alter the environment on a global scale. PFAS are man-made chemicals that pollute environments shared by animals and plants worldwide. Some studies show that EJ communities are the most at risk of exposure. Though individual actions can be taken to mitigate exposure to PFAS, such as installing water filters and avoiding consumer goods that contain PFAS, closing equity gaps will take group action.

Education and outreach, multisectoral collaboration, and regulations are fundamental to addressing PFAS and other emerging contaminants. Though federal MCLs regulate drinking water served by PWS, other PFAS exposure routes to consider are contamination in Arizona waterways and groundwater, as well as produce, livestock, and wild animals. These routes of human exposure are not addressed by existing or proposed regulation, and there is no immediate expectation that source water, food, industrial production, and most PFAS use will be regulated on a global scale or even nationally. For instance, the US Food and Drug Administration (FDA) still authorizes the use of some PFAS in food applications.[82] Thus, environmental and animal health will continue to be at risk. A One Health assessment points toward adoption of regulations and/or other policy tools that will reduce or eliminate PFAS contamination in the environment.

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NFIP

REAUTHORIZATION OF THE NATIONAL FLOOD INSURANCE PROGRAM

COMMITTEE ON BANKING, HOUSING, AND URBAN AFFAIRS HEARING

by Michael Hecht and Peter Waggonner, Greater New Orleans, Inc. (New Orleans, LA)

Editor's Note: This article presents the public testimony of Michael Hecht, the President and CEO of Greater New Orleans, Inc. (GNO, Inc.) at the Senate Committee on Banking, Housing, and Urban Affairs on January 25, 2024. Michael Hecht discusses reauthorizing and reforming the National Flood Insurance Program (NFIP) under the Federal Emergency Management Agency's (FEMA) administration of Risk Rating 2.0 and its associated impacts. This testimony has been minimally edited and formatted to better fit The Water Report. For more information on this hearing, *see* https://www.banking.senate.gov/hearings/reauthorization-of-the-national-flood-insurance-program-local-perspectives-on-challenges-and-solutions.

Introduction

CSFI

My name is Michael Hecht, and I am the President and CEO of Greater New Orleans, Inc. (GNO, Inc.), the 10-parish economic development organization for Southeast Louisiana. Since April 2013, GNO, Inc. has led the Coalition for Sustainable Flood Insurance (CSFI), a national alliance of approximately 250 organizations across 35 states. The Coalition for Sustainable Flood Insurance sees NFIP as a critical program that allows critical communities across our country to keep working.

GNO, Inc. originally created CSFI to support NFIP reform as a federal priority. Thus, we appreciate your longstanding leadership, as demonstrated today, and your continued recognition of the importance of available, affordable, and transparent flood insurance coverage for your respective districts and constituents. As you know, flood risk affects us all, and flood events have occurred in all 50 states and 99% of counties in the United States since 1996. Your work this Congress to address insurance challenges will shape the future of our nation's environment and economy, and make for a more prosperous and resilient country.

Flood Risk

Insurance Challenges

Today, I will discuss the need to reauthorize NFIP—given its benefits to our nation—and the need to reform the program—given FEMA's administration of Risk Rating 2.0 and its associated impacts.

Reauthorization

First and foremost, CSFI aims to ensure the availability of flood insurance through a reauthorized NFIP.

CSFI supports a long-term, multi-year reauthorization of NFIP to ensure program stability and to minimize ripple effects across the American economy. Since September 2017, NFIP has been operating under a series of short-term reauthorizations without comprehensive reform. Since then, NFIP has been extended on a short-term basis 28 times and has briefly lapsed three times. On March 8, 2024, NFIP's current authorization will expire.

NFIP Expiration

Effects of a Lapse

If NFIP lapses, NFIP will lose the authority to provide new flood insurance contracts, and existing policies will not be renewed. NFIP's authority to provide new flood insurance contracts is a particular necessity based on the **m**andatory **p**urchase **r**equirement (MPR). This requires property owners to purchase flood insurance as a condition of mortgages made or guaranteed by federal agencies, federally regulated lending institutions, and government-sponsored enterprises. Property owners, both residential and commercial, are required to purchase flood insurance if their property is identified as being in a Special Flood Hazard Area (SFHA) and is in a community that participates in the NFIP. While private flood insurance coverage can now satisfy the mandatory purchase requirement, private flood insurance availability varies nationwide and is limited in many states, and can be prohibitively expensive.

Required Flood Insurance

Thus, NFIP's reauthorization is consequential to the national housing market and real estate transactions. During a June 2010 lapse, about 1,400 home sale closings were canceled or delayed each day, representing over 40,000 sales per month. There are approximately six million homes located in SFHAs and subject to the MPR nationwide.

Impacts

A lapse also jeopardizes NFIP's ability to satisfy claims. NFIP can still process and pay claims on flood insurance policies as long as funds are available; however, NFIP's borrowing limit would be decreased from $30.425 billion to $1 billion.

NFIP

NFIP Statistics

Costs

Original Objectives

Premiums & Claims

Debt Forgiveness

Reducing Flood Risk

NFIP's Success

NFIP covers nearly five million policyholders with an annual premium of $3.5 billion and $1.3 trillion insurance in force. NFIP's policyholders are often misperceived as rich, second-home owners in beachfront communities. However, in 2017, a CSFI study found that that 98.5% of all NFIP policies are in counties with a median household income below $100,000, and 62% of all NFIP policies are in counties with a median household income below the national average of $53,889. According to FEMA, incomes are higher outside the SFHA than they are inside the SFHA. Twenty-six percent of policyholders inside of the SFHA are low income, compared to 21% of policyholders outside of the SFHA. Despite the MPR, 51% of non-policyholders in the SFHA are low income, compared to 41% of non-policyholders outside the SFHA. Thus, NFIP works to serve working Americans in need of sustainable, reasonable flood insurance.

David Maurstad, Deputy Associate Administrator for Insurance and Mitigation, said, "over the last 50 years, NFIP has collected $60 billion in NFIP premiums, but has paid $96 billion in costs (including losses, operating expenses, and interest)." That said, a difference of $36 billion to assist about 5 million American property owners today—and many millions more over the course of the program—is a good financial deal for the American public. According to FEMA, NFIP's flood management standards save the nation almost $2.4 billion annually in flood losses avoided. Thus, over a 50-year period, these savings total $120 billion in flood losses avoided—for a net benefit to the American public of nearly $85 billion.

NFIP should be reauthorized to fulfill its original objectives, and administered in a manner that respects these objectives. Congress, in the National Flood Insurance Act of 1968, declared the purpose of NFIP: "a reasonable method of sharing the risk of flood losses is through a program of flood insurance which can complement and encourage preventive and protective measures…if such a program is initiated and carried out gradually, it can be expanded as knowledge is gained and experience is appraised, thus eventually making flood insurance coverage available on reasonable terms and conditions to persons who have need for such protection."

Congress, in 1968, did not create NFIP to charge full-risk rates, if those premiums were onerous and exacerbated risk exposure. Rates were supposed to be "adequate, on the basis of accepted actuarial principles, to provide reserves for anticipated losses, or, if less than such amount, consistent with the objective of making flood insurance available where necessary at reasonable rates so as to encourage prospective insureds to purchase such insurance and with the purposes of this chapter." Yet, only 4% of structures in the United States are covered today, and more policyholders are being priced out of the program as we speak.

NFIP was given the authority to borrow money from the US Treasury from the beginning, with Congress foreseeing the possibility of collecting less in premiums than claims paid. The Congressional Research Service (CRS) affirms that, "The NFIP was not designed to retain funding to cover claims for truly extreme events; instead, the National Flood Insurance Act of 1968 allows the program to borrow money from the Treasury for such events."

For most of the NFIP's history, the program—exclusively on the backs of policyholders, without any other support from taxpayers—has been able to cover its costs. Prior to Hurricane Katrina in 2005, NFIP's largest level of debt was $917 million in 1997, which was reduced to zero by the end of FY2003. Since 2005, the NFIP—through premiums collected from its policyholders—has made six principal repayments totaling $2.82 billion and has paid $6.17 billion in interest. NFIP has not borrowed from the Treasury since 2016.

Unless debt is forgiven, only current and future participants in the NFIP—via premium revenues—are responsible for repaying NFIP's debt and accruing interest. The October 2017 cancellation of $16 billion of NFIP debt represents the first time NFIP debt has been cancelled. The outstanding $20.525 billion in debt—and $619 million in interest paid by policyholders annually to Treasury—continues to hamper NFIP policyholders, and NFIP's success as both an insurance company and a federal program. This $619 million in interest would be much better invested in mitigation.

Recent administrative changes by FEMA further threaten NFIP's success. This change—Risk Rating 2.0—further diverts the program from its original dual purposes of providing flood insurance and reducing the nation's flood risk.

Risk Rating 2.0

CSFI was formed in the wake of the implementation of the Biggert-Waters Act, when homeowners across the county were facing skyrocketing rate increases through a combination of the removal of grandfathering and new maps, which oftentimes were inaccurate. CSFI was a driving force behind the passage of the Homeowner Flood Insurance Affordability Act (HFIAA), which was signed into law in March 2014.

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Today, we find ourselves in a similar position. As we did a decade ago, CSFI will work with all partners—coalition members, Members of Congress, FEMA's public servants, and all other interested stakeholders—to successfully address challenges with Risk Rating 2.0.

TRANSPARENCY AND ACCURACY CONCERNS

Risk Rating 2.0 is a "déjà vu" of sorts, although this time around, Congress did not pass legislation to cause this change to NFIP, nor has Congress had any substantial input in its development. FEMA, through what they claim is their administrative authority, has removed historical processes and replaced them—without a rulemaking process, an economic impact analysis, or even requested Congressional briefings. In short, transparency has been an issue in Risk Rating 2.0's rollout.

Premium Calcuations

Risk Rating 2.0 represents the largest change to NFIP's premium calculations since the program began in 1968. Risk Rating 2.0 was implemented on October 1, 2021 for new policies, and April 1, 2022 for existing policies. FEMA, in April 2023, finally released average full-risk rates for states, counties, and ZIP Codes. Beforehand, FEMA had only released an analysis of premium increases per month (e.g., policyholders on average see premium increases of $8 per month). This is ironic, as FEMA doesn't yet allow for payments in monthly installments, despite having the statutory directive from HFIAA in 2014 to provide policyholders with the option of paying premiums monthly. FEMA's former demonstration of premium cost changes in terms of per-month increases also hid full-risk rates, given HFIAA's annual premium increase limit for existing policies.

Monthly Installments

Impacts

With Risk Rating 2.0, FEMA has "moved the goal line" for policyholders and communities who have historically followed the rules by maintaining flood insurance coverage and satisfying floodplain management requirements. For example, past recipients of FEMA Flood Mitigation Assistance (FMA) grant assistance for home elevations agreed to maintain flood insurance coverage in perpetuity, expecting large premium discounts for mitigation, and not expecting Risk Rating 2.0 to change their premiums. Now, they cannot drop coverage, despite current conditions that they did not accept. CSFI's floodplain manager members have reported cases of property owners eligible for elevations denying FMA assistance. These property owners feel as though Risk Rating 2.0 discounts for mitigation are unclear or insufficient to make even subsidized costs of elevation financially prudent. Thus, Risk Rating 2.0 is confounding and undermining FEMA's own programs, intended to mitigate risk.

Rating Factors

Contrary to common misconception, FEMA has released the Risk Rating 2.0 methodology through a "Risk Rating 2.0 Methodology and Data Sources" document and appendixes. One appendix is the "premium calculation worksheet," an Excel document of four example properties in California, South Carolina, and Michigan to demonstrate the methodology's interaction of rating factors at the property-level. The "Appendix D Rating Factor" spreadsheet shows tables and scores for Risk Rating 2.0's dozens of rating factors including: state base rates, distance to water bodies, levee quality, drainage area, concentration risk, foundation type, first floor height, floors of interest, and much more. Flood zones from Flood Insurance Rate Maps (FIRMs) are not a rating factor. CSFI members and Congressional staffers have questioned some factors, like why there are base rates by state, since NFIP is a national program and the new methodology intends to reflect an individual property's specific flood risk, as opposed to general risk.

Unclear Inputs

Unfortunately, policyholders do not have access to their property-level rating factor inputs, beyond the few listed on their declaration pages, which is made available only after purchasing coverage. Furthermore, there is no public-facing, interactive Risk Rating 2.0 premium calculator. So, it still isn't clear to policyholders how modifying each of these factors (like elevation / first floor height) may affect their premium at the property-level. With Risk Rating 2.0, FEMA is communicating flood risk through price of flood insurance coverage. Alternatively, FEMA could now use its wealth of rating factors—procured through many vendors—to demonstrate how, where, and why policyholders are at risk, and how policyholders can most cost-effectively mitigate this risk.

FEMA Commitments

Recently, FEMA has taken additional strides towards transparency, like through the release of a "Flood Insurance Discount Tool." FEMA also commits to future transparency improvements, in response to the July 2023 Government Accountability Office (GAO) report on Risk Rating 2.0 (GAO-23-105977). For example, FEMA says that they will "enhance policyholder communication productions and public-facing websites" by April 30, 2024; "pilot online quoting tool" by April 30, 2025; and "publish final draft" of an annual actuarial report by September 30, 2025. FEMA should be encouraged, if not legislatively required, to honor their commitments.

To date, FEMA's communications, materials, and tools still leave much to be desired by policyholders, stakeholders, and local communities. FEMA's Office of the Flood Insurance Advocate (OFIA), in its latest annual report, underscores concerns about Risk Rating 2.0's transparency and accuracy. For example, "Policyholders, insurance agents and community officials expressed to OFIA that premiums

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Mitigation Activities

OFIA Recommendations

Accuracy Concerns

Property Location

No Appeals Process

Need for Audit

Verify Accuracy

rates do not seem to adequately reflect mitigation activities. For instance, they have indicated that they believe insufficient credit is given for certain mitigation techniques…This makes it harder for homeowners to take action to reduce their flood premiums, and harder for OFIA to advise customers of their mitigation options."

Amongst other suggestions, OFIA recommends that:

- "FEMA's Federal Insurance Directorate (FID) should make information about premium rates more accessible to the public and should update language on NFIP's Pricing Approach (*see* FEMA.gov) to describe in further detail how risks are aggregated and tailor new materials to wider audiences."
- "FID should make information available about who policyholders, agents, insurers, and other stakeholders can go to within FEMA when questions arise about premium rates that are not addressed in the public material."
- "FID should require standardized information on quotes and declarations pages to include a description of a property's flood risk including the types of flood risk and other specific rating factors that most influence the individual premium so that customers can understand their risk of flooding."
- "FID should ensure that deductible discounts are applied in a manner that meaningfully reflects the financial risk assumed by either the insurer or the insured."

OFIA also expresses accuracy concerns of Risk Rating 2.0's methodology and data sources, suggesting that:

- "FID should update the rating engine to allow agents and insurance companies to provide more accurate geographic coordinate data."
- "FID should consider establishing a process to allow agents and policyholders an opportunity to provide other sources of information to demonstrate replacement cost value used for flood insurance rating."
- "FID should explore ways to incorporate more data from communities into the catastrophe models."

In further detail, OFIA explains issues with geolocation in Risk Rating 2.0: "Policyholders want to provide additional detail to FEMA to refine the flood insurance price including correctly identifying latitude and longitude for geolocating the structure. To determine elevations and distance to flood sources, FEMA geolocates the address provided and determines the latitude and longitude. For almost all existing construction, the latitude and longitude are correct. However, in newer developments and very rural areas, the geolocation may be off enough to raise concerns about rating accuracy. Currently, there is not a mechanism for agents or policyholders to correct inaccurate latitudes and longitudes."

Risk Rating 2.0 intends to calculate flood insurance premiums for individual properties based on actual flood risk. But, as explained by OFIA, there are cases where Risk Rating 2.0 incorrectly identifies latitude and longitude for the structure.

There are other known issues with data granularity across rating factors, from distance to coast to levee quality. Yet, there is no appeals process—for policyholders or communities—to ensure that FEMA's data is accurate and that rating factors are refined at the property-, community-, or state-level. Furthermore, there is no disputes process for policyholders to challenge the accuracy, or fairness, of chargeable premiums.

In the "Risk Rating 2.0 Methodology and Data Sources" document, FEMA's contractor speaks to data reliability: "In performing the services, we relied on data and other information provided to us by FEMA and other sources. We did not audit, verify or review the data and other information for reasonableness and consistency. Such a review is beyond the scope of our assignment. If the underlying data or information is inaccurate or incomplete, the results of our analysis may likewise be inaccurate or incomplete. In that event, the results of our analysis may not be suitable for the intended purpose."

It also appears that there has never been an independent third-party peer review of the Risk Rating 2.0 methodology. The Government Accountability Office (GAO) has conducted a review of Risk Rating 2.0; however, it was not a technical review nor an audit for accuracy. GAO said, "In performing this analysis, we relied on actuarial reports and documentation provided by FEMA. We reviewed the documents for reasonableness but did not audit them for accuracy. To the extent that there are material deficiencies in completeness and accuracy in FEMA's actuarial reports, the actuarial premium estimates may be materially different from those shown in the reports had these deficiencies not been present. This review is not a technical review, and we did not verify the accuracy of the calculations performed by the actuaries who developed the full-risk premiums."

Proper programmatic improvements to address data accuracy and methodology development are outstanding. To address this, FEMA can arrange for a third-party review of the methodology and data sources. FEMA can accept more input from agents, policyholders, floodplain managers, and technical experts. This will refine Risk Rating 2.0 based on specific, local, or technical knowledge. Furthermore,

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this can empower policyholders and communities, making them more likely to reduce their flood risk exposure and take on mitigation activities. Until then, identified frustrations above, and their impacts identified below, are expected to continue.

NATIONAL IMPACT OF RISK RATING 2.0

Increased Rates

On average, under Risk Rating 2.0, an NFIP policy will be $1,808, which represents a 103.6% increase over legacy rates. Although much of the public outcry about Risk Rating 2.0 has been from Louisiana, Louisiana is far from the most affected state. In terms of full-risk rates, there are 17 states with higher average rates than Louisiana. Rates will increase by over 50% in 41 states. States with the highest average full-risk rates are:

1. Hawaii: $3,653 (+154.1%)
2. West Virginia: $3,074 (+171.2%)
3. Connecticut: $3,000 (+88.6%)
4. Maine: $2,700 (+183.2%)
5. New Hampshire: $2,545 (+109.2%)
6. Vermont: $2,248 (+87.7%)
7. Florida: $2,213 (+131.1%)
8. Kentucky: $2,201 (+107.6%)
9. New York: $2,197 (+85.5%)
10. Mississippi: $2,137 (+149.1%)

Price Elasticity

In CSFI's 2022 white paper, "An Evaluation of Risk Rating 2.0 on NFIP Affordability," a literature review of NFIP price elasticity found that a price increase of 1% causes a decreased demand of 0.11% to 0.87% for flood insurance policies. Before Risk Rating 2.0 was implemented, an internal FEMA study estimated that that 20% of policyholders nationwide would ultimately leave the program due to premium increases. We are watching this prediction unfold.

Decreasing Policies

NFIP's participation peaked around 5,700,235 in 2009. On the day before Risk Rating 2.0's implementation in October 2021, there were 4,899,114 policies in force nationally. As of December 2023, there are now 4,683,971 policies in force nationally. Thus, NFIP has lost over 215,000 policyholders, or 4.39% of all policyholders, since Risk Rating 2.0's implementation. In Texas alone 121,739 policies have been lost. Participation has already fallen by over 5% in 26 states and by over 10% in 14 states. The 14 states with the greatest declines in policies in force, by percentage of policies, are:

1. West Virginia: -2,428 (-19.44%)
2. Oklahoma: -2,050 (-17.74%)
3. Texas: -121,739 (-15.50%)
4. North Dakota: -1,198 (-14.55%)
5. Iowa: -1,602 (-14.10%)
6. Minnesota: -919 (-11.29%)
7. South Dakota: -327 (-10.89%)
8. Missouri: -1,933 (-10.64%)
9. Louisiana: -53,558 (-10.54%)
10. Nebraska -886 (-10.54%)
11. Kansas: -848 (-10.35%)
12. Arkansas: -1,354 (-10.15%)
13. Ohio: -2,665 (-10.07%)
14. Mississippi: -6,086 (-10.00%)

Additional Costs

Clearly, Americans are not yet benefitting from Risk Rating 2.0. Risk Rating 2.0 is proving cost prohibitive to policyholders and is posing a burden to FEMA itself. David Maurstad said that, "Since 2017, hundreds of FEMA staff, over a dozen contractors pursuant to over two dozen different contracts, thousands of staff and insurance agents from the 47 Write Your Own (WYO) Flood Insurance companies participating in the NFIP, and 5 vendors have worked on the development and implementation of Risk Rating 2.0. This effort has cost the federal government over 80 million dollars, all of which would be wasted if the implementation of the current rates were permanently enjoined."

CSFI supports Congressionally-proposed, FEMA-supported, and private market-backed provisions that can provide coverage. For example, CSFI supports allowing for private flood coverage to satisfy continuous coverage requirements, which would allow policyholders to switch between public and private coverage without permanently sacrificing benefits of NFIP's annual rate increase limit. This priority is more urgent with a growing private market and a less affordable NFIP.

NFIP

REGIONAL IMPACT OF RISK RATING 2.0

Across the country, NFIP allows working communities to continue working. Our region—Greater New Orleans—is essential to the national economy, and even global food and energy security. NFIP simply does not take these factors into account. NFIP has not conducted a comprehensive assessment of the economic and social impacts of implementing Risk Rating 2.0, which would demonstrate ripple effects on government revenues, property values, national security, and more.

Illustrating the importance of Greater New Orleans, over 50% of all US grain exports travels through the Port of South Louisiana. Under Risk Rating 2.0, flood insurance premiums are increasing by 239.2% in St. Charles Parish, where many of the port's workers reside. While many federal levees in the National Levee Database are considered by Risk Rating 2.0—like the $14.5B Hurricane & Storm Damage Risk Reduction System surrounding our region. However, St. Charles Parish has invested in local levees and pump stations which are not accounted for in ratemaking. For example, near a local flood control structure that FEMA doesn't recognize, an X Zone home in Des Allemandes, LA will see premiums increase from $572 to $6,131.

Economic Impacts

Higher costs of living and higher costs to employ logistics and trade workers will be passed on to consumers nationwide. Eventually, by pricing out workers within our region, farmers in Nebraska and agricultural workers across the Midwest won't be able to export grain produced. Moreover, the US would lose competitive advantages in logistics and trade. The US would also sacrifice the agility to stabilize global markets, as seen in recent years, when Ukraine's grain exports are constricted.

Community Impacts

The largest private investment in human history—a $21B LNG export facility—is currently under construction in Plaquemines Parish, near the mouth of the Mississippi, for the benefit of the American economy, global security, and global climate (switching Asia from coal to gas). In Plaquemines Parish, the average full-risk premium is $5,431 per year, an increase of 545.3% compared to legacy rates. A property in Belle Chasse, LA is seeing an increase from $572 to $8,828. This is a parish with a poverty rate of 16.4%, five percentage points above the national average. The median value of owner-occupied homes is $253,300, compared to $281,900 nationally. And, due to NFIP floodplain management requirements, in some parts of the parish, a new home (or a substantially damaged property) must be built or elevated to a base flood elevation of 18 feet. NFIP is wreaking havoc on critical communities like this, which will inevitably have cascading consequences, without Congressional intervention.

Meanwhile in Plaquemines Parish, in addition to historic industry investment, there is historic environmental investment. The largest ecosystem restoration in the nation's history has broken ground. The $2.9B Mid-Barataria Sediment Diversion will harness the land-building power of the Mississippi River to build and sustain up to 26,000 acres of wetlands in the Barataria Basin. This project is part of Louisiana's 50-year, $50B Coastal Master Plan, which is not clearly factored into rates.

Modelling

Since 2016, Louisiana has restored and maintained 26,000 acres of coastal land and improved 83 miles of levees. The projects identified in the 2023 Coastal Master Plan will restore and maintain over 300 square miles of Louisiana's coastal wetlands and reduce expected annual damage by up to $15 billion. Instead, through catastrophe modeling and Risk Rating 2.0's "disaster to coast" factor, Louisiana may be being punished for a century of coastal land loss, largely due to federal management of the Mississippi River and largely out of communities' control.

Credit for Investment

Implementing all projects in Louisiana's Coastal Master Plan over a 50-year period could reduce risk from tropical storms and hurricanes to coastal communities to less than what the current risk level is today, even considering sea level rise projections. But, communities—and entire states—are not necessarily being given credit for their investments in resilience nor incentivized to do so. Thus, considering residents' cost-prohibitive premiums, communities could be left with fleeing populations and cratering tax bases. They will be unable to pay for necessary adaptations from their self-generated revenues, and they will have to rely more heavily on federal funding, both for public improvements and for residents' flood losses.

Mitigation Projects

Still, the City of New Orleans is wisely investing in green infrastructure and smarter storm water management practices, as advised by GNO, Inc.'s 2013 Greater New Orleans Urban Water Plan. The Mirabeau Water Garden is converting the site of a former convent, flooded by Hurricane Katrina, into a 10-million-gallon detention pond and an urban water management educational center. Despite being funded through FEMA's own Hazard Mitigation Grant Program (HMGP), this project won't necessarily reduce neighbors' NFIP premiums, although it will reduce flooding by up to 14 inches. Moreover, when neighbors drop NFIP coverage or move due to heighted premiums, this can affect a projects' **b**enefit **c**ost **a**nalysis (BCA) of projects and impact their eligibility for federal funding.

Throughout the Gentilly neighborhood where Mirabeau lies, through a "community adaptation program," approximately 200 households have installed various property-level retrofits to reduce their

NFIP

flood risk. These property-level flood adaptations—permeable pavement, stormwater planter boxes, tree plantings, infiltration trenches, rain barrels, and rain gardens—are also not considered in Risk Rating 2.0. While these property owners have reduced flood risk for themselves and their neighbors, they are not being credited by NFIP for doing so.

Incentivizing Adaptations

Across the state, we're also adapting by installing FORTIFIED roofs, a construction method that reduces the chance of wind-related losses through stronger roofs. The FORTIFIED Program, a program of the Insurance Institute for Business & Home Safety (IBHS), is a strong model for resilient building practices and relevant incentivization. In Louisiana, state law requires actuarially-sound premium discounts to be provided to policyholders who install FORTIFIED roofs. Similarly, NFIP policyholders could be incentivized to install floodproofing adaptations, from permeable pavements to rain gardens, in exchange for appropriate NFIP premium discounts.

Anomaly

Oddly, rates in our region are being treated as an anomaly, according to FEMA's "Risk Rating 2.0 Methodology and Data Sources" technical document. With no further explanation, the document reads, "As in the non-leveed analysis, Generalized Linear Models (GLM) were used to develop geographic rating factors for leveed areas. For the non-leveed analysis, separate models were fit by segments that consisted of groups of states. For the leveed analysis, there was a smaller volume of data that was more highly geographically concentrated. Using the same segments as the non-leveed analysis would have produced policy counts that were too low within a segment. Instead, the GLMs were fit on the countrywide data. Upon reviewing the residuals, Milliman created an interaction term in the Inland Flood model to allow for elevation as a rating variable in Louisiana. Without this rating variable, **a**verage **a**nnual **l**osses (AAL) were underpredicted in low elevation areas, especially areas with negative elevation in New Orleans. Milliman also found it necessary to create separate GLMs for Louisiana Storm Surge."

Affordability

Maybe regions like ours—communities that are economically important to protect, and imperative for the national economy to exist near water—should be treated differently in ratemaking than some second-home, vacation communities. This differentiation is seen in some parts of NFIP. For example, the HFIAA surcharge is $25 for primary residences and $250 for second homes. Annual premium increases are capped at 18 percent for primary residences but at 25 percent for secondary home and severe repetitive loss properties. A future affordability program to help working Americans could be only open to primary residences that are not severe repetitive loss properties.

Our community is like many of the 22,500+ in NFIP—a hardworking community that serves America through water resources. Over half of America's population lives in a coastal county, and over half of all jobs are located in coastal counties. Moreover, 57% of the country's **g**ross **d**omestic **p**roduct (GDP) is produced from counties by the coast according to a CSFI analysis of Lightcast GDP data. A flood insurance program should allow coastal economies to not only exist, but provide for the rest of our country through trade, logistics, agriculture, advanced manufacturing, energy production, and all industries that are dependent on proximity to water.

And beyond the coast, flooding still occurs—as you'll remember 99% of US counties have been impacted by a flooding event since 1996; in 2019, of the ten states with the most flooding events, only three were coastal states (FEMA). Fairly priced flood insurance—and complementary investments in mitigating flood risk—is essential to the American economy, in Greater New Orleans, and everywhere.

Reform Priorities

Reauthorize & Reform

With this understanding of NFIP's importance and current concerns, NFIP should be reauthorized and reformed. Although Congress did not cause the Risk Rating 2.0 predicament, fortunately, it can take action to address it in a manner that improves economies, empowers communties, and protects policyholders.

Priorities

We underscore the following reform priorities for consideration by the 118th Congress. These priorities are informed by legislation introduced this Congress, like the National Flood Insurance Program Reauthorization and Reform Act (NFIP-RE) of 2023, as well as CSFI's white paper on affordability, and our coalition members' insight (https://csfi.info/).

Peer Review

1. **Require a peer-review of the Risk Rating 2.0 methodology and an analysis of Risk Rating 2.0's economic impacts**—An independent actuarial review performed on an ongoing basis by a team of experts could heed improvements to the Risk Rating 2.0 methodology, while establishing insight into Risk Rating 2.0. This review may work to improve data resolution issues and a perceived undervaluation of certain factors, like first floor height and other mitigation measures. Congress can simultaneously require FEMA to review national impacts of Risk Rating 2.0. For example, the Risk Rating 2.0 Transparency Act would mandate that FEMA "complete and publish a comprehensive assessment of the economic and social impacts of implementing Risk Rating 2.0" over a 20-year period.

NFIP

Appeals Process

Cap Increases

Assistance Program

Forgive Debt

Policy Reform

2. **Mandate FEMA's transparency through the release of a public-facing rate calculator and establishment of rating factor appeals process**—Policyholders demand a way to review rating factors, validate property-level inputs, understand their comprehensive risks, and see the impact on premiums from undertaking mitigation measures. The NFIP-RE Act would mandate that FEMA "establish a tool that allows members of the public to estimate premium rates for covered properties under the Risk Rating 2.0 program (or any similar methodology) within a reasonable margin of error based on user inputs." Furthermore, the NFIP-RE Act would "establish a fair, transparent, and streamlined process to manage disputes regarding chargeable premium rates prescribed." This appeals process is necessary so that policyholders can ensure Risk Rating 2.0's data accuracy at the property-level.
3. **Lower annual premium increases to nine percent**—Cutting the annual rate hike cap in half, from 18% to 9%, cuts anticipated NFIP participation decreases in half, according to statistical models of NFIP price elasticity. NFIP participation has already decreased by over 4% since Risk Rating 2.0's implementation. Congress should cap single-family primary residential annual premium increases to a maximum of 9% each year, to stabilize program participation and serve as a bridge to a permanent affordability program. The Flood Insurance Affordability Act would accomplish this.
4. **Enact a means-tested assistance program with housing burden as a targeting factor**—Under Risk Rating 2.0, the median percentage of household income represented by the full-risk premium will exceed 1 percent in 45 states and will equal or exceed 2 percent in 10 states. FEMA has proposed to administer an affordability program for certain NFIP policyholders, but this requires Congressional authorization. This program should be authorized and made available to both current and prospective policyholders, with scaled discounts to assist those most in need, in order to encourage NFIP participation growth. The NFIP-RE Act proposes eligibility for policyholders earning up to 140% of **a**rea **m**edian **i**ncome (AMI), which CSFI supports. However, in lower income areas with higher costs of living, 140% of AMI may still be insufficient to reach homeowners in need. Beyond AMI, there are other cost of living measures—most relevantly housing burden—that can be used to determine eligibility or discount distribution.
5. **Forgive NFIP's debt or freeze interest payments**—Congress should forgive NFIP's debt, given that it was accumulated under a legacy pricing system. FEMA will pay the US Treasury $619M this year to service $20.5B of NFIP debt, much from policyholders who have left the program or mitigated their properties. According to FEMA, approximately 11% of each current policyholder's premium is applied towards these payments, equating to about $132 per policyholder per year. At the least, Congress should grant forbearance for interest payments over a defined period of time. The NFIP-RE Act would pause interest payments for five years, and deposit these savings into a National Flood Mitigation Fund.

The policies above—intended to resolve common equity, affordability, transparency, and accuracy concerns—would serve to stabilize participation, sustain the program, and support communities across the country.

Conclusion

These policies are just the beginning. Other reforms called for by NFIP stakeholders include Increased Cost of Compliance modernization, flood mapping modernization, claims process reform, among many more. Furthermore, Congress could work to address global insurance challenges that put pressure on NFIP, such as skyrocketing reinsurance costs. For example, a federal reinsurance commission could be established to study options for federal intervention, as well as associated savings to FEMA and other federal agencies, and then propose solutions.

Again, thank you for the opportunity to testify today about the reauthorizing and reforming the National Flood Insurance Program. We appreciate your recognition of NFIP's value to local communities and the American economy.

All stakeholders across the country interested in sustainable flood insurance are welcomed to join our coalition. CSFI stands ready and willing to assist the Committee as we work to reauthorize the NFIP by March 8, and as we pursue long-term solutions that improve NFIP and our country's sustainability.

For Additional Information:

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NFIP

Michael Hecht is President & CEO of Greater New Orleans, Inc., the economic development agency for southeast Louisiana. GNO, Inc.'s mission is to create a region with a thriving economy and an excellent quality of life, for everyone. Under Michael's leadership, GNO, Inc. has been named the "Top Economic Development Organization in the United States" by the International Economic Development Council. Prior to GNO, Inc., Michael led Louisiana's Hurricane Katrina Small Business Recovery Program, and worked for Mayor Bloomberg running NYC's post-9/11 small business program. Michael holds an MBA from Stanford University and undergraduate degree from Yale University. With family roots in Louisiana back to the 1830s, Michael lives in New Orleans with his wife and two sons.

Peter Waggonner is the Public Policy Director for Greater New Orleans, Inc., Southeast Louisiana's regional economic development organization. His portfolio encompasses infrastructure, insurance, and the environment at local, state, and federal levels. He manages the Coalition for Sustainable Flood Insurance (CSFI) and GNO, Inc.'s resilience work, after previous experience addressing quality of life issues and directing constituent services for a New Orleans City Council district. He has previously served in government administration for country's largest metropolitan planning organization and in nonprofit administration for a business improvement district in California. He is a graduate of the University of Pennsylvania.

WATER BRIEFS

UTILITY CYBER ATTACKS US
RESPONSE GUIDE

The Cybersecurity and Infrastructure Security Agency (CISA), Federal Bureau of Investigation (FBI), and Environmental Protection Agency (EPA) published a guide on Jan. 18 to assist owners and operators in the Water and Wastewater Systems (WWS) Sector with best practices for cyber incident response and information about federal roles, resources and responsibilities for each stage of the response lifecycle. Technical expertise is not required to understand and use this guide.

Developed in collaboration with over 25 WWS Sector industry, nonprofit, and state/local government partners, this resource covers the four stages of the incident response lifecycle:

1. **Preparation**: WWS Sector organizations should have an incident response plan in place, implement available services and resources to raise their cyber baseline, and engage with the WWS Sector cyber community.
2. **Detection and analysis**: Accurate and timely reporting and rapid collective analysis are essential to understand the full scope and impact of a cyber incident. The guidance provides information on validating an incident, reporting levels, and available technical analysis and support.
3. **Containment, eradication, and recovery**: While WWS Sector utilities are conducting their incident response plan, federal partners are focusing on coordinated messaging and information sharing, and remediation and mitigation assistance.
4. **Post-incident activities**. Evidence retention, using collected incident data, and lessons learned are the overarching elements for a proper analysis of both the incident and how responders handled it.

"The Water and Wastewater Systems sector is under constant threat from malicious cyber actors. This timely and actionable guidance reflects an outstanding partnership between industry, nonprofit, and government partners that came together with EPA, FBI and CISA to support this essential sector. We encourage every WWS entity to review this joint guide and implement its recommended actions," said CISA Executive Assistant Director for Cybersecurity, Eric Goldstein. "In the new year, CISA will continue to focus on taking every action possible to support 'target-rich, cyber-poor' entities like WWS utilities by providing actionable resources and encouraging all organizations to report cyber incidents. Our regional team members across the country will continue to engage with WWS partners to provide access to CISA's voluntary services, such as enrollment in our Vulnerability Scanning, and serve as a resource for continued improvement."

All WWS utilities are encouraged to use this incident response guide to augment their incident response planning and collaboration with federal partners and the WWS before, during, and following a cyber incident. Familiarity with this guide will better prepare WWS utilities to respond to, and recover from, a cyber incident.
FOR INFO: https://www.cisa.gov/resources-tools/resources/water-and-wastewater-sector-incident-response-guide-0

DELTA TUNNEL CA
COURT RULING ON FUNDING

A California court ruled on Jan. 16 that the California Department of Water Resources' (Department) efforts to fund the Delta tunnel project were unlawful.

The Department was seeking legal validation of the Delta Program Revenue Bonds, which would raise $16 billion or more to plan and construct a massive tunnel project under the San Joaquin Delta. The tunnel would divert billions of gallons of water annually from the Sacramento River, endangering the ecosystem's health and harming farming communities.

The Center for Biological Diversity and other environmental groups, as well as Sacramento and San Joaquin counties, local

and regional water districts, and taxpayer advocates, challenged the Department's attempt to secure legal validation for the Delta Program Revenue Bonds. The ruling by the Sacramento Superior Court found that the Department lacked the authority to issue revenue bonds to finance the Delta tunnel project.

The single-tunnel project was announced in 2020, to replace the twin-tunnel California WaterFix project.
FOR INFO: https://biologicaldiversity.org/programs/urban/pdfs/Delta-Tunnel-Validation-Judgment.pdf

GREAT SALT LAKE UT
STRATEGIC PLAN

The Great Salt Lake Commissioner's Office has released the state of Utah's first strategic plan to get the Great Salt Lake to a healthy range and sustain it. In November 2022, the lake fell to a new record low level. During the 2023 Legislative General Session, HB491 was passed, creating the Office of the Great Salt Lake Commissioner and required the preparation of a strategic plan applying "a holistic approach that balances the diverse interests related to the health of the Great Salt Lake…."

"The plan represents an initial strategy to more effectively protect the lake while balancing the other ecological, economic and societal interests surrounding the lake," Commissioner Brian Steed said. "Restoring the lake to a healthy range is not a one-year, one-policy, one-constituency solution. It will take a coordinated, data-driven approach so decision-makers can evaluate tradeoffs and balance competing interests."

The lake is a dynamic system, and its management must also be dynamic. The plan will be revisited regularly and adjusted to reflect the latest data and meet new challenges and opportunities. The strategy includes short-, medium- and long-term actions.

As outlined in HB491, the Great Salt Lake Strategic Plan helps ensure coordination of the work taking place among the many stakeholders who work on lake issues and calls for:

- Coordinating the efforts of a wide variety of agencies and stakeholders and ensuring robust public engagement on issues related to the lake
- Utilizing the best available science and data when making decisions that impact the lake
- Getting more water to the lake and ensuring a sustainable water supply while balancing competing needs, including human health and quality of life, a healthy ecosystem, and economic development
- Conserving water across different sectors (M&I, industrial, and agricultural), including quantification of water savings and shepherding saved water to the lake
- Protecting air and water quality

The release of the Great Salt Lake Strategic Plan is just the beginning. The hard work of implementing the plan builds off the work the state and others have already begun. The plan calls for additional detailed planning efforts to ensure enough water gets to the lake over the next 30 years and to maximize the investments that the Legislature has made for the benefit of the lake and everyone who relies upon it.

The Great Salt Lake is the largest saline lake in the Western Hemisphere and the eighth largest in the world—boasting a rich web of relationships between people, land, water, food and survival. The lake contributes $1.9 billion to Utah's economy, provides over 7,700 jobs, supports the highest concentration of Utah's valuable wetlands, and provides a stopover for millions of birds to rest and refuel during migration each year. Lake effect snow also contributes 5-10% to Utah's snowpack. The lake is vital to the environment, ecology and economy, not just in Utah but also the western US.
FOR INFO: https://greatsaltlake.utah.gov/wp-content/uploads/Great-Salt-Lake-Strategic-Plan-1.pdf

GROUNDWATER MANAGEMENT NV
SUPREME COURT DECISION

The Nevada Supreme Court ruled on Jan. 25 that the Nevada State Engineer has the authority to merge multiple water basins for the preservation of senior water rights and the public interest, including wildlife.

The decision in the Lower White River Flow System case will help determine the future of water management in the driest state in the US.

The case centers around an aquifer that sustains the Muddy River in Clark County, Nevada. This spring-fed oasis provides habitat for an endangered fish called the Moapa dace. The Muddy River is also a source of drinking water for Las Vegas.

Coyote Springs, a proposed city of a quarter-million people in the desert 50 miles northeast of Las Vegas, applied for groundwater rights to pump water that scientists say would deplete the springs the Moapa dace relies on for survival.

The State Engineer ordered a pump test and extensive hydrologic investigations. It was determined that there was a finite supply of water available in the aquifer and that excessive pumping would impair senior water rights and harm the Moapa dace.

This Supreme Court ruling, overturned a district court ruling in *Sullivan et al. v. Lincoln County et al.*

The court also remanded the case back to the District Court Judge Bita Yeager for a ruling on whether the state's order was based on substantial evidence. This is a distinct set of legal criteria which evaluated whether the state had the power to issue the order.
FOR INFO: https://www.documentcloud.org/documents/24376586-lower-white-river-flow-system-supreme-court-ruling

STORMWATER FUNDING US
CENTERS OF EXCELLENCE

As part of President Biden's Investing in America agenda, the US Environmental Protection Agency (EPA) announced the availability of $3 million through its Centers of Excellence for Stormwater Infrastructure Technologies grant program to expand stormwater infrastructure solutions across the country. EPA is seeking applicants to establish national Centers of Excellence for Stormwater Infrastructure Technologies, made possible by President Biden's Bipartisan Infrastructure Law. Eligible applicants for the funding include institutions of higher education, research institutions, and nonprofit organizations.

Stormwater is a significant source of water pollution as it can collect various pollutants including trash, chemicals, oils and sediment and move them to nearby waterways. When mixed with domestic and industrial wastewater in combined sewers, stormwater can also contribute to combined sewer overflows during heavy storm events. Once selected, the Stormwater Centers of Excellence will develop and enhance stormwater best practices by conducting research on new and emerging stormwater control infrastructure technologies and alternative funding approaches; providing technical assistance to state, Tribal and local governments; and collaborating with regional institutions.

Many communities struggle to address stormwater issues because of the costs associated with construction, operation and maintenance of the necessary infrastructure, and because their systems were built for the rain and storm patterns of the last century. In addition, a number of communities across the nation need practical stormwater technologies and the scientific understanding of those technologies to effectively implement stormwater management solutions.

The Centers of Excellence for Stormwater Infrastructure Technologies grant program was made possible by the Bipartisan Infrastructure Law, which also invests more than $50 billion in water, wastewater and stormwater infrastructure solutions across the country to protect public health and treasured waterways and create new green opportunities for communities.

In addition to the new Centers for Excellence, funding will also support the creation of a national electronic clearinghouse that contains information relating to new and emerging stormwater control infrastructure technologies.
FOR INFO: https://www.epa.gov/npdes/stormwater-centers-excellence-grant

CLEAN WATER ACT — ID
ENFORCEMENT & PENALTIES

The US Environmental Protection Agency announced on Jan. 24 that Michael Gagliano agreed to pay a penalty of $8,000 for violating the Clean Water Act when he discharged fill material into the South Fork of the Coeur d'Alene River at his property in Pinehurst, Idaho.

Beginning in September 2022, Gagliano discharged large rocks below the ordinary high-water mark of the South Fork of the Coeur d'Alene River without a Clean Water Act permit. The unauthorized discharges occurred within the Bunker Hill Superfund Site. As a result, these discharges likely mobilized highly contaminated sediment and mine tailings frequently found throughout the site. This type of mobilization is often exacerbated by high-flow events following heavy rains or snowmelt.

"Property owners must get the necessary Clean Water Act permits to make sure that any work impacting waters of the United States is done in a way that protects the health of the ecosystem and minimizes the impact to sources of drinking water and water used for recreation." said EPA Region 10 Office of Enforcement and Compliance Assurance Director Ed Kowalski. "These types of Clean Water Act enforcement actions are important in protecting our valuable water resources and are especially important in areas within Superfund sites with highly contaminated sediments."

The unauthorized discharges occurred when the landowner attempted to increase armoring of the riverbank. This activity, especially when combined with similar bank armoring activities throughout a river system, can have dramatic and long-term impacts on ecosystem health and can result in increased riverbank scouring and erosion on adjacent properties.

In addition to paying the penalty, Gagliano agreed to remove the fill material and restore the site prioritizing slope stabilization, erosion reduction, and establishing vegetation along the riverbank.

EPA Region 10 worked closely with the US Army Corps of Engineers, Idaho Department of Environmental Quality, Idaho Department of Water Resources, and the Panhandle Health District on an appropriate resolution to the violation.

This is the second Clean Water Act enforcement action brought by EPA within the Bunker Hill Superfund Site during the last couple of years. In 2022, Cody Karst of Pinehurst was required to pay a $14,000 penalty and restore wetlands that he damaged, also along a portion of the South Fork of the Coeur d'Alene River, and a tributary to the river.
FOR INFO: https://yosemite.epa.gov/oa/rhc/epaadmin.nsf/Advanced%20Search/186A8B5879CABD-DA85258A2E005870DD/$File/Consent%20Agreement_Michael%20Gagliano_CWA-10-2023-0132.pdf

PFAS FUNDING — AZ
TREATMENT & IDENTIFICATION

In response to concerns about PFAS found in three public drinking water systems serving the Globe community, the Arizona Department of Environmental Quality (ADEQ) is collaborating with the City of Globe on actions and solutions that will ensure community members in the area receive healthy drinking water. This collaboration was made possible by $5 million allocated by Governor Katie Hobbs and the Arizona Legislature to ADEQ in 2023 to identify, contain and treat Arizona water sources for PFAS chemicals.

In anticipation of the US Environmental Protection Agency (EPA) finalizing its National Primary Drinking Water Regulation for certain PFAS compounds, which will apply to approximately 950 Arizona systems, both ADEQ and public water systems have been conducting PFAS testing to identify the extent of PFAS in Arizona drinking water. While data for large systems is still being collected under EPA's Unregulated Contaminant Monitoring Rule (UCMR) testing program, estimates from ADEQ's ongoing sampling, which is 90 percent complete, indicate that 70 or more small water systems (serving 3,300 or less customers) could require PFAS mitigation when EPA's regulation goes into effect.

To provide support to small water systems and disadvantaged communities that will need assistance to address PFAS, ADEQ developed and is implementing a statewide drinking water PFAS mitigation plan. ADEQ's plan leverages both the $5 million in state funding and an additional $42 million in federal Bipartisan Infrastructure Law funding and includes:

- **Testing for public drinking water systems**—Confirming PFAS contamination and testing for other contaminants that can interfere with PFAS treatment.
- **Hydrogeologic evaluations**—Assessing several PFAS-impacted areas of the state where the hydrogeology is less-studied. These evaluations will help drinking water providers make decisions such as removing wells from service, relocating wells, blending water, and connecting with another system.
- **Treatment and infrastructure improvements**—Providing funding for design and construction of PFAS mitigation strategies, such as connection to a clean water source, deepening existing wells or drilling new wells, or PFAS treatment.
- **PFAS education for drinking water professionals**—Hosting a forum to discuss industry perspectives on PFAS solutions, developing technical guidance documents for engineers designing PFAS treatment systems and conducting ongoing training webinars.

FOR INFO: https://www.azdeq.gov/pfas-resources

CALENDAR

February 15-16 IL

IAGP 96th Annual Convention and Trade Show, East Peoria. Embassy Suites by Hilton East Peoria Riverfront Hotel & Conference Center. Presented by Illinois Association of Groundwater Professionals. For info: https://www.iagp.org/event-5428191

February 19-21 IA

42nd Annual Technical Conference, Effingham. Holiday Inn/Keller Convention Center. Presented by Illinois Rural Water Association. For info: https://www.ilrwa.org/ATC.html

February 21 WEB

One Water Demystified, Virtual. Presented by Water Education Colorado. For info: https://www.watereducationcolorado.org/civicrm/event/register/?id=348&reset=1

February 20-22 IL

49th Annual Conference, Des Moines. Community Choice Credit Union Convention Center Veterans Memorial Center. Presented by Iowa Rural Water Association. For info: https://iowaruralwater.org/annual-conference

February 23 CA

The Future of Water, Sacramento. The Elks Tower Event Center. Presented by Ground Water Resources Association of California. For info: https://www.grac.org/events/register/530/pre/

February 24 CA

California Water Law Symposium, San Francisco. University of San Francisco School of Law. For info: https://www.waterlawsymposium.org/

February 26-01 UT

2024 Rural Water Annual Conference, Saint George. The Dixie Convention Center. Presented by Rural Water Association of Utah. For info: https://www.rwau.net/events/rural-water-annual-conference-2024/register

February 29 CA

A Colorado River Roundtable: Solutions for the 21st Century, Riverside-Palm Desert Center. University of California**.** Presented by American Water Works Association. For info: https://engage.awwa.org/PersonifyEbusiness/Events/AWWA-Events-Calendar/Meeting-Details/productid/222073564?_gl=1*iicggc*_ga*oda4mze3mzewlje3mdewnzi5njc.*_ga_v6lk6lpn9v*mtcwmtk2ndg5oc40ljeumtcwmtk2ntexny40my4wlja.

March 4-7 FL

Membrane Technology Conference, West Palm Beach. Palm Beach County Convention Center. Presented by American Water Works Association. For info: https://www.awwa.org/Events-Education/Membrane-Technology

March 5-7 CO

Riparian Restoration Conference: Restoration for the Future,Grand Junction. Colorado Mesa University. Presented by RiversEdge West. For info: https://riversedgewest.org/get-involved/events/2024-riparian-restoration-conference-restoration-future

March 5-7 MN

MRWA Water & Wastewater Technical Conference, St. Cloud. River's Edge Convention Center. Presented by Minnesota Rural Water Association. https://www.mrwa.com/technical-conference-attendee-registration/

March 5-8 NV

2024 NvRWA Annual Training, Sparks. Nugget Casino Resort. Presented by Nevada Rural Water Association. For info: https://www.nvrwa.org/2024-nvrwa-conference-registration.html

March 6-8 NV

2024 Land and Water Summit, Albuquerque. Indian Pueblo Cultural Center. Presented by the Land and Water Summit. For info: https://www.landandwatersummitnm.org/index.php/registration/

March 7-8 FL

Water Audits and Non-Revenue Water Management, West Palm Beach. Palm Beach County Convention Center. Presented by American Water Works Association. For info: https://www.awwa.org/Events-Education/Water-Audits-and-Non-Revenue-Water-Management?utm_source=higher_logic&utm_medium=email&utm_term=Water%20Audit%20Seminar%20%2D%2012%2F11&utm_content=ce&utm_campaign=seminar_23

March 7-8 CA

Sustainable Water Investment Summit, Rancho Palos Verdes. Terranea Resort. Presented by Brownstein and WestWater Research. For info: https://www.sustainablewaterinvestment.com/registration

March 11-14 CO

WateReuse Symposium 2024: Removing Barriers, Elevating Opportunities, Denver. Hilton Denver City Center. Presented by WateReuse Trade Association. For info: www.watereuse.org

March 12-13 AZ

WRRC 2024 Annual Conference Implementing Water Solutions Through Partnerships, Tucson. University of Arizona Student Union Grand Ballroom. Presented by the Water Resources Research Center. For info: https://wrrc.arizona.edu/conference/2024

March 13-15 DC

Water Power Week, Washington. Capital Hilton. Presented by the National Hydro-Power Association. For info: https://waterpowerweek.com/

March 13-15 NV

Lower Colorado River Tour 2024, Las Vegas. Hilton Garden Inn. Presented by Water Education Foundation. For info: https://www.eventbrite.com/e/lower-colorado-river-tour-tickets-771888267587

March 15-16 WA

2024 Pacific Northwest Ground Water Exposition, Vancouver. Hilton Vancouver Washington. Presented by Pacific Northwest Ground Water Association. For info: https://pnwgwa.org/

March 18-19 WA

Northwest Groundwater Conference, Pasco. Holiday Inn Express Hotel & Suites. Presented by American Groundwater Trust Northwest Groundwater Conference. For info: https://agwt.org/civicrm/event/info?id=373&reset=1

March 18-21 CA

33rd Annual International Conference on Soil, Water, Energy, and Air, San Diego. The DoubleTree Mission Valley. Presented by the Association for Environmental Health and Sciences Foundation. For info: https://www.aehsfoundation.org/westcoast

March 27-29 TX

RuralWaterCon 2024, San Antonio. Henry B. Gonzalez Convention Center. Presented by Texas Rural Water Association. For info: https://www.trwa.org/page/rwc24

April 3 WEB

Cybersecurity and Risks of AI, Virtual. Presented by American Water Works Association. For info: https://engage.awwa.org/personifyebusiness/events/awwa-events-calendar/meeting-details/productid/225069726?_gl=1*1m8xsns*_ga*oda4mze3mzewlje3mdewnzi5njc.*_ga_v6lk6lpn9v*mtcwnjm0mzm0mi44ljeumtcwnjm0mzm1ns40ny4wlja.

April 3-6 AZ

Biennial Symposium on Managed Aquifer Recharge, Tucson. Casino Del Sol. Collaboration of the Arizona Hydrological Society and the Groundwater Resources Association of California. For info: https://ahssymposium.org/bsmar/

The Water Report
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3615 W. Hills of Gold Dr. Tucson, AZ 85745

CALENDAR

April 5 **CA**

Water 101 Workshop, Sacramento. McGeorge School of Law. Presented by Water Education Foundation. For info: https://www.eventbrite.com/e/water-101-workshop-the-basics-beyond-tickets-771887595577

April 7-13 **DC**

2024 Water Week, Washington DC. Presented by Waterweek. For info: https://www.waterweek.us/#about-water-week

April 9-12 **TX**

Texas Water 2024, Fort Worth. Fort Worth Convention Center. Presented by the Water Environment Association of Texas and the Texas Section of the American Water Works Association. For info: https://www.txwater.org/about.cfm

April 11-12 **NM**

Wisconsin ILSA 38th Coming Together of Peoples Conference, Madison. UW Law School. Presented by Wisconsin ILSA. For info: https://turtletalk.blog/2024/01/17/wisconsin-ilsa-38th-coming-together-of-peoples-conference-april-12-13-2024/

April 12-13 **WI**

Law of the Rio Grande, Sante Fe. La Fonda on the Plaza. Presented by Water Law Institute CLE International.
For info: https://www.cle.com/

April 24 **TX**

Texas Groundwater Protection Committee, Austin. Texas Commission on Environmental Quality Campus. Presented by the Texas Groundwater Protection Committee.
For info: https://tgpc.texas.gov/meetings/

April 24-26 **CA**

Central Valley Tour, San Joaquin. Field Trip. Presented by Water Education Foundation. For info: https://www.eventbrite.com/e/central-valley-tour-tickets-771888357857

April 30-May 1 **IA**

National Hydro-Power Association Mid-West Regional Des Moines. Des Moines Marriott Downtown. Presented by National Hydro-Power Association in collaboration with Midwest Hydro Users Group.
For info:https://www.hydro.org/event/2024-nha-midwest-regional-meeting/

May 06 **WEB**

Technological Advancements to Support an Intelligent Water System, Virtual. Presented by American Water Works Association. For info: https://www.awwa.org/Events-Education/Webinars

May 14-15 **TX**

Environmental Trade Fair & Conference, Austin. Austin Convention Center. Presented by the Texas Commission on Environmental Quality. For info: https://www.tceq.texas.gov/p2/events/etfc

May 15-16 **CANADA**

Smart Water Utilities Canada 2024 Exhibition & Conference: Reducing Water Leakage Across the Network, Toronto. Presented by Canada Smart Water Utilities. For info: https://www.canada.smart-water-utilities.com/booking

May 21-22 **DENMARK**

Tech Tour Water Tech 2024, Aarhus. Presented by Tech Tour. For info: https://www.techtour.com/events/2024/5/event-tech-tour-water-tech-2024%5B5%5D.html?pageId=7421622

June 06-07 **CO**

2024 Conference on the Colorado River, Boulder. Wolf Law Building. Presented by GWC and Colorado Law School. For info: https://www.colorado.edu/center/gwc/2023/11/16/2024-conference-colorado-river#:~:text=GWC%20and%20Colorado%20Law%20School,from%20across%20the%20Colorado%20Basin