

currents

PureWater COLORADO

WORLD'S FIRST CARBON-BASED
DIRECT POTABLE REUSE
MOBILE DEMONSTRATION



PLUS — | Beneficial Use of Stormwater | 2021 Bipartisan Infrastructure Law | Water ARC® Updates | Bee Ridge Advanced Treatment Conversion Project

THIS ISSUE'S EDITORIAL

NICK WEBBER, PE (nwebber@carollo.com)



Welcome to the 2022 Volume 2 issue of *Currents*! I hope you enjoyed the previous Special Edition issue, highlighting our Wastewater Technical Practice.

In this issue, you'll read about the world's first carbon-based direct potable reuse (DPR) mobile demonstration facility. It's quite a mouthful, and is also packed full of cutting-edge advanced water treatment technology such as biological filtration, low-pressure microfiltration membranes, granular activated carbon (GAC), and an ultraviolet (UV) advanced oxidation process. This demonstration can be moved around Colorado to educate the community about the benefits, safety, and efficiency of DPR. If you'll be in Colorado, contact the primary author to line up a visit!

You'll read about the benefits of capturing stormwater and rainwater (yes, these are different!) in potable, non-potable, and reuse applications. And we'll also introduce you to the recent infrastructure law and its funding opportunities, advancements in Water ARC®'s research and development capabilities, and the conversion of Sarasota County's Bee Ridge Water Reclamation Facility to an advanced wastewater treatment facility.

I hope you enjoy reading this issue as much as we did producing it. Please reach out to me or the primary authors with any questions or feedback. Take care and enjoy your summer!

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TECHNICAL EDITOR: Jess Brown, 714-593-5100 | jbrown@carollo.com

CONTENT EDITOR: Nick Webber

COPY EDITOR: Youmi Park

DESIGN AND PRODUCTION: Silvia Backlund, Laura Corrington, Matthew Parrott

LEADERSHIP in the BENEFICIAL USE of STORMWATER from URBAN AREAS

JIM RASMUS, PE (jrasmus@carollo.com)



In its broadest interpretation, stormwater capture and use (SCU) represents the practice of collecting and beneficially using stormwater (i.e., water from precipitation runoff that reaches the ground, streets, and other impervious surfaces) and rainwater (i.e., precipitation that falls on roofs and is collected before reaching the ground).

With appropriate treatment and storage, this captured water can serve various potable uses, including: aquifer recharge, blend water for potable reuse projects, as well as a wide range of non-potable purposes, such as irrigation, industrial supply, toilet flushing, washing, dust suppression, firefighting, and evaporative cooling. **Figure 1** shows different types of SCU, with their complexity and contamination potential plotted against their size and scale.

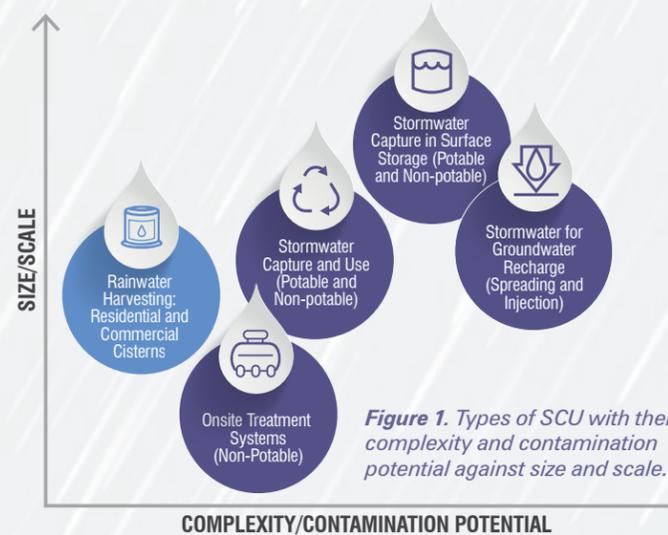


Figure 1. Types of SCU with their complexity and contamination potential against size and scale.

Recognizing the flexibility and merits of SCU, the Water Reuse Association is currently supporting the implementation of the Environmental Protection Agency's (EPA) Water Reuse Action Plan (WRAP), namely Action 3.3, which aims to "convene experts to address opportunities and challenges related to urban SCU."

To directly inform activities associated with this action, Carollo's experts are supporting two notable projects being pursued by the Water Research Foundation (WRF), which will not only expand our knowledge and research of SCU practices, but also inform regulatory actions that responsibly hold those practices to high standards of reliability and safety.

Figure 2 exemplifies how both projects are timed to coordinate with the outcomes of WRAP Action 3.3.



Figure 2. Interrelation between WRAP Actions 3.3 and 3.4, and WRF Projects #4841 and #5034.

* Onsite Non-potable Water Reuse System

WRF 4841: Assessing the State of Knowledge and Research Needs for Stormwater Harvesting

Carollo's Jim Rasmus and Elisa Garvey serve as the Principal Investigator and Water Supply Expert, respectively, for WRF 4841, which aims to set a new baseline for the level of current knowledge surrounding SCU and to identify critical, nationwide research objectives. By meeting these goals, the team hopes to understand priorities for, and differences in, SCU practices across various regions of the US.

One key outcome of this project to date is an SCU decision tree that enables agencies and utilities to develop a robust SCU program by assessing geographically-driven opportunities, such as:

- How much water is available?
- When will water be needed the most?
- What are the most optimal ways to reuse this water?
- Where can it be stored?

WRF 5034: Assessing the Microbial Risks and Potential Impacts from Stormwater Collection and Use

Jim Rasmus and Principal Technologist Amos Branch are on a project team led by Colorado State University's Professor Sybil Sharvelle to execute WRF 5034, an effort that strives to establish best management practices for SCU. The team is currently synthesizing existing research on stormwater's microbial risks, associated impacts, and viable treatment processes to develop a Stormwater Use Roadmap that offers pragmatic guidance on the design and operation of stormwater use systems.

The guidance will address the selection of appropriate log-reduction targets according to stormwater quality and intended end-use in a manner consistent with approaches used for the non-potable reuse of sewage as well as methodologies for tracking stormwater's microbial quality and continuously monitoring operational systems.

The study has determined the following outcomes to date:

- Proposed a log sewage-dilution approach that adjusts sewage-reuse targets derived from quantitative microbial risk assessments to appropriate values that specifically serve the beneficial use of stormwater.
- Investigated novel bacteriophage HF183 and quantified its ability to determine sewage-contamination levels in stormwater between dilutions of 10:1 to 10:4.
- Investigated likely chemical source trackers and estimated their abilities to determine potential sewage contamination in stormwater between dilutions of 10:1 to 10:3.

WRF 5034's findings are being used to directly inform progressive regulations created to expand SCU practices. In California, SB 966 (2018) requires the State to establish uniform, risk-based water-quality standards for the on-site treatment and use of non-potable water. The State Water Resources Control Board is expected to publish its standards in December 2022, while the State has until December 2023 to develop any corresponding updates to building standards.



PureWater

Direct Potable Reuse Mobile Demonstration: The first-of-its-kind direct potable reuse (DPR) mobile demonstration system for Colorado’s sustainable water future

JOHN REHRING, PE (jrehring@carollo.com)
JASON ASSOULINE, PE (jassouline@carollo.com)
SHAUN THOMPSON (Colorado Spring Utilities)
BIRGIT LANDIN (Colorado Springs Utilities)

In 2015, the Colorado Water Conservation Board (CWCB) published the Colorado Water Plan, a comprehensive statewide framework that addresses the present and future water challenges facing communities across Colorado.

The plan concluded that, even with aggressive conservation, Colorado will encounter significant water supply shortages by 2050. By the same year, the state’s population is expected to double current values, which will not only place heavy burdens on natural resources and existing water collection and conveyance infrastructure, but also exacerbate the state’s strain under frequent drought conditions.

COLORADO SPRINGS UTILITIES WATER STEWARDSHIP AND REUSE EFFORTS

Located in south-central Colorado, Colorado Springs Utilities (Springs Utilities) relies heavily on water conveyed from other parts of the state. In fact, 60 to 70 percent of their water comes from the opposite side of the Continental Divide, traveling up to 100 miles to meet the needs of their customers. As the largest Colorado city that does not reside on a river or a major stream, Colorado Springs has long spearheaded water stewardship and reuse efforts that make the most out of resources available to



them, including pioneering the use of reclaimed water for non-potable irrigation use in the 1960s.

WORLD'S FIRST CARBON-BASED MOBILE DPR DEMONSTRATION

Anticipating the potential role of direct potable reuse (DPR) in the coming decades, Springs Utilities forged a unique partnership between engineers, academics, and state agencies to design, construct, and successfully utilize the PureWater Colorado Mobile Demonstration Project, a traveling DPR demonstration system. The first-of-its-kind in the world, this small but mighty advanced water purification system treats secondary- or tertiary-treated wastewater to federal and state drinking water standards without producing a waste stream that requires disposal.

To demonstrate compliance with anticipated DPR regulations and remove emerging constituents, Carollo designed this system with ozonation, biologically active filtration (BAF), microfiltration, granular activated carbon (GAC), and ultraviolet (UV)/advanced oxidation. Built by dedicated students, staff, and faculty from the Colorado School of Mines, the system can purify 5 gallons per minute, and its state-of-the-art process train comprises accessible technologies that can be scaled up to an advanced water purification plant that produces millions of gallons of water per day.

Supported by a \$350,000 grant from the CWCB, this project was planned and operated in consultation with the Colorado Department of Public Health and Environment (CDPHE), who, by closely following the development and success of the demonstration, gained key context for DPR regulations that will serve Colorado. By setting achievable but uncompromising water quality standards, other municipalities can begin evaluating the benefits and feasibility of such reuse projects under prudent guidance. CDPHE expects to finalize these regulations by 2023.

COMMUNITY ENGAGEMENT AND EDUCATION

While regulatory advisement was a key benefit, the DPR system’s primary purpose while stationed in Colorado Springs was to engage and educate members of the public on the safety, sustainability, and efficiency of DPR. The project was well-received by the community, demonstrating interest in working to achieve a water-secure future for Colorado. For instance, beverage producers in the area partnered with Springs Utilities to make beer, hard seltzer, and soda using the system’s purified water to further extend awareness and education in the community about DPR and sustainable water management practices.



In January 2022, Carollo partnered with Springs Utilities and Storybook Brewing to brew and can a batch of amber ale, dubbed “Recycle Amber” to highlight the purified water used for brewing.

Recognizing these merits, the **PureWater Colorado Mobile Demonstration Project** received the prestigious **Award for Excellence in Outreach and Education** from the **WaterReuse Association** at its **2022 Annual Symposium** in San Antonio. The national award recognizes the leadership of Colorado Springs Utilities, Colorado School of Mines, and Carollo in fostering community education on DPR and forwarding the principles of sustainability water reuse, and environmental stewardship.



BIPARTISAN INFRASTRUCTURE LAW

WHAT SHOULD AGENCIES BE DOING?

SEEMA CHAVAN, PE (schavan@carollo.com)

Municipalities nationwide are facing increasing demands to invest in public infrastructure due to stricter compliance requirements, increasing climate impacts, aging infrastructure, and increased resiliency needs. Funding for water infrastructure projects has not previously matched these needs. Due to tighter budgets and competing needs, agencies have had to prioritize capital improvement projects, increase rates, and seek funding from federal, state, and local sources.

SUPPORT FROM THE FEDERAL GOVERNMENT

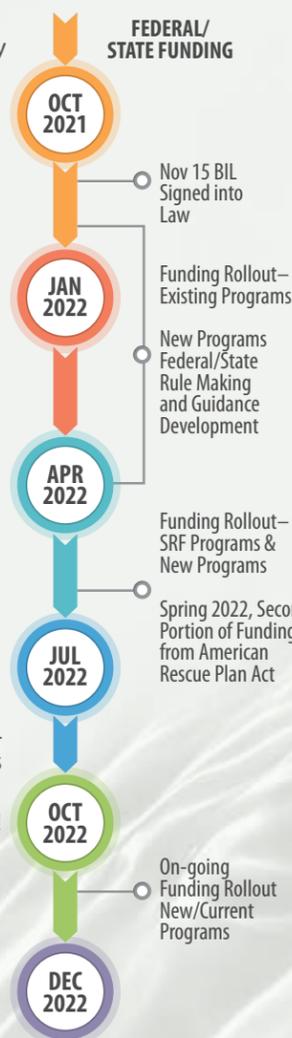
The \$1.2 trillion Infrastructure Investment and Jobs Act, commonly referred to as the Bipartisan Infrastructure Law (BIL), was signed into law in November 2021 and includes \$550 billion of new spending for water infrastructure, cybersecurity, and resiliency. Over \$55 billion is specifically for water utilities, \$22 billion of which will flow through State Clean Water and Drinking Water State Revolving Funds (SRF) over the next 5 years. The BIL commits \$15 billion in funds for Lead Service Line Replacement (LSLR) projects and \$9 billion in grants to address per- and polyfluoroalkyl substances (PFAS) and emerging contaminants.

Additionally, through the US Bureau of Reclamation, \$8.3 billion in funding from Western Water Infrastructure provides additional water project opportunities. The BIL and Western Water funding equates to the single largest investment in water from the federal government!

EQUITABLE DISBURSEMENT OF FUNDING

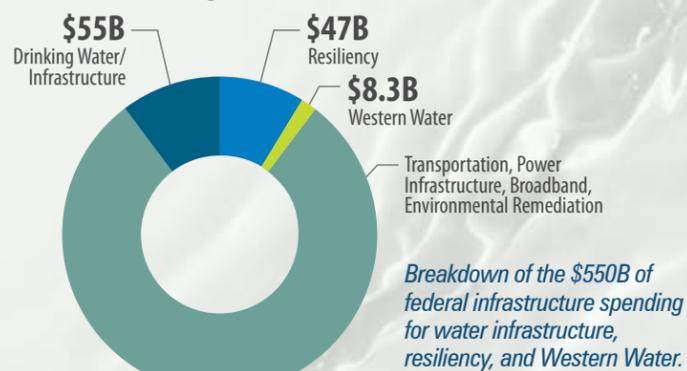
The BIL mandates that 49 percent of SRF and LSLR funding, and 25 percent of PFAS funding, must be provided as grants for disadvantaged communities.

A key priority of the BIL is to ensure that disadvantaged communities benefit equitably from the appropriations for critical water projects, including environmental justice concerns. However, many of these communities face hurdles to access these funds. In addition, to provide some added flexibility, state SRF program managers are working to better define the criteria used to identify a "disadvantaged community," including consideration of affordability to ensure the distribution of funds.



DON'T WORRY, IT'S NOT TOO LATE

Federal and state agencies have been developing rules and guidance since November 2021, with the first rounds of funding pushed out in early 2022 through established programs. With the issuance of the Environmental Protection Agency's (EPA) Implementation Guidance in March 2022, SRF programs are gearing up to award FY 2022/2023 appropriations this summer – including resources for PFAS and LSLR.



It is not too late for water utilities to secure BIL funds for projects. Carollo recommends the following actions to "get in line" for these funding opportunities:

- 1. Plan:** Identify projects, funding needs, and schedules.
- 2. Funding Strategy:** Identify high-priority projects, project details, and enhancements to make projects more attractive. Develop list of target funding programs and program requirements.
- 3. Have a Voice:** Participate in rule-making and guidance development.
- 4. Documentation Readiness:** Determine required project documentation for specific funding programs.
- 5. Market:** Meet with funding agencies to market project, gain insight into program priorities, and understand how funding programs fit to your project.
- 6. Federal Requirements:** Understand federal requirements (such as Buy America, Build America) and account for impacts in the project budgets and schedules.
- 7. GET IN LINE!**

Interested in funding opportunities for your project? Carollo is here to help, from the pursuit phase to design planning! For questions, please contact **Seema Chavan** (Grants Management Group Lead) at schavan@carollo.com or (925) 932-1710.



A Continually Evolving R&D Asset for Carollo's Clients

JUSTIN SUTHERLAND, PhD, PE (jsutherland@carollo.com)

YOU MI PARK (ypark@carollo.com)

AARON SAMSON (asamson@carollo.com)

Since opening its doors in 2018, Carollo's 8,900-square-foot Water Applied Research Center (Water ARC®) has grown into a full-scale advanced research facility that delivers a comprehensive range of services, from bench-scale treatability and corrosion testing to full-service field, pilot, and demonstration equipment support. Located in Boise, Idaho, this applied research and development (R&D) hub designs custom solutions to meet any scale or need, whether clients require immediate results through emergency diagnostics or long-term support on complex, extended studies that result in one-of-a-kind designs, products, and initiatives.

WATER ARC® PROJECT HIGHLIGHTS

Here are just some of Water ARC®'s recent projects, which reflect its innovative ability to address the industry's most pressing challenges and turn theory into application.

Wastewater Surveillance

Wastewater surveillance has become an important tool in understanding the spread and concentration of SARS-CoV-2 infections and variants. However, without an effective control for non-municipal wastewater, identifying representative samples can be challenging.

Enter the Pepper Mild Mottle Virus (PMMoV): Known for its prevalence in human digestive systems due to the abundant use of peppers in cuisines and food manufacturing, this virus's concentration in wastewater can act as a control for the presence of industrial wastewater in municipal systems.

Water ARC® developed its own SARS-CoV-2 polymerase chain reaction (PCR) test for use in municipal wastewater monitoring. This method simultaneously tests for PMMoV, which helps refine the required sensitivity of the PCR test administered for a given system. Other applications of Water ARC®'s wastewater surveillance testing include lab, pilot, and full-scale treatability and pathogen-removal studies.

Equipment Fabrication, Piloting, and Troubleshooting

Water ARC® is fostering the City of Tampa's development of the country's first full-scale suspended ion exchange (SIX) system, a Netherlands-born advanced water treatment (AWT) technology specializing in high-efficiency organics removal. For this technology's pilot, Water ARC® provided Carollo-owned ozone and filtration units and field instruments, as well as custom-fabricated equipment, including an instrumentation skid and a portable pressure data logger.

Over the last 4 years, Water ARC® has conducted more than 120 applied research projects that affect more than \$1 billion in water and wastewater infrastructure.



Water ARC® provided real-time, integrated troubleshooting and system support that bolstered the pilot with a strong foundation, helping the City make history through the adoption of an exciting new AWT process.

Condition-specific Corrosion Testing and Pipe Loops

With the EPA's new Lead and Copper Rule Revisions now in effect, corrosion testing for system piping continues to be a critical tool in maintaining public health and meeting stringent regulatory requirements. With endlessly variable combinations of water chemistry, treatment processes, and conveyance infrastructure, Water ARC®'s corrosion testing goes straight to the source: No guessing.

For Oklahoma City, in addition to lead and copper testing, Water ARC® used sample cross-sections of pipes harvested from the utility's water distribution system to develop accurate conditions for bench-scale testing, not to mention full-scale pipe loops that test current and proposed pipe scale stabilization methods and chemicals. Tailored to their specific conditions, this ongoing effort is already changing the way Oklahoma City views and operates their distribution system.

SUPPORT FOR YOUR VISION

At its core, Water ARC® believes that approaching common challenges with unique, condition-specific solutions, no matter how small, can be as innovative as completely new processes or designs. This center regularly achieves both.

The seamless integration of Carollo-owned or -built equipment, with advanced testing capabilities and on-site talent, provides a center for all your applied research needs. Working directly with Carollo's design and project teams also gives our clients the confidence and convenience of knowing that their designer, lab technologist, researcher, troubleshooter, and testing experts are all in one place—and their support is just a phone call away.

To see how Water ARC® can bring your next project to life, contact **Justin Sutherland** at jsutherland@carollo.com or (208) 327-2693.

SARASOTA COUNTY BEE RIDGE WATER RECLAMATION FACILITY EXPANSION The Largest MBR Project in Florida

JODY BARKSDALE, PE (jbarksdale@carollo.com)

This innovative capacity expansion and conversion project to advanced wastewater treatment (AWT) with membrane bioreactor (MBR) technology will produce reliable, high-quality reclaimed water for Sarasota County, Florida.

Sarasota County owns and operates the Bee Ridge Water Reclamation Facility (BRWRF), a secondary wastewater treatment facility designed to produce 12 million gallons per day (mgd) of reclaimed water. In 2020, the County embarked on a monumental effort to expand this facility's capacity to 18 mgd and upgrade its processes to meet Florida AWT standards.

This BRWRF Expansion and AWT Conversion Project is a direct response to the many needs stemming from a growing region in Southwest Florida. However, even as service demands increase and existing assets age, the County must adhere to regulatory treatment and discharge requirements that become more stringent with each passing year. All the while, the County remains committed to implementing actionable measures that protect their local waterbodies, which are vital to the state's overall quality of life, health, and economy.

Innovative Solutions to Meet Project Needs

The project applies innovative, yet cost-efficient, solutions that prioritize sustainability. By expanding and enhancing to AWT, the BRWRF will be capable of reliably serving growing communities with high-quality treated water that offsets groundwater withdrawals and reduces concentrations of nutrients (e.g., phosphorous and nitrogen) that are discharged



The groundbreaking ceremony for this project took place on March 22, 2022, and included Sarasota County Commissioners (left photo), Garney Construction, and Carollo Engineers leadership team (right photo, from left to right: Bob Cushing, Jody Barksdale, Dean Milton, and B. Narayanan).

to the environment. With improved effluent quality, the County can confidently comply with current and future regulations while gaining flexibility in their water reuse options, which now include the sustainable use of reclaimed water for irrigation, potential local aquifer recharge, and eventually positions them for indirect potable reuse.

The County retained Carollo as the engineer for this project to be delivered through construction manager at risk (CMAR). This alternative project delivery approach was selected to expedite the project schedule and meet the County's goal of planning, designing, and building this enhanced facility by the end of 2025.

Nearly half of the project's \$219 million costs will be financed by an EPA Water Infrastructure Finance and Innovation Act (WIFIA) loan.

After assessing numerous treatment alternatives, Carollo and the County selected the AWT MBR technology. When completed, it will be the largest MBR plant in Florida. Additionally, Carollo's design leveraged the sustainability and resiliency framework from Envision®, a tool developed by the Institute for Sustainable Infrastructure that guides project teams on sustainable infrastructure practices.