

currents



Tampa Augmentation Project "Taps" Two Reclaimed Water Delivery Alternatives

plus

Operator Training
on Par with Reuse
Technology

Modeling
UV AOPs

WRF Final
Report: Biofilter
Performance

Clifton Wins
Design-Build
Award

Awards and
Recognitions

LOOKING

downstream...

By Andy Salveson, PE, Chief Technologist - Reuse



Welcome to the second issue of *Currents*!

2016 provided many memorable moments within Carollo and our industry; foremost in my mind is the continued ascent of potable water reuse from coast to coast, based upon critical needs. Our team has been especially active on this topic in California, Arizona, Colorado, Oklahoma, Texas, and Florida. Municipalities now look toward more impaired source waters for water purification. With challenge comes innovation, as highlighted in this new issue of *Currents*.

Potable water reuse places a new demand on **advanced water treatment plant operators**; membranes, advanced oxidation, critical control points, advanced surrogates and control systems. Austa Parker writes about the future Advanced Water Treatment (AWT) operator, what his/her job will entail, who is developing training materials, and how future certifications will unfold. Innovation is not only about technology, it includes use of Mother Nature. In Florida, David Ammerman is helping the City of Tampa to find **lower cost approaches to potable water reuse** and groundwater recharge in the Tampa Augmentation Project (TAP). **Legacy groundwater pollutants** remain an issue for some

of our Southern California clients. Giridhar Upadhyaya highlights the latest achievements in the use of **UV advanced oxidation** for pollutant destruction, allowing recovery and use of important groundwater resources. Coming back to Mother Nature, biofiltration is the new “buzz” word in potable water reuse after having long been successful in the drinking water market. For both water and water reuse, Carollo is developing new tools for **monitoring biofiltration performance**, as detailed by Jennifer Nyfennegger. I encourage you to dig deep into these articles, learn, reflect, and drive your own innovation.

Be sure to stay in touch with the latest exciting Water Reuse news from Carollo at: <http://carollo.com/blog/771>.

If you have comments or suggestions, please feel free to email me at asalveson@carollo.com. Thanks for reading!



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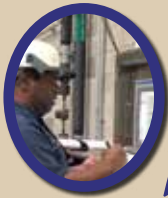


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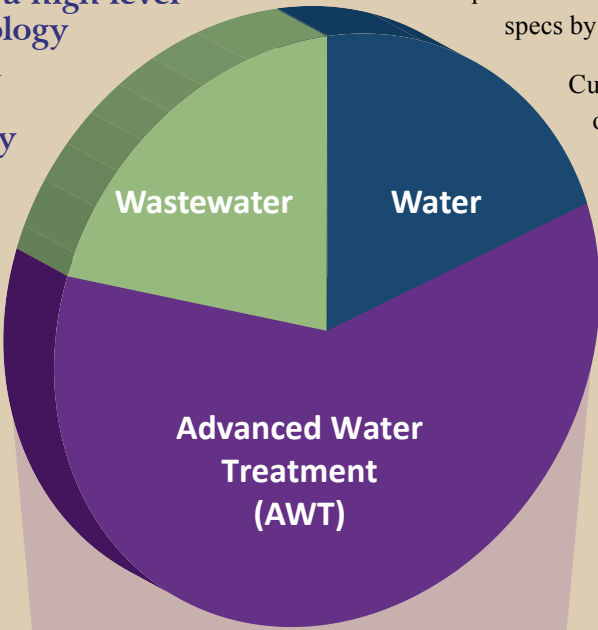
By Austa Parker, Ph.D., Andy Salveson, P.E., Nicola Fontaine, P.E.

In California, indirect potable reuse (IPR) and future direct potable reuse (DPR) projects require the use of advanced water treatment (AWT) facilities to treat secondary wastewater effluent for release to a potable water supply. Potable water reuse requires a high level of confidence in both technology and monitoring to ensure all health-related goals are met. Risk aversion is a top priority in all water and wastewater treatment projects, and facility operation is the cornerstone of public health protection.

Depending on the organization, the AWT facility may be run by only water treatment operators, wastewater treatment operators, or both. The curriculum for water and wastewater treatment at higher levels of certification is different and blending the two requires an additional layer of uniformity. Title 23 and Title 22 CCR, California's roadmap for water and wastewater operator certifications respectively, differ by curriculum and experience needed. In September 2016, the California State Water Resource Control Board released a framework detailing future DPR regulations that included the need for advanced water treatment operator certifications.

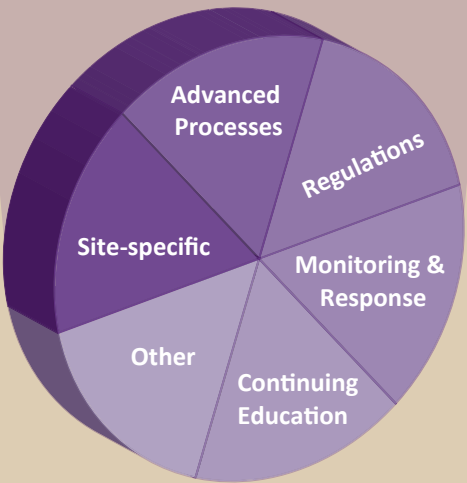
Advanced technologies including microfiltration (MF), reverse osmosis (RO), UV advanced oxidation process (UV AOP), membrane bioreactors (MBR), and ozone/biofiltration (O₃/BAF) are currently included or planned to be included in IPR/DPR projects.

A very small number of operators have training in all of these processes. An AWT operator license will need to incorporate many aspects of both wastewater and water treatment along with topics specific to AWT facility operation. Beyond treatment processes and monitoring, regulations and site-specific information could also be required—with site-specific information listed in O&M specs by design teams.



Curriculum development for an AWT operator license has yet to be decided on. However, many professional organizations and research projects are working towards this goal. Over the past year, Carollo has been participating in an expert panel and guidance team with American Water Works Association, California Urban Water Agencies, California Water Environment Association, and Water Environment & Reuse Foundation to provide recommendations to the State of California.

Dedicating additional resources for educating water, wastewater, and AWT operations staff, the collaboration provides many benefits beyond meeting regulatory requirements, including risk reduction, cost savings via proper maintenance, operator buy-in and consumer confidence.



Tentative requirements for AWT certification build on the foundation of traditional water and wastewater focuses. Site-specific conditions and advanced processes are examples of additional areas of subject matter recommended to the State of California for consideration in AWT curriculum.

City of Tampa Augmentation Project "Taps" Two Reclaimed Water Delivery Alternatives

By David Ammerman, P.E. (dammerman@carollo.com); City of Tampa, FL: Brad Baird, P.E., Chuck Weber, P.E., and Seung Park, P.E.

The Hillsborough River Watershed consists of hundreds of acres of wetlands and miles of rivers and streams. This watershed, home to an abundance of unique Florida wildlife, is also the main source of water for the City of Tampa. Surface water from the Hillsborough River Reservoir is treated at the David L. Tippin Water Treatment Facility (WTF), which provides drinking water to approximately 600,000 people. The City's wastewater ends up at the Howard F. Curren Advanced Wastewater Treatment Plant (AWTP) and is treated into reclaimed water. With a permitted capacity of 96 mgd, the plant is the fourth largest in the state and can treat all wastewater to meet state and federal requirements for beneficial reuse. While the City delivers some of this water for landscape irrigation and non-potable industrial uses, most of it is discharged into the Tampa Bay in compliance with all regulatory requirements. The City is now considering how this water can be used to provide additional drinking water supplies to the region.

Tampa Augmentation Project

Enter the Tampa Augmentation Project (TAP), managed by Carollo. This innovative project is evaluating the use of natural treatment systems, including wetlands, infiltration basins, and aquifer treatment systems, to make beneficial use of up to 50 mgd of reclaimed water. After flowing through these natural treatment systems, TAP reclaimed water will provide additional raw water supplies to secure the City's water needs and to help meet the demands of a growing population. TAP will also improve water quality in the Tampa Bay, lowering nitrogen levels and reducing the potential of algal blooms.

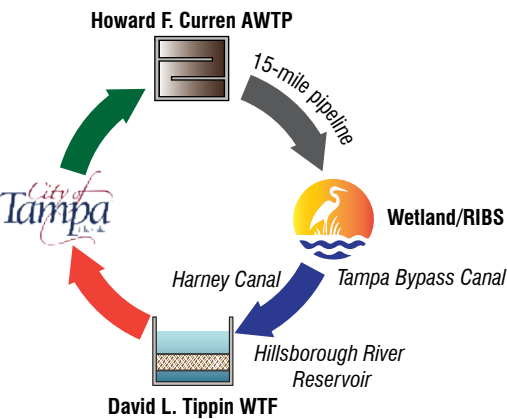
Right now, though, one question remains: How can the City deliver this water in the most efficient and environmentally friendly way? To answer that question, the City partnered with the Southwest Florida Water Management District (SWFWMD) and contracted Carollo to identify and explore two alternatives, both founded on natural treatment processes, prior to delivering additional raw water to the regional surface water systems.

This innovative project is evaluating the use of natural treatment systems, including wetlands, infiltration basins, and aquifer treatment systems, to make beneficial use of up to 50 mgd of reclaimed water. After flowing through these natural treatment systems, TAP reclaimed water will provide additional raw water supplies to secure the City's water needs and to help meet the demands of a growing population.

Alternative 1: Transmission Pipeline and Infiltration Basins

The first TAP option would be to build a 15-mile transmission pipe from the Howard F. Curren AWTP to a site owned by the SWFWMD. Reclaimed water would flow through wetlands and infiltration basins into the Tampa Bypass Canal.

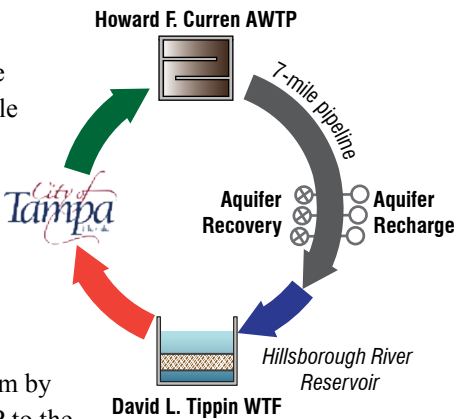
Preliminary results of the field investigations suggest this strategy has a number of limitations and the TAP team has recently shifted its efforts towards investigating Alternative 2 more thoroughly.



Alternative 2: Aquifer Recharge/Recovery Wells

The second TAP option would utilize aquifer recharge and recovery wells. This would involve injecting the reclaimed water into the Avon Park formation, an area of limestone rock that forms part of the Floridan Aquifer System. This recharge could make it possible for the City to withdraw fresh water from the Suwannee Aquifer, also part of the Floridan Aquifer. Additional treatment of the reclaimed water would be provided as it flows through the aquifer between the recharge and recovery wells.

Alternative 2 would require approximately half of the transmission piping of the first option. Also, unlike the first option where reclaimed water delivery ceases during high rainfall, recharging the Avon Park aquifer could continue regardless of the surface conditions. This alternative also prepares the City for a future direct potable reuse system by constructing a reclaimed water transmission pipeline from the Howard F. Curren AWTP to the David L. Tippin WTF.



Summary

The TAP feasibility study is scheduled for completion in January 2018. Until then, Carollo is taking a closer look at Alternative 2, working on groundwater modeling to measure the amount of new water this option will supply, and managing the project's regulatory, hydrogeologic, and environmental investigations. Once these analyses are complete, the City will decide if Alternative 2 is the best option for managing its water supplies.

Regardless of the City's choice, the project itself serves as an example of the City of Tampa's commitment to increasing the water supply sources while respecting an area's beautiful natural surroundings. This commitment ensures that Tampa's citizens have clean drinking water while sustaining the unique ecosystems home to the herons, turtles, and other wildlife that thrive in the State's diverse natural settings.

By Giridhar Upadhyaya
(gupadhyaya@carollo.com),
Harold Wright, Adam Zacheis

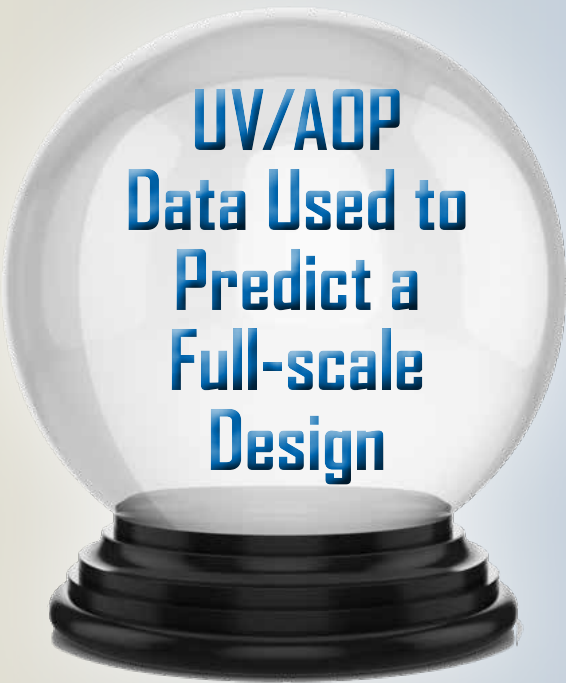
For most water agencies in the Western United States, groundwater is an important part of their overall water supply portfolio. However, as groundwater supplies are squeezed, public agencies are looking to emerging advanced technologies to help them recapture groundwater sources that need some help to meet stringent quality standards.

One such technology is the combination of ultraviolet (UV) disinfection and advanced oxidation processes (AOPs) to remove organic contaminants from groundwater. In Southern California, Carollo has been working closely with one of the region’s key water suppliers to evaluate UV/AOP processes for an aquifer contaminated with chemicals, such as 1,4-dioxane, tetrachloroethylene (PCE), trichloroethylene (TCE), and 1,1-dichloroethylene (1,1-DCE).

For this study, we based treatment goals on existing regulatory provisions for these contaminants, as shown below, with the exception of the 1,4-dioxane, in which our client wanted a stricter treatment goal of <0.25 µg/L.

Existing Regulatory Provisions for the Contaminants of Interest	
Contaminant	• 1,4-dioxane • PCE • TCE • 1,1-DCE
Regulatory Provision	• HA 0.35 µg/L • MCL 6 µg/L • MCL 5 µg/L • MCL 6 µg/L
Treatment Goal	• < 0.25 µg/L • < 5 µg/L • < 5 µg/L • < 6 µg/L

Our first step was to analyze historical data for the wellfields to determine the contaminant levels and the water quality parameters that can affect UV/AOP performance. The water quality parameters analyzed included total organic carbon, pH, temperature, alkalinity, total dissolved solids, nitrate, and nitrite.



Carollo then conducted both bench- and pilot-scale tests with low pressure (LP) and medium pressure (MP) UV lamps. In addition to the contaminants listed above, we analyzed post-treatment water samples to look for disinfection byproduct (DBP) formation. The graphic below shows the results of our bench- and pilot-scale treatment processes.

Bench- and Pilot-scale Removal Results					
Lamp Pressure	Oxidant	Effective Removal of:			
		1,4-Dioxane	PCE	TCE	1,1-DCE
Low Pressure	None		●●		
	Cl ₂ *		●		
	H ₂ O ₂	●●	●●	●●	●
Medium Pressure	None	●	●	●	●
	Cl ₂	●●	●●	●●	●●
	H ₂ O ₂	●●	●●	●●	●●

● Bench-scale results ● Pilot-scale results

Since 1,4-dioxane is not broken down by MP UV light, the removal we observed was due to the UV/nitrate AOP. When UV/Cl₂ AOP was used, we observed the formation of DBPs, including bromate at levels above the 10 µg/L MCL. We used these results to refine a UV AOP model that was used for both the development of pilot-scale test criteria and full-scale conceptual designs.

For the pilot-scale testing phase, we headed out to the wellfields. On the UV side, we installed a WEDECO LBX 90 reactor with four LP lamps and a WEDECO Quadron 100 reactor with one MP lamp. We evaluated different AOPs using LP or MP. These AOPs included UV without any oxidant addition, UV/H₂O₂, and UV/Cl₂ (using only MP lamps).

With the Quadron 100 reactor, we found that contaminant removal did not increase with the increase in the UV dose. This was interesting as the Quadron 100 reactor is a drinking water UV reactor designed for efficient contaminant removal in high UVT applications. However, during the wellfield testing, we found that the UVT at the range of wavelengths for MP was very low (e.g., 46 percent at 230 nm). We concluded from these results that the UV dose delivery was not efficient.

The final phase was UV dose modeling based on computational fluid dynamics to analyze the pilot-scale results and determine UV dose distribution in the pilot-scale reactors. Once we validated the model, we used it to develop conceptual designs and life-cycle cost estimates for a full-scale system.

While UV/AOP shows great promise to help public agencies reclaim troubled groundwater supplies, there is still more work to be done.

Further studies must look at the effect of nitrate on UV efficiency, find better ways to control DBP formation, and optimize chemical and UV dosages to control capital and operational costs. Carollo has consistently been a leader in UV disinfection technologies, and this project gets us one step closer to making this exciting technology consistently reliable, practical, and affordable for our clients.

New report showcases tool to help utilities track drinking water biofilter performance

By Jennifer Nyfennegger, Ph.D., P.E. (jstokke@carollo.com)

The Water Research Foundation (WRF) recently published a Tailored Collaboration Report entitled, “Full-Scale Engineered Biofiltration Evaluation and Development of a Performance Tracking Tool” (Project #4525). The report was authored by Carollo Engineers (Jennifer Nyfennegger, Sarah Burns, Nishel Ross, Giridhar Upadhyaya, Jess Brown), HDR (Chance Lauderdale), and the University of Texas (Mary Jo Kirisits, Sarah Keithley, Sungwoo Bae). The project was funded by WRF and Tampa Bay Water.

The main outcome of the project was the development of a comprehensive and user-friendly biofiltration performance tracking tool. This Excel-based tool allows utilities to monitor “biofilter health” and to effectively manage and interpret performance data. Regular monitoring and evaluation of hydraulic, water quality, and microbial data allows utilities to maintain effective biofilter operation, optimize performance, and more quickly identify and mitigate potential issues. Utilities can apply the guidance provided in the report to their own biofiltration monitoring program,

regardless of the type of data collection/analysis tool used. The biofiltration performance tracking tool can be found on the WRF website.

The second outcome of the project evaluated low-level hydrogen peroxide supplementation as a biofiltration enhancement strategy at full scale. The performance of peroxide-supplemented and control biofilters at the Tampa Bay Regional Surface Water Treatment Plant were monitored through the use and optimization of real-time and non-real time tools. Peroxide supplementation (1 mg/L) to the biofilter feed water slightly improved the hydraulic performance while maintaining biofilter health and water treatment performance. The extent of process improvement is site-specific and testing (at bench/pilot and full scale) is recommended for utilities considering any performance enhancement strategy. Utilities can follow the approach described in this study as a framework for evaluating biofiltration enhancement strategies at full scale.



Carollo Wins National Award of Merit for Clifton Water District’s MF/UF WTP Upgrade



The Design-Build Institute of America recently announced its 21st annual Design-Build Project/Team Award winners. Carollo won the National Award of Merit in the Water/Wastewater category for the Clifton Water District, CO, Microfiltration/ Ultrafiltration (MF/UF) Water Treatment Plant Upgrade.

In 2014, the Clifton Water District selected the Carollo Design Build Group (CDBG) to add a new MF/UF system to their aging WTP. Carollo used an "open platform" design approach that gave the District more operational flexibility while reducing costs. A strong partnership helped the project go from 40 percent design to an operational plant in just 14 months and exceeds the Carollo team’s performance guarantees.

Congratulations to the entire team on this outstanding recognition of excellence!



Dragash to Serve as 2017 FWEA President-Elect

Kristiana Dragash, of the Sarasota office, was nominated to serve as the President-Elect of the Florida Water Environment Association (FWEA) in May of last year. In May 2018, she will become president of the association.

Over the past eight years, Kristiana has ascended from becoming a member of the association and serving as the secretary of a local chapter to becoming a vice president of the state-wide organization, which has approximately 1,400 members. In 2010, Kristiana created a new Manasota chapter of FWEA, serving Manatee, Sarasota, Highlands, Hardee, and Desoto counties. She was awarded the Young Professional of the Year award in 2014 for her contributions to the association.

At a recent Manasota chapter meeting, she was recognized by her peers and the past president of the association, Greg Chomic, as the founding chair of the Manasota chapter and presented with an outstanding service award. Though Kristiana is at the top of the board of directors for the association, it is not uncommon to see her helping out at the registration table for seminars or events. Kristiana has quickly become one of the leaders of the state because she is always there to jump in and help in any way needed to make an event or publication a success.

Professionally, Kristiana focuses on hydraulic modeling of potable and reclaimed water distribution systems, wastewater collection systems, master planning, and asset management. She enjoys encouraging and mentoring new engineers and solving Florida's water quality and quantity challenges, one modeling scenario and spreadsheet at a time.



Carollo Awards First Bryant L. Bench Scholarship to Utah State Student



Carollo awarded the first Bryant L. Bench Scholarship to Stetson Bassett, a student at Utah State University, at the AWWA ACE16 Conference in Chicago, IL, in June 2016.

The scholarship was established in honor of Bryant Bench, Carollo's Water Practice Director, who passionately worked to improve water quality and develop unique treatment methods for treatment concepts for millions of people across the country. Bryant was also a mentor and teacher who established trust, integrity, and development "Benchmarks" for everyone he worked with and for.

Applicants for this scholarship must be pursuing a Master's degree in a water engineering-related field and have shown a passion and dedication to providing innovative solutions to the world's water challenges. The scholarship is a one-time \$10,000 award that students can use to complete or further their education in their chosen field.

Congratulations to Stetson!

**Top-Notch
Design Earns
Austin's WTP 4
an ENR Merit
Award**

**Congratulations
to the City and the
Carollo Team!**

