CAROLLO ENGINEERS | VOL 2. 2018

currents

WATER ARC
Applied Research Center™

PLUS

By Paul M. Flick
Corporate Communications Manager

If you're a regular reader of ***Currents***, you'll know we take our water pretty seriously. We poke it, we prod it, we swish it around, and we run it through machines to see what happens. And now we can do all of that in one place: Carollo's new Water Applied Research Center (or Water ARC™) in Boise, Idaho. Jump to page 4 now to read about our newest (and biggest) tool to test treatment solutions for some of our clients' most complex water treatment challenges.

In this issue you'll also read about what we're doing to help public agencies up their resiliency game when it comes to major disasters or disruptions; how we're helping Henderson, Nevada, improve asset management; and why the ancient art of biofiltration is getting a shiny new set of guidelines.

It's all here, it's all water, and it's all…well, ***Currents***. We hope you enjoy this latest issue—we had fun making it!

IN THIS ISSUE

carollo
Engineers...Working Wonders With Water®

TECHNICAL EDITOR: JESS BROWN
(714) 593-5100 | JBROWN@CAROLLO.COM

CONTENT EDITOR: NICK WEBBER

DESIGN AND PRODUCTION:
CAROL BELISLE, LAURA CORRINGTON, STACY FULLER, MATTHEW PARROTT

RESILIENCY

Carollo Embeds Resiliency into Project Planning and Design Considerations

By Sarah A. Deslauriers, P.E., ENV SP (sdeslauriers@carollo.com)

If you ask water and wastewater utility staff across the U.S., "What does resilience mean to you?" as expected, answers will vary depending on their role at the utility and the region in which the utility is located, since risks vary geographically. Generally, utility staff sees resilience as the ability of their utility to:

- Recover quickly (restore services and treatment operations) following extreme conditions.
- Adapt assets and operations to handle changes in extreme conditions.

These extreme conditions utilities referenced include: earthquakes, hurricanes, and various other impacts due to climate change they are already experiencing (i.e., rising sea/tide levels and increasing frequency of extreme precipitation events and drought conditions).

While utilities have routinely considered extreme conditions based on historical trends, those trends are changing and continue to change — lending to the expression "stationarity is dead." Utilities want to see these changing extreme conditions addressed in master planning efforts with the objectives of: 1) assessing at-risk assets (structures and equipment), 2) recommending resiliency measures to protect critical assets to reduce or eliminate the risk of damage and loss of services during and following the new extreme conditions, and 3) estimating potential costs and savings for implementing those measures.

While Vulnerability and Resilience Assessments are one of the first steps Carollo takes in helping water and wastewater utilities begin their journey in developing emergency response plans and long-term planning efforts, there are many ways we help utilities address and build resilience into their operations and programs.

Climate Change Adaptation

- **Integrated "One Water" planning efforts** that consider water, wastewater, recycled water, and storm water, as was done for the One Water Los Angeles 2040 Plan.
- **Analyses of and planning for** changing sea (tide) levels and frequency of extreme events (precipitation and heat).

Climate Change Mitigation

- **Greenhouse gas emissions** accounting and management in response to state regulations or proactive initiatives at the regional, state, city, or facility level seeking to reduce emissions to mitigate further climate change.
- **Working directly with regulatory agencies** to estimate the wastewater sector's ability to contribute toward state mandates or goals to reduce greenhouse gas emissions. For example, Carollo is working with California's State Water Board to analyze the co-digestion capacity of existing anaerobic digesters across California publicly owned treatment works. The goal is to estimate the extent of their support in achieving its organic waste diversion from landfills mandate (75% by 2025) to reduce methane statewide (40% by 2030).

Value Engineering

Review of other consultants' resiliency-related work to ensure the latest scientific, legislative, and regulatory concerns are addressed. (e.g., NYC Rockaway WWTP Optimization following inundation from Hurricane Sandy).

Legislative and Regulatory Advocacy

Carollo has been educating elected and appointed officials in agencies at the federal, state, and local levels on water- and wastewater-related vulnerabilities and opportunities for the last decade. Examples include:

- **National Association of Clean Water Agencies** - Climate & Resilience position statement development/advocacy
- **California Association of Sanitation Agencies** - Climate Change Program Manager since 2013
- **Bay Area Clean Water Agencies** - Air Issues & Regulations Committee supporting consultant since 2016

Providing Leadership in National, State, and Local Professional Organizations

By serving as members of professional organizations related to resiliency, and eventually as leaders, Carollo has been able to educate and engage water and wastewater utility staff. A couple examples of national organizations Carollo has been actively engaged in for the last decade include:

- **Water Environment Federation Residuals & Biosolids Committee**
  - Carbon Resource & Recovery Subcommittee
  - Bioenergy Technology Subcommittee
- **American Water Works Association**
  - Climate Change Committee
  - Sustainable Infrastructure Committee
  - Water Resource Sustainability Division

It is our objective not only to protect a utility's assets and operations in the long term, but also improve a utility's ability to quickly re-establish service to customers during/after an extreme event.

Water ARC™

BY JUSTIN SUTHERLAND, Ph.D., P.E.
jsutherland@carollo.com

Since 1933, Carollo has successfully maintained a single-minded focus on the water industry. Much of this success is based on our ability to offer advanced solutions that are practical, affordable, and reliable. Our investment in applied research, through the Carollo Research Group (CRG), has been a cornerstone for the development and integration of these advanced solutions. As the company continues to grow, in part using this approach, and expands services for our clients, new and expanded applied research services are required. To meet these needs, the CRG has introduced a new service, the Water Applied Research Center (Water ARC™), that integrates and enhances our capabilities for field analytical, pilot, demonstration testing, and laboratory-based treatability testing.

WATER ARC
Applied Research Center™

OUR BENCH TREATMENT CAPABILITIES INCLUDE:

- **Coagulation/Flocculation/ Sedimentation**
- **Biological Filtration**
- **Adsorptive Media**
- **Reverse Osmosis**
- **MF/UF**
- **Ozone**
- **UV**
- **Advanced Oxidation**
- **Simulated Distribution System Tests**

For field analytical, pilot, and demonstration testing, Water ARC™ manages a multi-million dollar inventory of custom-made, pilot- and demonstration-scale equipment. We provide full-service support for this equipment, including training, troubleshooting, and safety and quality control review.

The goal of the Water ARC™ treatability lab, located in Boise, Idaho, is to apply laboratory expertise to help solve our clients' treatment challenges. Whether a single process or a simulated treatment train is needed, our facility and staff provide a controlled environment to economically and efficiently respond to project testing requirements. Our bench testing equipment for conventional and advanced processes may be used for a wide range of applications, including:

- Treatment process screening
- Developing design criteria, optimizing, and troubleshooting of pilot- and full-scale systems
- Testing innovative process concepts

Additionally, to provide the latest analytical capabilities (for example, emerging contaminants and exploratory analyses for troubleshooting) to our clients, we collaborate with universities, contract labs, and other research laboratories, as needed.

A key part of integrating our capabilities is the incorporation of a data management system into projects that use Water ARC™ services. Maintaining a single point of data collection from various sources, such as field, pilot, and laboratory testing, will help reduce time to manage and analyze large data sets. This will include the use of a mobile app to collect data during field analytical and pilot testing and uploading of data directly from third-party laboratories.

Water ARC™ services are available nationwide for both municipal and private sector clients with drinking water, wastewater, reuse, and infrastructure applications. Water ARC™ leverages Carollo's extensive experience with bench and pilot studies in the last 25 years and couples it with our technical expertise. This produces a formula for quality and service that delivers optimized process designs and innovative tools and techniques to help solve our clients' water quality and treatment challenges.

Carollo's Water ARC™ lab, located in Boise, Idaho, applies laboratory expertise to help solve our clients' treatment challenges.

Planning for Future Growth
Building an Asset Renewal Plan

for the City of Henderson Wastewater Treatment Facility and Effluent Management Master Plan

by Felicia L. James, P.E. (fjames@carollo.com) and Keli A. Callahan, P.E. (kcallahan@carollo.com)

Background

The City of Henderson has a population of approximately 300,000 and ranks as the second largest City in the State of Nevada. The City has expanded to 105 square miles and is about 65 percent built out. Within the next 25 years, some of the City's wastewater treatment infrastructure will be approaching its economic life — the period from the acquisition of the asset to the time when the asset ceases to be the lowest cost alternative. Additionally, there is a potential for a significant amount of growth within the City. For these reasons, the City sought a rigorous planning and prioritization Master Plan for its wastewater treatment and effluent facilities.

Highlights

Develop a 25-yr Comprehensive Master Plan that:

- Establishes levels of service goals for Henderson's wastewater treatment and effluent facilities.
- Identifies renewal projects to meet those goals.
- Prioritizes projects based on the inter-relation and timing of four failure modes.

Approach

The planning approach incorporates the fundamentals of asset management by establishing levels of service (LOS) targets to support capital and operation expenditure recommendations that align with the City's Strategic Plan.

Carollo worked with the City through a series of workshops to establish how the City's priorities flow from the City level down to individual assets and develop LOS targets that link these priorities to actual treatment unit processes. Furthermore, remaining useful life estimates for the LOS targets were defined to project when a unit process would no longer achieve its intended level of service. The remaining time to a projected LOS failure could then be compared to the timeline projected for the other failure modes: Capacity, Financial Efficiency, and Physical Mortality.

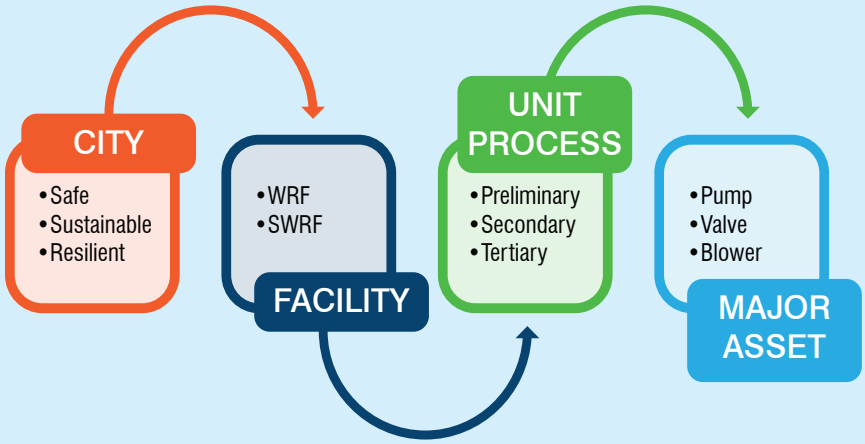
The City staff collaborated to evaluate 50 unit processes for their two wastewater treatment facilities. The resulting LOS targets were organized into the following four categories, each with a specific target and defined measurement approach.

- Maintain Redundant Hydraulic/Process Capacity
- Maintain Equipment Reliability (preventive vs. corrective maintenance)
- Access Maintainability
- Safety

Results

The LOS assessment produced a list of improvement projects for unit processes not meeting their LOS targets. The majority of the recommended projects to improve LOS outcomes were operational- and maintenance-based, rather than capital improvement projects. However, findings from these assessments were incorporated in the recommended capital improvement projects.

By taking an asset management focused approach to traditional master planning efforts, Henderson has gained a better understanding of their facility's assets and likely failure modes and from that, has built an asset renewal planning framework that can change as imminent failure modes change. The framework provides specific justification for budget decisions on how capital and operational projects will improve service levels while reducing the City's risk.



City of Henderson's priorities starting at the CITY level down to the individual MAJOR ASSET level.

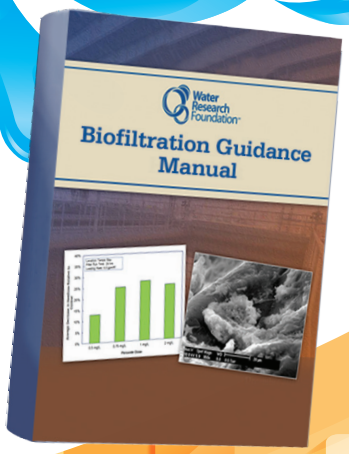
Funneling Biofiltration References into a Single Guidance Manual

By Jess Brown, Ph.D., P.E. (jbrown@carollo.com), Giridhar Upadhyaya, Ph.D., P.E.; Jennifer Nyfennegger, Ph.D., P.E.; and Greg Pope, Ph.D., P.E.

Biological drinking water treatment has been practiced for centuries and has received considerably increased attention over the last decade. The vast majority of this attention has focused on surface water biofiltration (aerobic, high-rate, biologically enhanced filtration), which is typically implemented for the removal of organic constituents (e.g., disinfection by-product [DBP] precursors, ozonation by-products, taste & odor compounds). In spite of this increased attention, industry experience indicates that most biofilters today are still operated passively, without a clear strategy for optimizing biological activity or overall biofilter performance. This is largely due to the absence of a consolidated, central reference for biofiltration design and operation.

Water Research Foundation Project 4719 "Development of a Biofiltration Guidance Manual for Drinking Water Utilities" will fill that gap by developing a set of guidelines for the design, operation, maintenance, monitoring, and testing of biologically active rapid-rate gravity filters. These guidelines are intended to benefit existing biofiltration plants, filtration plants that intend to convert to biofiltration, and future greenfield biofiltration plants. In addition to providing practical and readable guidance for operators, regulators, engineers, manufacturers, and researchers, the guidance manual will include multiple biofiltration-related tools to benefit the industry, including:

- Definitions of biofiltration terminology.
- Operator's checklist and pocket guide.
- Troubleshooting guide.
- Standard calculations and reference examples.
- Tools compendium and monitoring SOPs.
- Sample testing plans.
- Frequently asked questions summary.
- Biofiltration reference list.
- North American Biofiltration Plants list linked with key design and operational parameters.



In short, this project will produce the definitive resource for biofiltration design and operation, which will help utilities leverage intentional biofiltration to mitigate unintended consequences and improve overall biofilter performance.

Carollo is the Principal Investigator for the project and we are teamed with co-PIs from Arcadis, HDR, CDM-Smith, American Water, Southern Nevada Water Authority, and Brown & Caldwell. Four advisory committees (utility, regulatory, academic, and manufacturer) will provide review and input throughout the project. The core team alone has over 200 years of combined biofiltration experience and has been Principal Investigators or co-Principal Investigators for 21 previous biofiltration-related WRF projects. The project kicked-off at the 2018 AWWA Biotreatment Symposium and is expected to wrap up in 2019.

Utility Advisory Services Project Wins the

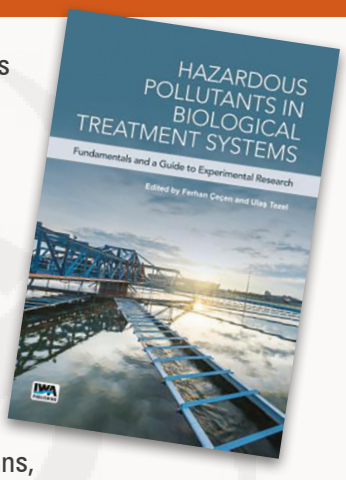
2017 DBIA National Award of Excellence

IN THE WASTEWATER CATEGORY

The **Metro Wastewater Reclamation District's (District) Northern Treatment Plant (NTP) Facilities** project received both the 2017 National Award of Merit and the 2017 National Award of Excellence in the Water/Wastewater category from the Design Build Institute of America (DBIA). The awards were presented to the District and Carollo Engineers at DBIA's annual awards dinner on November 9, 2017 in Philadelphia, Pennsylvania. The $280-million NTP Facilities project was part of the $475-million NTP Program, which included planning, design, and construction of a new 24-mgd regional advanced treatment and transmission facilities. The Program was completed in 2017 at $60 million below the Program budget.

Carollo's Program Management Group (sub-practice to the Utility Advisory Services Technical Practice) served as the Owner's Advisor for the NTP Program helping the District deliver its largest and most visible project in its 56-year history. As Owner's Advisor, Carollo served as the District's planner, manager, advocate, team member, and collaborator throughout the entire 7-year duration of the Program. As part of its Owner's Advisor role, Carollo led the project delivery analysis, developed procurement and contract documents, established project controls processes and procedures, and oversaw all Designer-Builder management activities for the NTP Facilities project. As a result of exemplary teamwork and effective management systems, the NTP Facilities project finished on-schedule and under budget with a 1.3% change order rate. The NTP Facilities project is recognized as the largest water or wastewater project constructed to date in the United States utilizing the Progressive Design-Build (PDB) delivery method. Because of its exceptional project performance, it is commonly recognized as the "best in class" in PDB delivery by owners, practitioners, and professional organizations across the design-build industry. The NTP Facilities project demonstrates the collaborative spirit of PDB to meet scope, quality, budgetary, and schedule goals.

Hazardous Pollutants
IN BIOLOGICAL TREATMENT SYSTEMS



From across the pond we learn that Dr. Jess Brown and Dr. Giridhar Upadhyaya are the most recent Carollo authors to have their knowledge committed to paper. They are co-authors of a chapter in a book titled "Hazardous Pollutants in Biological Treatment Systems."

The issue of hazardous pollutants, which are present at very low concentrations in wastewaters and waters, but are very harmful to both ecosystems and humans, is becoming increasingly important. Today, treatment of hazardous pollutants in the water environment becomes a challenge as water quality standards become stricter. "Hazardous Pollutants in Biological Treatment Systems" focuses entirely on the hazardous pollutants present in wastewater and water and gives an elaborate insight into their fate and effects during biological treatment.

This publication is printed with soy inks on FSC®-certified 10% post-consumer waste recycled content.