

RESEARCH. RESILIENCE. INNOVATION.

2020 ANNUAL REPORT

A Message to Our Subscribers: Research, Resilience, and Innovation

In 2020, The Water Research Foundation continued to deliver the high-quality research and innovation that our subscribers rely on to advance the science of water to improve the quality of life.

Safe and sustainable water resources are the cornerstones of every community. Throughout 2020, water utilities maintained their essential services without pause, despite unprecedented challenges, including the COVID-19 pandemic, extreme climate-related events, and significant financial hardships for customers across multiple jurisdictions.

Resilience is what enables the water sector to rise to these challenges. As we look back on 2020, the connection between research, innovation, and resilience in the water sector has never been more clear.

The Water Research Foundation (WRF) continues to work side-by-side with our subscribers across the globe to provide cutting-edge research and innovation to strengthen their resilience, highlight their leadership, and support their commitment to public service. Our work together is delivering remarkable results. WRF published over 60 projects in 2020 and funded 42 new projects with a value of \$7.5 million—a 33% increase in research funding over 2019. We also guickly leveraged our network of subscribers, partners, and world-class researchers to share critical knowledge on wastewater surveillance for the genetic signal of SARS-CoV-2 and complete vital research to inform public health decisions related to the pandemic.

In 2021, WRF will continue to lead and deliver timely and world-class research and innovation efforts to support the communities we serve.







WRF would like to thank Dennis Doll, outgoing Chair of our Board of Directors, for his service and long-term commitment to our mission. Dennis first joined the Board in 2010, and has served in many leadership positions, including Chair, Vice Chair, and Treasurer. He has also participated in numerous committees, providing guidance and strategic direction for the organization. Dennis is a true water leader, and we are honored that he will continue to serve on the Board as a Director Emeritus.

Research Accomplishments

Our integrated One Water research and innovation activities address critical issues holistically and provide actionable solutions for communities.

Published Research Highlights

WRF's research benefits every aspect of the water sector and considers cross-sector interdependencies with agriculture, energy, clean air, watershed management, and commercial industries. WRF published over 60 projects in 2020, on topics ranging from per- and polyfluoroalkyl substances (PFAS) and resource recovery to climate change, intelligent water systems, and much more. Several notable projects published in 2020 are listed below:

Evaluation of Lead Pipe Detection by Electrical Resistance Measurement (4698)

This report explored the use of electrical resistance measurements to determine the presence of lead in a service line. Electrical resistance measurements from the lab and field confirmed that the presence of lead pipe can be discriminated from other materials. With additional field testing to better understand interferences and overcome potential obstacles encountered in the field, this technique has the potential to quickly determine the presence of lead between any two points on a service line without excavation or service disruption.

Intelligent Water Networks Summit (4714)

Through a series of collaborative workshops with utilities, technology providers, consultants, regulators, and academia, WRF developed a model to assist utilities with assessing their readiness to adopt digital approaches to utility management. The Digital Maturity Model helps utilities conduct self-assessments and develop strategies, budgets, and implementation plans to enhance their operational efficiency and strengthen their customer service.



Published Research Reports



Covering All Aspects of One Water Research



Webcasts

Live

Reaching Nearly 15,000 Viewers a 206% Increase Over 2019

Most Popular 2020 Webcast Topics

- COVID-19
- Lead
- Intelligent Water Systems
- Climate Change
- Water Use

Managing Water and Wastewater Utility Data to Reduce Energy Consumption and Cost (4668)

Water and wastewater utilities are increasingly seeking to implement data management solutions to reduce energy costs and operate more sustainably. This report provides a comprehensive knowledge base for implementing effective strategies for energy data management at water and wastewater utilities. The report emphasizes the importance of conducting a data needs assessment that address types of data, frequency of collection, collection priorities, data use, available funding, and types of resources to be allocated. The document recommends Internal validation methodologies and protocols that can be put in place to address data accuracy, precision/repeatability, turn down ratio, time stamps, granularity, and frequency. The report also provides a set of clearly defined key performance indicators, connecting energy and non-energy data, that can be identified for energy optimization.

Assessing Water Demand Patterns to Improve Sizing of Water Meters and Service Lines (4689)

Oversized water meters are a common problem for utilities across North America, especially considering increased water conservation and more efficient plumbing fixtures. Service lines need to be large enough to provide water at a reasonable pressure, but not so large that water residence times become excessive, increasing the risk of bacterial growth within the line. This project improves the results of research focused on understanding the correct meter sizing and performance to prevent inaccurate meter registration at low flow regimes and underreporting of delivered water. More accurately sized meters will ultimately help increase recurring utility revenue and enhance effective management of the distribution system.

Evaluating Analytical Methods for Detecting Unknown Chemicals in Recycled Water (4992)

Funded by the California State Water Resources Control Board, this report summarizes the current state-of-the-science for analytical methods used

to identify and measure unknown trace organic compounds in recycled water. The researchers provided an integrated framework that includes targeted analysis of known contaminants, as well as semi- and non-targeted analysis of unknown contaminants by both instrumental methods and bioassays, along with the advantages and limitations of each approach. The report includes a communications strategy that can be used by regulators, managers, and the public, and will have utility far beyond water reuse.



Biosolids Research Summit

Biosolids Research Summit (5055) documents findings of the 2020 WRF summit to identify the highest priority research needs related to biosolids. Summit participants set a new biosolids research agenda to address unanswered questions, re-examine the 40 CFR 503 regulations, demonstrate the latest innovative technologies for solids treatment, and examine the fate of emerging contaminants (e.g., PFAS) in biosolids. Held in February 2020, this summit focused on identifying high-priority biosolids research needs and developed 11 project concepts for the multi-year research agenda.

Highlights of Ongoing Research

PFAS

There is a critical need for utilities to quantify the occurrence, fate, and distribution of per- and polyfluoroalkyl substances (PFAS) in water resource recovery facilities (WRRFs). In 2020, WRF launched **Occurrence of PFAS Compounds in US Wastewater Treatment Plants** (5031) to quantifying a wide range of PFAS within WRRFs in the aqueous, solid, and gaseous phases. Sorption to solids, including colloidal attachment as well as interfacial partitioning, is being investigated, and this research will provide definitive guidance on process-based strategies to attenuate the mass flow of PFAS from WRRFs to the environment. WRF recruited 38 WRRFs to participate in the study to develop a comprehensive, comparable dataset characterizing the occurrence of PFAS entering and exiting municipal WRRFs to provide a statistical comparison of PFAS mass flows with WRRF characteristics. Future efforts under this study will provide guidance on when temporal viability should be investigated to fully capture PFAS occurrence and will provide further evaluations of the PFAS mass flow through various stages of treatment.



Assessing Poly- and Perfluoroalkyl Substance Release from Finished Biosolids (5042) has confirmed that colloidal PFAS release from biosolids may be more important than previously thought and requires further consideration in conceptual models and as a PFAS reservoir in mass balances. Baseline biosolids results indicate that the average sum total of PFAS in biosolids analyzed in this study was on the order of hundreds of μ g/kg. Precursor and suspect compounds, while not typically measured, significantly contributed to the total PFAS signature in these biosolids samples. Work on this project will continue into 2021.



New Research Projects Funded

With a Value of \$7.5 Million



With a Value of \$87 Million



Increase in Research Funding



Compared to 2019 Funding Levels

Disinfection Byproducts

During 2020, WRF continued to build on its extraordinary portfolio of disinfection byproduct (DBP) research to assist the water sector in addressing these concerns in the most appropriate and health protective manner. Several examples of our ongoing DBP research are presented below.

Haloacetonitriles (HANs) are a class of nitrogenous disinfection byproducts that can form during disinfection of water with chlorine or monochloramine. HANs have been shown to be more cytotoxic and genotoxic than their regulated counterparts, trihalomethanes and haloacetic acids. In 2020, WRF continued work on **Precursors and Control of Halogenated Acetonitriles** (5053) to conduct a comprehensive and systematic study to characterize HAN precursors in varying water sources, as well as their control in water treatment. This project will determine the sources and types of HAN precursors, identify precursor structures and formation pathways, and evaluate HAN degradation behavior to provide guidance to utilities on controlling HANs in drinking water and potable reuse systems.

Bromide and iodide ions also can react with oxidants and natural organic matter to produce regulated and emerging organic or inorganic DBPs. Brominated and iodinated organic DBPs can pose greater human health risks than chlorinated analogs. Occurrence Survey of Bromide and Iodide in Water Supplies (4711) will investigate the sources influencing the temporal and spatial occurrence of bromide ions and total organic bromine or chlorine in drinking waters, and identify

 $\neg ()$

7

Research Priority Program: 2020 Funded Projects



Research Project	Drinking Water	Wastewater	Water Reuse	Stormwater
Linking Nutrient Reduction to Receiving Water Responses		•		•
Assessing Water Quality Monitoring Needs, Tool, Gaps, & Opportunities for Potable Water Reuse)		•	
Assessment of Vulnerability of Source Waters to Toxic Cyanobacteria Outbreaks	•		•	
Guidance for Using Pipe Loops to Inform Lead and Copper Corrosion Control Treatment Decisions	6 •	•	•	
Investigation of Alternative Management Strategies to Prevent PFAS Entry into Treatment Plants	6 •	•	•	•
Advancing Low-Energy Biological Nitrogen & Phosphorus Removal		•		
Holistic & Innovative Flood Management Under Extreme Wet Weather & Climate Impacts	•	•	•	•
Impact of Haloacetic Acid MCL Revision on DBP Exposure & Health Risk Reduction	•		٠	
Case Studies on Management of Cross-Sector Dependencies	•	•	•	•
BNR Process Implementation Through Improved Control Systems & Analytics		•		
Defining Exposures of Microplastics/Fibers in Treated Waters & Wastewaters	•	•	•	•
Developing a Framework for Quantifying Energy Optimization Reporting	•	•	•	•

potential treatment strategies to control bromide and iodide within water treatment plants.

The U.S. Environmental Protection Agency (EPA) is considering changes to the disinfectant and disinfection byproducts (D/DBP) rule. Specifically, there may be a shift from the currently regulated five haloacetic acids (HAA5) to nine (HAA9), which would include four additional brominated compounds. Impact of a Haloacetic Acid MCL Revision on DBP Exposure and Health Risk Reduction (5085) will aid in a better understand the toxicology, public health, treatment, and compliance implications of a shift from an HAA5- to HAA9-based regulation.



Other Projects Funded in 2020

Unsolicited Program

Rapid Detection and Quantitation of Active Microorganisms (5100)

Real-Time Carbon Management of WRRFs Using In-situ Bio-electrochemical Sensors (5101)

Application of Novel Method to Estimate Total PFAS Content in Water (5102)

Microwave Regeneration of PFAS-Exhausted Granular Activated Carbons (5103)

Use of DNA Nanostructures as Viral Surrogates in Potable Reuse Applications (5104)

Facilitated Program

Evaluating Utility Staff Training to Improve Knowledge Retention (5074)

Videos on Development of Recycled Water Use in Southern California (5090)

Emerging Opportunities Program

Leading Water Utility Innovation (4907 Add On)

Persistence and Disinfection of SARS-CoV-2 in Wastewater (5029 Add On)

Distributed Renewable Energy Opportunities and Workshop (5062)

Development and Validation of a Real-Time Fluorescence Sensor Prototype for Early Detection of Nitrification in Drinking Water Distribution Systems (5073)

Evaluation of Water Pitcher Filter Performance for Lead Removal (5076/5077)

Interlaboratory and Methods Assessment of the SARS-CoV-2 Genetic Signal in Wastewater (5089)

Tailored Collaboration Program

Post-Wildfire Distribution System Water Quality Impacts and Potential Responses (5106)

Understanding Pyrolysis for PFAS Removal (5107)

Acid+ Digestion (5108)

Application of Finite Element Analysis in the Design of Large-Diameter Buried Pressure Pipes – Special Cases (5109)

Filtration Process Control for Pathogen Removal and Climate Change Adaptation (5110)

Studying the Fate of PFAS through Sewage Sludge Incinerators (5111)

SARS-CoV-2 Wastewater Surveillance

WRF provided international leadership to accelerate the pace of research on wastewater surveillance of SARS-CoV-2 throughout 2020 to protect public health in communities across the globe.

Throughout 2020, WRF provided international leadership in advancing wastewater surveillance of the RNA fingerprint of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)—to provide an additional tool to protect public health in communities across the globe.

Shortly following the declaration of the global pandemic, many research groups and water utilities mobilized to conduct wastewater surveillance for the genetic fingerprint of SARS-CoV-2. Wastewater surveillance is not new; it has been critical to detect the presence of poliovirus in communities in lower- and middle-income countries, and WRF also has an ongoing project to study opioid use in communities through wastewater surveillance. What is new, however, is the rapid development of this tool to provide a community-level indication of the presence of SARS-CoV-2. Given our unique position as the world's leading research collaborative supporting the water sector, WRF quickly mobilized to convene global water research leaders to support information sharing and conduct research to accelerate the pace of this critical work.

International Water Research Summit on COVID-19

In April, WRF hosted a groundbreaking International Water Research Summit on Environmental Surveillance of COVID-19 Indicators in Sewersheds. This brought together global utility and research leaders



Methods Survey

In April 2020, WRF conducted a survey of wastewater surveillance activities related to SARS-CoV-2 from 127 individual respondents across the water sector. Most respondents were collecting samples representing service areas of 50,000 people or more; however, smaller service areas were also represented. The survey showed that 54% of respondents were already testing for the genetic signal of SARS-CoV-2, and the remaining 46% were developing methods with the intention of initiating testing efforts. The results provided information on the many different specific approaches that were being utilized by individual laboratories. The results of the survey were published in *Science of the Total Environment*. to identify best practices and near-term research priorities to accelerate the pace of this important work. In particular, the summit attendees identified several leading use cases for this information, including tracking increasing and decreasing community trends in SARS-CoV-2 infection rates, and the identification of the presence of mutant variants of the virus within individual communities. The Summit provided detailed recommendations on successful approaches to sampling design, analytical tools, interpretation of results, and communication of this information to stakeholders. **Read the Summit white paper**.

Research Efforts

WRF quickly launched several research projects on wastewater surveillance of SARS-CoV-2 to address the near-term research priorities identified by attendees at the April Summit. A critical and immediate priority for the water sector was ensuring that the workforce was protected from potential exposure to SARS-CoV-2 in wastewater. WRF quickly expanded ongoing pathogen-related research projects to include a focus on potential exposure to SARS-CoV-2: **Pathogen Monitoring in Untreated Wastewater** (4989), focuses on the development of recommendations for the collection and analysis of pathogen monitoring in raw wastewater to develop better empirical data on pathogen concentrations and variability. SARS-CoV-2 has been added to the list of pathogens of concern for this project, and the research team has been analyzing SARS-CoV-2 in samples archived since November 2019, along with current and future samples. The project will be published in summer 2021.

SARS-CoV-2 has also been added to the list of pathogens of concern for Feasibility of Collecting Pathogens in Wastewater During Outbreaks (4990), which is determining the feasibility of measuring pathogen concentrations in California wastewater as early warning during community outbreak events. This research effort involves in-depth literature reviews of sewage monitoring studies and of seasonal and spatial trends of enteric pathogen outbreaks in California. The project will be published in summer 2021.









A third project, Environmental Persistence and Disinfection of the Lassa Virus and SARS-CoV-2 to Protect Worker and Public Safety (5029) will develop a user-friendly model to estimate worker viral exposure and environmental viral release from wastewater treatment operations. This will help prepare the wastewater industry for the next epidemic or pandemic outbreak of highly infectious viruses by providing a quantitative basis to respond to worker and public concerns regarding virus persistence, disinfection, and potential exposure. Project completion is expected in 2022.

WRF also immediately launched two new research projects based on the high-priority opportunities identified during the International Summit on COVID-19. The first, Interlaboratory and Methods Assessment of the SARS-CoV-2 Genetic Signal in Wastewater (5089), provides an assessment of the reliability and repeatability of laboratory methods currently being used to test for the genetic signal of SARS-CoV-2 in untreated wastewater. WRF evaluated over 35 independent methods in over 30 partnering laboratories to enhance the available analytical tools in advance of the expected fall surge in 2020. WRF completed the project less than 180 days after the Summit, and the project findings have already been published in *Environmental Science: Water Research & Technology*.

The second new SARS-CoV-2 research project, Understanding the Factors That Affect the Detection and Variability of SARS-CoV-2 in Wastewater (5093), seeks to optimize sampling design to best capture signals of SARS-CoV-2 in wastewater. This research will develop a framework providing specific recommendations for sample design to enable implementation of wastewater surveillance at three scales: large urban sewersheds, medium-sized regional sewersheds with small bore sewers, and small regional systems. Project completion is expected in 2022. The Bill & Melinda Gates Foundation contributed funding to help support these two important projects.

In addition, WRF shared the results of the International Summit with Congressional leaders through a Virtual Congressional Briefing focused on the importance of water research and innovation to support healthy communities, as well as the latest information on wastewater surveillance of SARS-CoV-2.



Maximizing Subscriber Value

The Water Research Foundation maximizes subscriber value by leveraging subscriber dollars and providing personalized outreach to our subscribers on our latest research and innovation activities.

WRF's research is focused on addressing the greatest needs of our subscribers. In 2020, WRF leveraged the support of subscribers by winning over \$1.3 million in grant funding to address subscriber needs.

As mentioned above, The Bill and Melinda Gates Foundation provided matching resources to support our research projects on SARS-CoV-2. Additional grant awards were received from the Foundation for Food and Agricultural Research for the project Addressing Impediments and Incentives for Agricultural Reuse (4956), and the National Science Foundation for research on wastewater surveillance of SARS-CoV-2.

In mid-September, the EPA announced the award of nearly \$1 million in funds to WRF to lead a critical project to reduce nutrients for cyanobacterial harmful algal bloom management: When a Detour Becomes a Shortcut: Going Full-Scale with Partial Denitrification/Anammox as an Alternative Strategy for Mainstream Deammonification and Incorporating Biological Phosphorus Removal. This project will improve full-scale applications of shortcut nitrogen removal processes in mainstream wastewater treatment systems. The research team, led by WRF, includes Columbia University, DC Water, Hampton Roads Sanitation District, George Washington University, and Northwestern University.

The Foundation also held many workshops and visits with subscribers throughout 2020. In February, WRF held a Distribution System Water



Expanded Media Reach

Throughout 2020, WRF research and innovation activities achieved an extraordinary reach. WRF staff participated in 36 interviews with major media outlets, including *The New York Times, The Boston Globe,* The Associated Press, and the *Chicago Tribune.* WRF has also received broad social media exposure from media outlets with millions of followers, including *The New York Times* (47 million), *The Independent* (10 million), and *POLITICO* (4 million). As a result, WRF's social media following and website traffic both increased by 59%. Quality Management Workshop at Chicago Department of Water Management's (Chicago DWM) Jardine Water Purification Plant. Participants from Chicago DWM and 12 suburban customer communities attended and learned about new chlorine residual rules enacted by Illinois EPA, disinfection byproduct formation potential, and the latest science and knowledge regarding corrosion control and the proposed revised LCR. Dr. David Cornwell of Cornwell Engineering Group and Dr. Abigail Cantor of Process Research Solutions shared their expertise and advisement for Chicago DWM and suburban municipal customers to best meet the challenges of competing water quality regulations in distribution systems.

Later the same month, WRF hosted a regional workshop in Vancouver, British Columbia, with over 75 attendees. Experts presented the latest research findings and knowledge gaps for constituents of emerging concern (CECs) across North America, focusing on how CEC management can protect public and ecosystem health, specifically that of southern resident killer whales and their prey, salmon.

In March, WRF hosted a cyanobacterial harmful algal blooms workshop, focused specifically on issues related to cyanobacteria, cyanotoxins, and cyanobacterial harmful algal blooms on the Front Range of Colorado.



Subscriber Value through Virtual Visits

While travel was eliminated in late March, our outreach to subscribers did not slow down. From March through the end of the year, the Subscriber Services team and WRF's CEO participated in nearly 140 virtual subscriber visits to discuss priorities and share our latest research findings directly with subscribing organizations. This personalized service helps to ensure that our work at WRF remains timely and focused on the greatest needs of our subscribers and partners.











Research Is the Foundation for Innovation

The WRF Innovation Program provides a seamless pipeline for research outcomes to culminate in implementation of innovative processes and technologies.

WRF's 2020 innovation agenda commenced with a strategic planning session for the Leaders Innovation Forum for Technology (LIFT) in collaboration with the Water Environment Federation and the LIFT Steering Committee in February. Over 50 participants met in San Antonio to build upon the vision of the water sector embracing innovation. Participants identified the importance of supporting the water sector throughout the innovation cycle, meeting innovators where they currently are to support them on their innovation journey and help them reach their goals. Participants also discussed the importance of extending innovation beyond evaluation of new treatment technologies to include innovations in business processes. WRF is excited to provide leadership for innovation across the whole water sector, including LIFT as a component of the much broader WRF innovation portfolio.

The Innovation Cycle Has Five Key Phases, Each Supported by WRF Innovation Activities.





WRF TechLink

The innovation cycle starts with **Find It**—seeking information, expanding knowledge, and generating ideas, which is supported by WRF TechLink, an online platform that allows users to explore new technologies, network with other innovators, and partner with peers on innovation initiatives.

The WRF TechLink platform averaged 432 users per month, and the most popular search inquiries were Microvi, Ephyra, CalPrex, innovative polyvinyl chloride pipe (iPVC), and advanced biological nutrient recovery (ABNR). The See It phase of the water innovation cycle is supported by the Scholarship Exchange Experience for Innovation & Technology (SEE IT) program in partnership with the Water Environment Federation and the National Association of Clean Water Agencies. The SEE IT program provides funding for participants to visit peer organizations to examine new technologies firsthand. Ten scholarships were awarded to utility applicants from eight different organizations in 2020 (see box).

The **Try It** and **Do It** phases of the innovation cycle are supported by WRF's FAST Water (Facilities Accelerating the Science & Technology of Water) Network, which helps utilities identify facilities that are willing to partner to test new technologies and collaborate and conduct pilot and demonstration projects to assess the feasibility of new processes and technologies. There are currently 119 facilities participating in the FAST Water Network globally.

As we prepared for the exciting opportunity to build on our innovation portfolio in 2021, WRF worked across the water sector to identify four priority innovation topics for potential pilot projects in the new year.

These pilot projects represent another opportunity for interested parties to Try It and Do It:

- Energy Efficiency at Water Resource Recovery Facilities
- Intensified Nitrogen Reduction Technologies to Protect Coastal Waters
- Destruction of Per- and Polyfluoroalkyl Substances
- Technology Innovations in Water Reuse

These areas will be the focus of innovation collaborations, including technology pilots, in 2021. WRF's new pilot program will evaluate



2020 SEE It Recipients

- City of El Dorado Wetlands & Water Reclamation Facility: Sidestream Bio-P Removal
- DC Water: Energy Neutrality
- Denver Water: Grey Water Systems, Inland Reverse Osmosis-Based Potable Reuse, and Brine Purification
- Loudoun Water: Potable Reuse, Innovative Approaches to Reclaimed Water and Aquifer Recharge
- Louisville & Jefferson County MSD: Innovation Efforts
- New York City Department of Environmental Protection: Deammonification, Struvite Recovery, Thermal Hydrolysis, PAC/GAC Implementation at Large-scale
- Ontario Clean Water Agency: Partial Siphon-driven Ultrafiltration Membrane Process
- South Platte Water Renewal Partners: Pilot/Demonstration

All SEE IT trips were postponed due to the impact of the COVID-19 pandemic, and all participant scholarships will be extended through 2021.

promising technologies and processes beyond the bench scale. These projects will be supported by a consortium of utilities, researchers, consultancies, private foundations, and agencies to create the seamless pipeline between research and innovation at WRF.

The Share It phase of the innovation cycle is facilitated through knowledge transfer with WRF's Technology Scan process, which helps utilities identify appropriate technologies to meet their needs. The Technology Scan process is supported by the WRF TechLink platform. Water innovations and technologies are reviewed by volunteers from the water sector to provide an expert and unbiased view of which technologies have the greatest potential to benefit the water sector.

In 2020, WRF presented 12 Technology Scan webcasts, featuring 32 new technologies covering topics as diverse as nutrients, digestion enhancement, water reuse, leak detection, sensors, source water quality, pyrolysis, stormwater, pipes, and digital water. The size of the Technology Scan webcast audience doubled during 2020, reflecting growing interest among water sector professionals for the credible, unbiased reviews of innovative technologies that only their peers within the sector can provide.



Struvite formation was crippling our operations, leading to extensive maintenance and increased chemical usage. WRF TechLink connected us with other utilities who had struggled with the same issue. Their advice led us to successfully pilot MagPrex and Hydroflow technologies, which drastically decreased our chemical usage."

Jeff Prevatt, Deputy Director, Pima County Wastewater Reclamation



Technology Scan Webcasts

Peaturing 32 New Technologies



Working Together to Create

Innovation Opportunities





Awards

Each year WRF recognizes some of the most influential utility and research partners through the Dr. Pankaj Parekh Research Innovation Award, the Outstanding Subscriber Award for Applied Research, and the Paul L. Busch Award.

Dr. Pankaj Parekh Research Innovation Award

The Dr. Pankaj Parekh Research Innovation Award was given to Dr. David Cornwell, President of Cornwell Engineering Group. This award honors researchers who have advanced the science of water through WRF-sponsored projects. Dr. Cornwell has served as a Principal Investigator on over 25 WRF projects on topics including filtration, residuals management, coagulant optimization, and more. More recently, he has led projects on lead and copper control. Dr. Cornwell's impressive body of work provides valuable insight and knowledge that can be applied by utilities to protect public health.

Outstanding Subscriber Award for Applied Research

WRF's Outstanding Subscriber Award for Applied Research honors subscribing utilities that have successfully applied WRF research to make notable improvements to their water treatment, delivery, and/or management processes. This year's award winners, Hampton Roads Sanitation District (HRSD) and Metro Vancouver, have both been subscribers to The Water Research Foundation for 30 years and have participated in a total of over 80 WRF projects. This highlights their lasting dedication and leadership in supporting WRF. HRSD provides regional wastewater treatment to 18 cities and counties in southeast Virginia, operating 13 treatment plants with a combined capacity of 249 million gallons per day. HRSD is recognized as a leader in the industry. SWIFT (the Sustainable Water Initiative for Tomorrow) is HRSD's newest water treatment innovation, designed to further protect the region's environment and enhance the long-term sustainability of the region's groundwater.

Metro Vancouver provides water and liquid waste services through its member municipalities for 2.6 million residents in southwestern British Columbia, Canada. This includes acquiring, treating, and delivering water, as well as collecting and treating wastewater on behalf of its municipalities. Since 2002, Metro Vancouver has put sustainability at the center of its planning and operating philosophy and advanced its role as a leader in the pursuit of a low-carbon future for the region.

Paul L. Busch Award

The 2020 Paul L. Busch Award recipient is Dr. Shihong Lin, Assistant Professor in Civil and Environmental Engineering and Chemical and Biomolecular Engineering at Vanderbilt University in Nashville. The award recognizes an individual for innovative research, focusing on those who are successfully bridging research and its practical applications. Dr. Lin is regarded as an emerging leader in the field of water separation technologies. His innovative research is poised to have a transformative impact on water treatment and desalination.

At Vanderbilt, Dr. Lin combines both experimental and theoretical approaches to study a variety of water separation technologies, including membrane-based, electrochemical, and hybrid processes. The main research goals of his lab are to enhance fundamental understanding of various water separation technologies from molecular to system level and develop new processes and materials that lead to higher process efficiency, reliability, and versatility. The Paul L. Busch Award will enable Dr. Lin to develop advanced separation processes that can help water utilities desalinate seawater and brackish water, purify contaminated groundwater, and reuse municipal and industrial wastewater. They also make possible the recovery of resources, such as nutrients from wastewater and valuable minerals from industrial wastewater.

The Paul L. Busch Award is made possible through the Endowment for Innovation in Applied Water Quality Research. We sincerely thank the individuals who have supported the Endowment.



I am honored and humbled to receive the 2020 Paul L. Busch Award, joining a cohort I have looked up to as role models throughout my career. Separation processes have always been critical to water and wastewater engineering, and I have been fortunate to work in this exciting field.

Dr. Shihong Lin, Assistant Professor, Civil and Environmental Engineering and Chemical and Biomolecular Engineering, Vanderbilt University

The Paul L. Busch Award: **Two Decades of Innovation**





Up-and-Coming, Innovative Researchers





Financial Snapshot

WRF prides itself on sound financial stewardship of subscriber resources and federal, state, and private foundation grants.

Total Revenue \$25.8M	Research Subscription Funding Project Co-Funding & Grants 19.7% Realized Gain on Investments 2% Facilitated Research Services 1.1% Investment Income – Interest 1% Other .2%	76%
WRF Functional Allocation	Research & Dissemination Services Support Services 16%	84%



WRF's key source of revenue is subscriber funding, representing more than 75% of all revenue recognized in FY2020. Additionally, almost 20% of all revenue recognized in FY2020 is co-funding and grant revenue, which supports research. In alignment with WRF's mission, this revenue directly contributes to the portfolio of research available to subscribers.

WRF's total expenses include both program and support services. Program services include research management, communications and marketing, subscriber services, and research and innovation program services. These functional areas and their related activities directly support the delivery of research to subscribers. Support services include management and general costs, as well as fundraising expenses, totaling 16% of all expenses.



Full financial statements are available upon request.



Volunteers

WRF's research and innovation activities are greatly enriched by our extensive network of volunteers. Their donated time and expertise make it possible for WRF to deliver integrated One Water research focused on the needs of the entire water sector.

Board of Directors

Members of our Board of Directors are WRF subscribers and leaders in the water community. Our Board provides leadership, strategic direction, policy setting, and operational oversight to ensure that our organizational goals are achieved, and resources are deployed wisely. For more information, contact Lucy Dickhoff at ldickhoff@waterrf.org.



Dennis Doll (Chair) President and CEO, Middlesex Water Company



Michael Markus (Vice-Chair) General Manager, Orange County Water District



Paul Rush (Treasurer) Deputy Commissioner, New York City Dept. of Environmental Protection



Cathy Bailey (Member-at-Large) Director, Greater Cincinnati Water Works



Douglas Owen (Member-at-Large) Program Manager, Stantec

Martin Adams

General Manager and Chief Engineer, Los Angeles Department of Water and Power

Hardeep Anand

Deputy Director, Capital Improvement Program, Miami-Dade Water and Sewer Department

Jeannette Brown Research Assistant Professor, Manhattan College

Shane Chapman

Assistant General Manager/Chief Administrative Officer, Metropolitan Water District of Southern California

Randy Conner Commissioner, Chicago Dept of Water Management

Shayne Cunis Watercare Services Limited **Glen T. Daigger** President and Founder, One Water Solutions, LLC

Lou Di Gironimo General Manager, Toronto Water

Kyle Dreyfuss-Wells Chief Executive Officer, Northeast Ohio Regional Sewer District John Entsminger General Manager, Las Vegas Valley Water District & Southern Nevada Water Authority

Yvonne W. Forrest Director, Houston Water

Paul D. Jones. II General Manager, Eastern Municipal Water District

Thomas E. Kunetz Thomas Kunetz Consulting

Jonathan Lanciani Lanciani Consulting, LLC

Carrie Lewis General Manager, Portland Water District

Nadine Leslie Chief Executive Officer. SUEZ North America

Jim Lochhead Manager/CEO, Denver Water Ron Lovan President/CEO, Northern Kentucky Water District Walter Lynch

Chief Executive Officer. American Water

Alex Margevicius Commissioner, City of Cleveland Division of Water

Patricia Mulroy Sr. Fellow, William S. Boyd School of Law, UNLV, Climate Adaptation & Environmental Policy, Brookings Institution

Garv ReVoir Vice President, Tetra Tech

Kathryn Sorensen Former Director, City of Phoenix Water Services Department

Brian Steglitz Manager, Water Treatment Services, Ann Arbor Water Utilities Department

John Stomp Chief Operating Officer, Albuquerque Bernalillo County Water Utility Authority

John Sullivan Chief Engineer, Boston Water and Sewer Commission

Robert Teegarden RTEE Advisors/Orlando Utilities Commission

Eric Thornburg Chairman, President & CEO of SJW Group

Gilbert Trejo Chief Technical Officer – Technical Services Division, El Paso Water Utilities

Bart Weiss Director, Reclaimed Water and Discharge Elimination Division, Hillsborough County Public Utilities Department

New Board of Directors Members

WRF welcomes the following new Directors, who attended the December 2020 Board meeting and began their three-year term on January 1, 2021.



Clifford Chan General Manager, East Bay Municipal Utility District



David Gadis Chief Executive Officer and General Manager, DC Water



Randy Hayman Commissioner and CEO Department



Cheryl Norton President, New Jersey American Water: Senior Vice Philadelphia Water President Eastern Division; Chief Environmental Officer. American Water



Brian Perkovich Executive Director. Metropolitan Water **Reclamation District** of Greater Chicago



Beverley Stinson Executive Vice President and Water Business Line Leader, AECOM



Enrique Zaldivar Director and General Manager, I A Sanitation

Research Advisory Council

The Board appoints the Research Advisory Council (RAC), which provides technical recommendations regarding issues and challenges to be addressed under the Research Priority Program. The RAC also selects projects for funding. For more information, contact John Albert at jalbert@waterrf.org.



Yvonne Forrest (Chair) Deputy Director, City of Houston Water & Wastewater Facility

Cathy Bailey Director, Greater Cincinnati Water Works

Pinar Balci Assistant Commissioner, New York City Dept. of Environmental Protection

Alex Coate General Manager, East Bay Municipal Utility District

Randy Conner, Water Commissioner, Chicago Dept of Water Management **Donald Gray** Manager, Process Engineering, East Bay Municipal Utility District

Chance Lauderdale Vice President, HDR, Inc.

Ron Lovan President/CEO, Northern Kentucky Water District

Alex Margevicius Commissioner, City of Cleveland Division of Water

Per Henrik Nielsen VandCenterSyd

Jim Pletl Director, Water Quality, Hampton Roads Sanitation District

Phil Rolchigo Vice President, Technology & Innovation, Pentair

Robert Teegarden Orlando Utilities Commission Art Umble Global Wastewater Practice Leader, Stantec

Whit Wheeler Assistant Public Utilities Director, City of Raleigh Public Utilities

Ken Williamson Directory, Regulatory Affairs, Clean Water Services

John Willis Vice President, Wastewater Solutions, Brown and Caldwell

Shahla Farahnak Assistant Deputy Director, California State Water Resources Control Board

Phil Zahreddine Senior Technical Advisor, Office of Wastewater Management, U.S. Environmental Protection Agency

Tailored Collaboration Review Committee

The Board appoints the Tailored Collaboration Review Committee (TCRC). Members must be from WRF subscribing utilities. The Tailored Collaborative Research Program addresses issues important to subscribers on a regional or national level. For more information, contact John Albert at jalbert@waterrf.org.



Brian Steglitz (Chair) Unit Manager, City of Ann Arbor Joan Arthur Asset Manager, Tulsa Metropolitan Utility Authority, City of Tulsa

Colin Chapman Innovation, Research, & Development Coordinator, Queensland Urban Utilities Andrew Linard Assistant Director of Water Engineering, Los Angeles

Department of Water and Power

Peter Keenan Director of Engineering, American Water



The Water Research Foundation

www.waterrf.org | info@waterrf.org

1199 N. Fairfax St., Ste. 900, Alexandria, VA 22314

6666 W. Quincy Ave., Denver, CO 8023

Connect with us in f У 💿

