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THE Water Research FOUNDATION

Annual Report 2018

advancing the science of water $\ensuremath{^{(\! \ensuremath{\mathbb{R}})}}$

his is a time of tremendous excitement and opportunity for The Water Research Foundation (WRF), our subscribers, and the entire water sector. It is also a time to reflect on the milestones we've reached since the integration of the Water Environment & Reuse Foundation and the Water Research Foundation in January 2018. We have made significant strides in all aspects of our work, from research and innovation to collaboration and funding.

We now offer a stronger, broader, more interconnected research agenda than ever before, with even greater value to the water sector. Creating a comprehensive research agenda was not an easy task, and we are proud to be launching our five integrated research programs in 2019. Each of these research programs has its own focus, and together the programs allow us to take a proactive and innovative One Water approach to addressing high-priority research needs while maintaining the ability to be responsive to time-critical issues.

Pursuing innovative solutions to the greatest challenges facing the water sector is fundamental to our work here at WRF—it is an essential aspect of everything that we do! The Leaders Innovation Forum for Technology (LIFT), a partnership launched in 2012 by WRF and the Water Environment Federation, is possibly the most well-known aspect of our innovative culture. LIFT historically focused on innovation for wastewater, stormwater, and reuse. The program has now successfully expanded to include drinking water, with the LIFT Utility Working Group for Drinking Water meeting for the first time in June 2018.

The LIFT working groups provide opportunities for utilities to collaborate to bring ground-breaking innovation to the water sector. An additional collaborative effort that we led in 2018 focused on the federal National Priorities Water Research Grant Program. WRF partnered with all of you to send more than 500 letters to Congress in support of increased appropriations for this program. Through these and other efforts, we collaborate with subscribers, partners, and additional stakeholders on six continents, all of whom bring incredible expertise to our efforts. Our partnerships also brought WRF financial successes in 2018. We received funding from the California State Water Resources Control Board to further our work in both potable and nonpotable reuse. In addition, the Department of Defense provided financial support for our work on the assessment of treatment technologies for perand polyfluoroalkyl substances.

Exciting partnerships like these enable us to deliver innovative solutions to the most significant water-related challenges around the globe. WRF will continue to be the leader in delivering the cutting-edge science and innovation the water sector needs as we fully integrate water resources management to protect public health and the environment. Our vision is of a water sector that fully embraces and applies innovative solutions and a One Water perspective. With our strong scientific foundation, WRF will lead and support the sector in making this vision a reality. We look forward to working with you and all of our stakeholders in the years ahead.



mia W. Doll

Dennis W. Doll Chair, Board of Directors (2018 Co-Vice Chair)



Peter Grevatt, PhD Chief Executive Officer



RF was fortunate to secure funding for research through several exciting grant opportunities in 2018. The California State Water Resources Control Board provided two grants, totaling \$4.5M, and the U.S. Department of Defense awarded \$1.1M to WRF. In addition, work was concluded on a \$2.2M, five-year-long research effort funded through the U.S. Environmental Protection Agency's Science to Achieve Results program.

The California State Water Resources Control Board (SWRCB) awarded the grants as part of a research program to advance potable and nonpotable water reuse applications statewide in a way that is protective of public health and the environment. These grants were possible due to a long-term relationship between SWRCB and WRF, as well as California legislation that has increased attention on direct potable reuse. The funding was leveraged by WRF and other key partners, including Metropolitan Water District (CA), utilities in California and across the United States, engineering firms, and manufacturing companies.

The first grant of \$1M supports five projects whose research findings will be used to inform the development of regulations for direct potable reuse, driven by the 2017 CA legislation SB 574, which established a deadline of 2023 for these regulations. The second grant uses WRF's Research Priority Program process to conduct approximately \$2M of research on potable reuse and \$1.5M of research on nonpotable reuse. The research from both grants will be used to advance potable reuse, not only in California, but throughout the world, establishing potable reuse as a reliable solution to global water supply challenges and as a sustainable component of integrated water resources management.

The U.S. Department of Defense (DoD) grant is for conducting research on per- and polyfluoroalkyl substances (PFAS) in sources of drinking water. The project, *Evaluation and Life Cycle Comparison of Ex-Situ Treatment Technologies for PFAS Substances in Groundwater*, will develop a framework for assessing PFAS treatment techniques from a life cycle cost/assessment perspective.

In addition to creating the treatment technique framework, the project team will develop a treatment testing protocol and conduct laboratory-scale studies to evaluate the performance of various technologies for PFAS removal

\$1.1M

under different treatment scenarios. The results will be used to develop an Excel-based decision support tool to help DoD, utilities, and other practitioners select the most viable treatment technologies for specific scenarios on a life cycle cost/ assessment basis by identifying advantages, disadvantages, limitations, and costs. The research team includes the Colorado School of Mines, North Carolina State University, University of Colorado Boulder, and CDM Smith. The total project budget is \$1,090,451.

> 2018. WRF ln completed work on our U.S. Environmental Protection Agency (EPA) Science to Achieve Results (STAR) grant. This was one of four grants awarded in 2013 to establish Centers for Water Research on National **Priorities Related** to a Systems View of Nutrient Management. The grant recipients were tasked with taking a broad approach to nutrient management, while considering behavior, technology, and economics as methods to protect water resources by controlling the flow of nutrients. WRF's National Research Center for **Resource Recovery**

and Nutrient Management (Center) effort included seven projects that explored replicable, scalable strategies demonstrating the renewable resource potential of waste streams, focusing on nitrogen and phosphorus recovery. The Center's research was conducted by teams of subject matter experts at universities, wastewater utilities, nonprofit organizations, and commercial animal facilities. Our partners included Columbia University, DC Water, Hampton Roads Sanitation District, Stanford University, The State University of New York at Buffalo, University of California at Berkeley, University of Michigan, University of Washington, and Washington State University.

The Center's goal was to provide innovative data, tools, and demonstration projects to bring about a paradigm shift in the water community where nutrients (nitrogen and phosphorus) are seen as valuable resources, rather than wastes to be removed and disposed of. In addition, the Center sought to provide communities with cost-effective options to recover and reuse nutrients while significantly reducing nutrient loading and helping to attain designated uses of waterbodies. The Center supported nutrient management projects as a cross-cutting theme within four existing WRF research programs: Resource Recovery, Nutrient Removal, Sustainable Integrated Water Management, and Energy Production and Efficiency. This approach ensured that the Center's projects were informed by the most up-to-date water quality research in each area.

In August, we hosted a Capstone Summit to showcase the research findings to utility, engineering/design, regulatory, academic, and nonprofit representatives. Our Center successfully demonstrated that a collaborative approach with an integrated systems view of nutrients (from small and large wastewater systems, stormwater runoff, and agriculture) can help to shift the view of nutrients as pollutants to one of nutrients as valuable resources.

• Research Successes • •

RF staff and Research Strategy Committee members worked together throughout 2018 to evaluate our former research priorities and develop a comprehensive One Water research agenda. The new research agenda will be instituted in 2019 and will be fulfilled through five research programs designed to provide subscribers with flexible funding and partnership opportunities.

WRF will continue to focus on applied research and innovative processes and technologies, and will still incorporate a competitive selection process, the highest quality control measures, and a nationally recognized expert review process. The research programs provide unique opportunities for subscribers, partners, volunteers, and other stakeholders to further their research priorities, grow from interaction with the world's top water leaders and innovators, and lend their expertise to further advance the science of water.

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	% Annual WRF
Research Program & Description	Research Budget
Research Priority A strategic research program broadly relevant to the water sector	60
Tailored Collaboration	20
A matching program designed to support	
utility-specific/regional issues	
Emerging Opportunities	10
A program to address emerging and time crit-	
ical issues; additionally, supports partnering	
opportunities and add-ons to current projects	
Unsolicited Research	10†
A program that focuses on novel,	
transformative research	
Facilitated Research	0
A program that utilizes the WRF's research	(funded by the
management experience at cost to subscribers	proiect team)

The Distinguishing Features of New WRF Research Programs

tWhile research budget is allocated to this program annually, research-project funds are released every other year, starting in 2020.

In 2018, WRF published a series of research reports and funded a variety of projects that showcase our One Water approach. These projects cover topics such as innovation in integrated water resource management, the water workforce, collaboration, resiliency, energy optimization, and more. For example, Collaborative Water Utility Benchmarking assists water utilities in assessing asset management practices and aligning them with American Water Works Association's Benchmarking Survey performance metrics, Effective Utility Management attributes, and the International Organization for Standardization's standard ISO 55000. The white paper, Management of Water Sector Utilities: Summary of Industry Initiatives and Research, explores collaborative water utility benchmarking, as well as other initiatives that share the goal of providing utility managers with information and methodologies for monitoring and improving performance. Two additional projects examined opportunities for collaboration between planning and water resource management efforts. Joining-Up Water Management with Urban Planning investigated the key barriers to such coordination and identified strategies for overcoming them. Integrating Land Use and Water Resources: Planning to

<u>Support Water Supply Diversification</u> explored current and future opportunities to diversify water supplies through better coordination between water utilities and the land use planning and development community. Our innovative, integrated research agenda will build upon these projects and our full portfolio of One Water science and will enable us to holistically integrate issues of the highest priority to the water sector.

••LIFT in Review ••

he Leaders Innovation Forum for Technology (<u>LIFT</u>), developed in partnership with Water Environment Federation (WEF), helps to accelerate the adoption of innovation in the water industry. In 2018, LIFT reached several important milestones that not only benefit subscribers, but the water sector at large. Over the past year, LIFT expanded its water innovation focus and pioneered several initiatives that advanced growth in technology.

Drinking Water Utility Working Group

The Drinking Water Utility Working Group was formed and the first meeting was held in June 2018 at American Water Works Association's Annual Conference and Exposition.



The meeting provided utilities with opportunities for peer-to-peer networking and discussion. Attendees brainstormed ideas for pilots and demonstrations that would bring additional technological innovation to drinking water. The expansion into drinking water will enable LIFT to demonstrate the value of new technology to all major areas of the water sector.

Scholarship Exchange Experience for Innovation & Technology (SEE IT)



SEE IT enables utility personnel to visit other utili-

ties with innovations of interest and share their experiences with peers. In its second year, SEE IT awarded travel scholarships to 28 staff members from 10 utilities to view the implementation of technology at peer facilities. Scholarship recipients were from facilities across the United States and Canada, and were able to visit facilities abroad. This program is a partnership between WRF, WEF, and the National Association of Clean Water Agencies.

Intelligent Water Systems (IWS) Challenge

The first IWS Challenge launched in 2018 to demonstrate the value of intelligent water systems to utilities and encourage adoption



of such technologies in the areas of big data, Internet of Things, data analytics, and workforce issues. The 2018 challenge had over 70 participants. Great Lakes Water Authority won the grand prize of \$25,000 for their partnership with the University of Michigan on an open-storm Detroit Dynamics solution, which seeks to enable the next generation of smart stormwater and sewer collection systems.



WRF is proud to recognize our 2018 award winners!

The 2018 <u>Paul L. Busch Award</u> recipient was **Dr. Krista Wigginton**. The award recognizes an

individual for innovative research, focusing on those who are successful bridging research and its practical applications. Dr. Wigginton's approach relies on uniting virology with engineering to detect and directly measure viruses in water. Applying this research to water treat-



ment can ultimately protect public health and reduce treatment system costs.

The *Paul L. Busch Award* is made possible through the Endowment for Innovation in Applied Water Quality Research. Thank you to the individuals who have supported the <u>Endowment</u>.

The <u>Dr. Pankaj Parekh Research Innovation</u> <u>Award</u> was given to **Dr. George Di Giovanni** of

Metropolitan Water District of Southern California. This award honors researchers and research teams who made significant contributions to advancing the science of water through WRF-sponsored research. Dr. Di Giovanni served as Principal Investigator on



significant *Cryptosporidium* detection projects that developed and field tested an innovative and cost-effective method for genotyping that has since been adopted by laboratories around the world.



The <u>Outstanding Subscriber Award for Applied</u> <u>Research</u> was given to Halifax Water and Orange County Water District (OCWD). This award recognizes subscribing utilities that made notable improvements to their treatment, delivery, and/ or management processes through application of WRF research. Halifax Water has been involved in 27 WRF research projects and is currently active in 9 ongoing studies. In addition, 15 Halifax Water staff members have served on various planning bodies. OCWD has been managing the region's groundwater basin and ensuring water reliability and quality for over 85 years, and its Water Factory 21 was the first facility ever to use reverse osmosis to purify wastewater.





• • 2018 Volunteers • •

Thank you to our volunteers!

RF is grateful for the support of our volunteers, which enables us to reach out to other professionals, organizations, and communities! Our volunteers are the lifeblood of WRF and allow us to continue to develop research and tools that have a lasting impact on the water sector.

Board of Directors

Members of our Board of Directors (Board) 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 <u>ldickhoff@waterrf.org</u>.



(front row, left to right) Robert Renner The Water Research Foundation

Cindy Wallis-Lage Black & Veatch

Jim Lochhead (Member-at-Large) Denver Water

Douglas Owen (Member-at-Large) Stantec Michael Markus (Co-Vice Chair) Orange County Water District Charles Murray (Co-Chair) Fairfax Water

Dennis Doll (Co-Vice Chair) *Middlesex Water Company*

Julie Hunt (Co-Treasurer) Trinity River Authority Paul Rush (Co-Treasurer) New York City Department of Environmental Protection

Jody Puckett Dallas Water Utilities

Jeanette Brown *Manhattan College*

Melissa Meeker The Water Research Foundation

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(middle row, left to right) Cathy Bailey Greater Cincinnati Water Works

Martin Adams Los Angeles Department of Water and Power

Scott Dyer LaTourneau University

Glen Daigger University of Michigan and One Water Solutions, LLC

(back row, left to right) Michael Carlin San Francisco Public Utilities Commission

Robert Teegarden Orlando Utilities Commission

Bart Weiss Hillsborough County Public Utilities Department

Christopher Hill Arcadis North America

(not pictured)

Kevin Shafer (Co-Chair) Milwaukee Metropolitan Sewerage District

Paul Bishop University of Rhode Island

Julius Ciaccia, Jr. Northeast Ohio Regional Sewer District

Alexander Coate East Bay Municipal Utility District

Michael Connor East Bay Dischargers Authority

Paul Cook Irvine Ranch Water District

John Entsminger Las Vegas Valley Water District & Southern Nevada Water Authority

Philippe Gislette Degremont, Suez Environment

John Hanula *Stantec*

Mark Knudson Tualatin Valley Water District

Jonathan Lanciani Sustainable Water, Inc. Ron Lovan Northern Kentucky Water District Lou Di Gironimo Toronto Water Brian Steglitz Ann Arbor Water Utilities Department John Sullivan Boston Water and Sewer Commission

Gary ReVoir Tetra Tech Jim Fiedler Jim Fiedler Consulting

Shayne Cunis Watercare Services Limited

Russell Ford Jacobs (formerly CH2M)

Ken Lykens Centennial Water and Sanitation District

Craig Lichty Kennedy/Jenks Consultants Walter Lynch American Water

Alex Margevicius Cleveland Water Department

Patricia Mulroy Brookings Institution

Fred Nenninger Metro Vancouver

Halla Razak Inland Empire Utilities Agency

Alan Rimer EnviroTechNovations

Kathryn Sorensen City of Phoenix Water Services Department

Lisa Sparrow *Utilities, Inc.* Ufuk Erdal *AECOM*

Hardeep Anand Miami-Dade Water and Sewer Department

Randy Conner Chicago Department of Water Management

Kevin Young Sydney Water Corporation Limited

Eric Thornburg San Jose Water Group

Dominique Demessence SUEZ North America

John Stomp Albuquerque/Bernalillo County Water Utility Authority

Diane Taniguchi-Dennis Clean Water Services

Timothy Thomure City of Tucson Water Department

Gilbert Trejo El Paso Water Utilities

Rhodes Trussell Trussell Technologies, Inc.

Peter Tunnicliffe *CDM Smith, Inc.*

Rick Warner Washoe County Water Department

Research Advisory Council

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



(left to right) Alex Margevicius City of Cleveland Division of Water Phil Zahreddine U.S. Environmental

Protection Agency Mark Knudson (Co-Chair)

Tualatin Valley Water District

Jeff Swertfeger Greater Cincinnati Water Works

Whit Wheeler *City of Raleigh Public Utilities* John Willis

Brown & Caldwell

Ron Lovan Northern Kentucky Water District

Shahla Farahnak California State Water Resources Control Board

Yvonne Forrest City of Houston Water & Wastewater Utility

Jim Pletl Hampton Roads Sanitation District

Kyle Dreyfuss-Wells Northeast Ohio Regional Sewer District

Robert Teegarden Orlando Utilities Commission

(not pictured) Alexander Coate East Bay Municipal Utility District

Phil Rolchigo *Pentair* Paul Rush New York City Department of Environmental Protection Rob Spackman City of Calgary Water Resources Pinar Balci New York City Department of Environmental Protection

Chance Lauderdale *HDR*, *Inc.*

Ken Williamson *Clean Water Services*

Rhodes Trussell (Co-Chair) Trussell Technologies, Inc.

Per Henrik Nielsen VandCenterSyd

Donald Gray East Bay Municipal Utility District Art Umble Stantec

Lisa Sparrow *Utilities, Inc.*

Crystal Rogers-Jenkins U.S. Environmental Protection Agency

Tailored Collaboration Review Committee

The Board appoints the Tailored Collaboration Review Committee (TCRC). Members of the TCRC must be from utilities that are WRF subscribers. The TCRC is responsible for selecting and funding projects under the Tailored Collaboration Research Program, which addresses issues important to subscribers on a regional or national level. For more information, contact John Albert at jalbert@waterrf.org.



(left to right) Colin Chapman Queensland Urban Utilities

Andrew Linard Los Angeles Department of Water and Power

Joan Arthur Tulsa Metropolitan Utility Authority, City of Tulsa Public Works

(not pictured) Michael Wehner Orange County Water District Abhay Tadwalkar Toronto Water Cheryl Norton (Chair) Missouri American Water

Public Council on Water Research

The Board appoints the Public Council on Water Research (PCWR), which includes representatives from organizations such as government agencies, environmental groups, regulatory agencies, and state drinking water and wastewater administrators. The PCWR advises the Board on pertinent social issues, public perception of research needs, public reaction to utility contributions for research, and any other socioeconomic topics deemed significant. PCWR feedback is also provided to the RAC to help inform the research agenda. For more information, contact Beate Wright at bwright@waterrf.org.



(left to right) Suzanne van Drunick U.S. Environmental Protection Agency Daniel Hall Missouri Public Service Commission Dennis Doll (Co-Chair) Middlesex Water Company

(not pictured) Julia Anastasio Association of Clean Water Administrators

Andrew Sawyers U.S. Environmental Protection Agency Edward Osann Natural Resources Defense Council Jennifer Peters Clean Water Action/ Clean Water Fund

Michael Markus (Co-Chair) Orange County Water District Jessica Godreau North Carolina Public Water Supply Section

Doug Farquhar National Conference of State Legislatures

Christine Hoover Pennsylvania Office of Consumer Advocate

Academic Council

The Board appoints the Academic Council (AC), which consists of representatives from the academic community. The AC advises the Board on the academic perspective on emerging topics and potential research areas; ways for WRF to better engage the academic community and potential partners; and also provides input on research programs, initiatives, and activities. AC feedback is also provided to the RAC to help inform the research agenda. For more information, contact John Albert at jalbert@waterrf.org.



(front row, left to right) George Tchobanoglous University of California at Davis

David Stensel University of Washington

(back row, left to right) Manuel Teodoro Texas A&M University

Richard Luthy Stanford University Dennis Doll (Co-Chair) Middlesex Water Company

Daniel Van Abs Rutgers - The State University of New Jersey

Andrea Dietrich Virginia Polytechnic Institute & State University Michael Stenstrom University of California at Los Angeles

(not pictured) Nicholas Ashbolt University of Alberta

Amy Childress University of Southern California

Jorg Drewes Technical University of Munich Charles Haas Drexel University Michael Markus (Co-Chair) Orange County Water District Carol Miller Wayne State University Sybil Sharvelle Colorado State University

Glen Daigger University of Michigan and One Water Solutions, LLC

Robert Pitt University of Alabama

LIFT Steering Committee

The LIFT Steering Committee is responsible for the development and implementation of goals and a strategic plan for LIFT, with the purposes of accelerating water technology adoption and engaging the entire water sector in all phases of the innovation process. Members are appointed by the WRF Board and the WEF Board of Trustees. For more information, contact Lauren Baden at <u>lbaden@waterrf.org</u>.



(left to right) Jim McQuarrie (Chair) Metro Wastewater Reclamation District (Denver)

Erika Bailey (Vice-Chair) *City of Raleigh* John Arena

Metropolitan Water District of Southern California

John Barber Ret., Eastman Chemical Company

Charles Bott Hampton Roads Sanitation District Colin Chapman (International Liaison) *Queensland Urban Utilities*

Angelita Fasnacht American Water

Thomas E. Kunetz Metropolitan Water Reclamation District of Greater Chicago

Jeff Lape (Liaison) U.S. Environmental Protection Agency Nancy Love University of Michigan Sudhir Murthy NEWhub

Jeff Peeters SUEZ Water Technologies and Solutions

David Rexing Southern Nevada Water Authority

Art Umble *Stantec*