



California Direct Potable Reuse Initiative  
**REPORTING ON SIGNIFICANT  
PROGRESS**

Spring/Summer 2015

## Background

The Foundation, in partnership with WateReuse California, launched the Direct Potable Reuse (DPR) Initiative in June of 2012 to advance DPR as a water supply option in California. This was driven by the establishment of statewide goals for the use of recycled water, and a mandate from the California legislature to come up with a feasibility of DPR criteria study by 2016 to investigate developing uniform water recycling criteria for DPR.

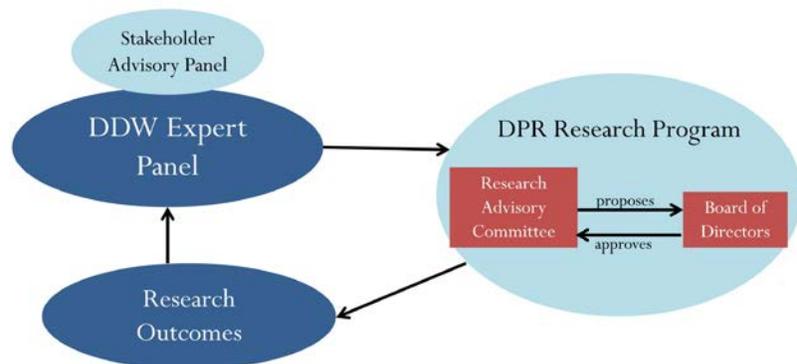
This Initiative was built upon a solid research program that started in 2011 when WRRF began funding research identified in WateReuse's *Direct Potable Reuse: A Path Forward* publication. That insightful effort informed a DPR Research Needs meeting held in December 2012 which forged the framework of the Foundation's research agenda.

Since 2012, the DPR Initiative has raised over \$6 million for cutting edge DPR research. This includes \$500,000 in matching funds from the Metropolitan Water District of Southern California (MWD) and a partnership with Water Research Foundation for \$600,000. Not included in that total is a \$2.1 million grant from the Department of Water Resources and San Diego County Water Authority for a DPR demonstration project in San Diego launched in September, 2014.

## Continued Success

To date, the Foundation has allocated \$5.8 million to fund [34 DPR research projects](#). This important research to address the regulatory, utility, and community concerns facing DPR is valued at over \$20 million.

The California State Water Resources Control Board (SWRCB) has set up an [Expert Panel](#) under its new Division of Drinking Water Programs (DDW) to make a recommendation about the feasibility of developing DPR criteria by 2016. All of the research under our DPR Initiative is made available to the [DDW Expert Panel](#) for their consideration as they navigate the important task of making a recommendation to the State Board by 2016.



Since our last [update](#), there has been continued progress in providing the Expert Panel with vitally needed information. We participate in the quarterly Expert Panel meetings and respond to their recommendations. In the last several months, we have built PACs and started to launch RFPs for the suite of 7 projects that were developed in direct response to the Expert Panel report ([Vol I](#) and [Vol II](#)). Our role will soon increase as the Expert Panel shifts focus from the first part of their mission (developing criteria for surface water augmentation) to the second (feasibility of DPR criteria).

Since the last update in November, there have been several noteworthy events:

- **2015 Research Needs Survey.** In January 2015, the Foundation released a research needs survey, organized by research area including water quality and treatment for potable reuse. Nearly 250 members participated, and these results were shared with the RAC to shape their focus.
- **RAC Meeting and development of 5 new DPR projects.** The RAC convened on April 7-8 in Tampa, FL and developed 5 additional DPR projects valued at \$1M. Notably, the highest ranked project is a Synthesis/Critical Review that will pull together findings of the 34 DPR projects to organize succinct summaries and presentations by topic, particularly for use with the Expert Panel and DPR Initiative supporters.
- **Board Approval of 2015 Principal (solicited) Program.** The 5 RAC-developed DPR projects were approval by the Board of Directors on May 3. PACs will be formed in the upcoming months, so please contact the project manager if you are interested in nominating a PAC member. RFPs will be released late 2015.
- **Board Approval of 2015 Tailored Collaboration Projects.** Three highly significant TC potable reuse projects were approved by the Board on May 3, as further described below. Please contact the project manager if you are interested in nominating a PAC member.
- **Submission of grants for USBR and DOE support.** The Foundation submitted five DPR proposals in February 2015 to the Bureau of Reclamation Desalination and Water Purification Research and Development program. We were invited back to submit three of the DPR proposals for phase two of the application process and hope to hear the results by the summer. We also partnered with Sandia National Laboratories who coordinated a large project team (MIT, Rice, PNNL, AMTA, Baker Institute, EPA, EPRI, NOAA, etc) in response to the DOE Funding Opportunity Announcement under the U.S.-China Clean Energy Research Center Program. The application was submitted on May 4<sup>th</sup> and award total is \$12.5M over 5 years (\$12.5M cost share required). WRRF request was \$100,000 towards WRRF-14-01 for the first year, with additional future opportunities in coming years.



## *ANNUAL RAC MEETING*

The WRRF Research Advisory Committee (RAC) convened on April 7-8 in Tampa, FL for their annual meeting to develop the 2015 research program. Using member survey results and recommendations from past and ongoing research to drive the agenda, the RAC developed a slate of five new DPR projects valued at \$1 million, which were unanimously approved by the Board of Directors on May 3. The projects are detailed further below.



- 2015 Research Conference.** A record breaking 255 water professionals attended the 19<sup>th</sup> Annual Water Reuse and Desalination Research Conference in Huntington Beach, CA on May 4-5. Fran Spivy-Weber, State Water Resources Control Board Vice Chair, kicked off the event with her keynote address on the CA drought and state initiatives to ensure a sustainable water supply. The lunch keynote was given by George Tchobanoglous, who spoke of the momentum of DPR since his cornerstone publication ‘DPR: A Path Forward’ publication in 2011. He highlighted the DPR Framework project, which he chairs, and got the audience thinking holistically to alter conventional wastewater and drinking water practices to better support DPR. The conference included an entire track devoted to



Potable Reuse, from novel treatment to case studies. At a closing research needs panel, attendees highlighted the need for sophisticated training and certification for DPR operation, as well as the challenge resulting from the water being heavily subsidized, negatively impacting both recruiting and appropriate compensation.

- 11-02 Toolbox and Manual released.** In April, the Foundation a third early-release product out of the Treatment Train equivalency project led by Trussell Technologies. This [Excel based tool and manual](#) allows a user establish treatment goals for pathogens, trace chemicals, and total organic carbon and develop up to three advanced treatment trains for potable reuse (both direct and indirect). The tool outputs include an estimate of the treatment provided by each train relative to the treatment goals provided by the user, and planning-level cost estimates.
- Release of Economics Report.** In October 2015, the Foundation published a white paper ([WRRF 14-08](#)) by Bob Raucher and George Tchobanoglous on the economics of DPR in California. This already greatly referenced paper estimates the potential cost savings from choosing DPR over alternatives and the total volume of “new water” that could be generated from DPR in California.
- Research Reports to be available free of charge.** In its May meeting, the Board of Directors unanimously voted to make Foundation research reports free of charge. Members will benefit from a six month preview of these products, and then they will be available for all. Tools, framework/guidance manuals, and outreach pieces will be priced on a case by case basis.
- DPR Communication pieces available.** Several outreach products as recommended by the Model Communications plan (WRRF-13-02) were made available.

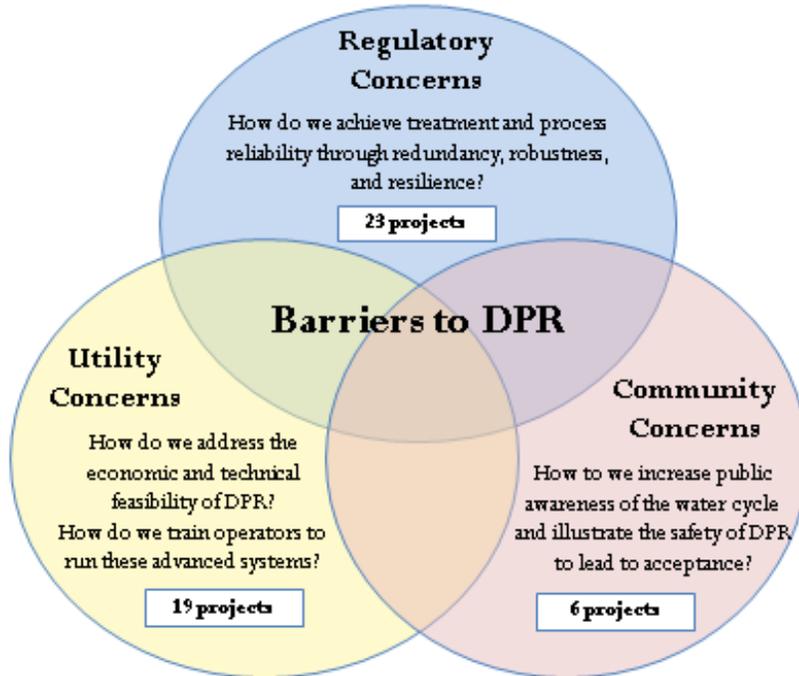


## *Upcoming Activity*

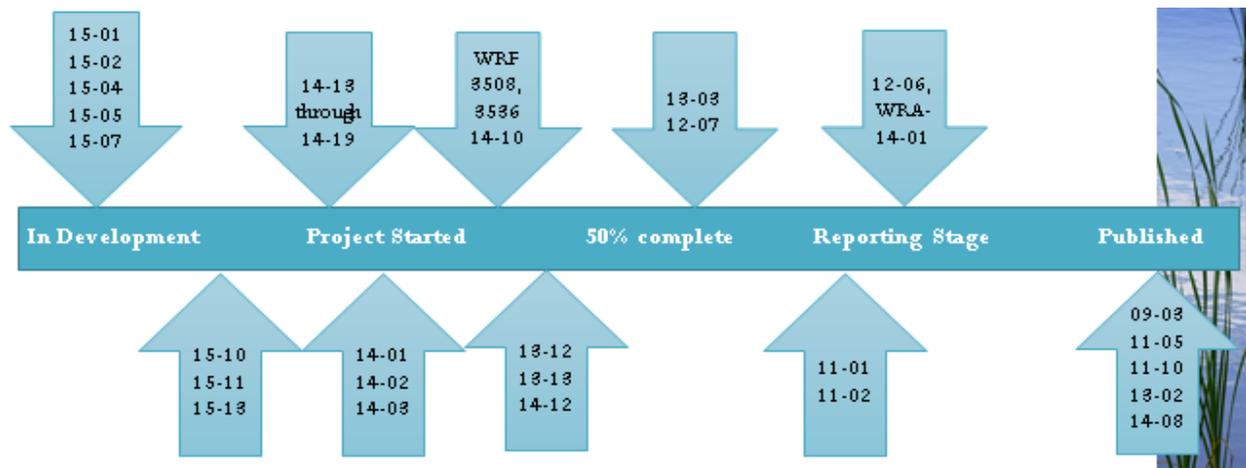
- **Showcasing DPR work at ACE15.** On June 7-10 in Anaheim, representatives from the Foundation will participate in 3 sessions.
  - *Overcoming the Hurdles of Direct Potable Reuse: A Debate on Economics, Regulations, Treatment, Operations, and Public Acceptance.* Panelists are Shane Trussell (pathogens), Andy Salveson (chemicals), Troy Walker (operation), Mark Millan (perception/acceptance), Bob Raucher (economics), and Guy Carpenter (moderator).
  - *State-led efforts for Potable Reuse Guidelines.* Panelists are Jeff Mosher (national), Andy Salveson (NM), Tim Thomure (AZ), Doug Owen (CA), Bart Weiss (FL), Ellen McDonald (TX), and Julie Minton (moderator).
  - *The Journey to DPR – Direct Potable Reuse Treatment – Technology and Drivers.* Julie Minton will participate on this panel coordinated by Hazen and Sawyer.
- **Launch of New and Improved Website.** In mid-June, WaterReuse will launch its new website. This will include newly organized and easily searchable research – past and current, and educational/outreach engagement tools and videos.
- **DPR Framework publication.** The DPR Framework project, led by NWRI and chaired by George Tchobanoglous, will be available this summer. This important work is co-funded by AWWA and WEF, and reviewed by EPA.
- **Announcement of DPR Summit in 2016.** We will soon announce the location and date of our 2016 DPR Summit, stay tuned!

## WRRF Research

WRRF has funded numerous DPR projects addressing regulatory (23), utility (19), and community (6) concerns.



Most of the work is in progress; however several reports have been published and are available now. We are striving to meet the Expert Panel’s 2016 deadline for most of the projects.



Below is a table of research themes identified by the DDW Expert Panel, and the Foundation research that is addressing these important topics.

Project #	DPR vs. alternatives, Economics	Evaluation of potential DPR trains	Demonstration of reliable, redundant treatment performance	Critical Control Points	Pathogens: surrogates, credits	Pathogens: Rapid /continuous monitoring	Failure and resiliency	Public perception and acceptance	CEC removal and risk	Operations Training, Framework	Source Control
WRRF-11-01		x	x		x	x					
WRRF-11-02		x	x		x				x		
WRRF-11-05			x								
WRRF-11-10		x	x				x				
WRRF-12-06		x	x		x	x		x			
WRRF-12-07			x								
WRRF-13-02								x			
WRRF-13-03		x	x	x	x		x				
WRRF-13-12											x
WRRF-13-13							x			x	
WRF4508*			x		x	x			x		
WRF4536*					x						
WRRF-14-01			x		x	x					
WRRF-14-02					x						
WRRF-14-03	x	x									
WRRF-14-08	x										
WRRF-14-10		x	x	x	x	x					
WRRF-14-12	x	x	x	x	x		x		x		
WRA-14-01										x	
WRRF-14-13		x	x		x		x				
WRRF-14-14									x		
WRRF-14-15									x		
WRRF-14-16		x	x	x	x	x	x			x	
WRRF-14-17			x		x	x					
WRRF-14-18					x	x					
WRRF-14-19			x						x		
WRRF-15-01	x	x	x	x	x	x	x	x	x	x	x
WRRF-15-02									x		
WRRF-15-04		x	x								
WRRF-15-05							x			x	
WRRF-15-07					x	x					
WRRF-15-10		x	x				x				
WRRF-15-11		x	x				x				
WRRF-15-13									x		

## *Project Status Summaries*

Prior to the DPR Initiative’s start, the Foundation funded 6 projects valued at \$4M, 4 of which are ongoing.

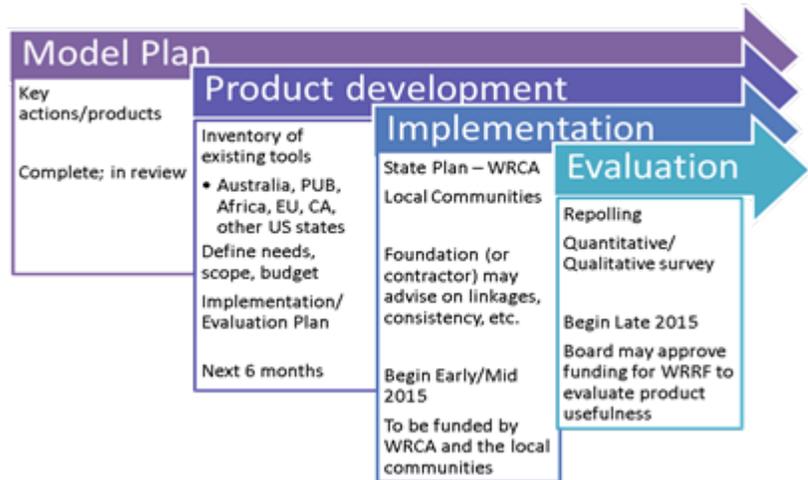
Project #	Research Project Title	Principal Investigator	Expected Publication
WRRF-11-01	Monitoring for Reliability and Process Control of Potable Reuse Applications	Ian Pepper, University of Arizona	Nov-2015
WRRF-11-02	Equivalency of Advanced Treatment Trains for Potable Reuse (early reports: <a href="#">Examining the Criteria for DPR: Potable Reuse: State of the Science Report: Treatment Train Toolbox</a> )	Rhodes Trussell, Trussell Technologies	Sep-2015
WRRF-11-05	<a href="#">Demonstrating the Benefits of Engineered DPR versus Unintentional Indirect Potable Reuse Systems</a>	Glen Boyd, The Cadmus Group Inc	published May-2014
WRRF-11-10	<a href="#">Risk Reduction Principles for DPR</a>	Andy Salveson, Carollo	published Jul-2014
WRRF-12-06	Guidelines for Engineered Storage for Direct Potable Reuse	Andy Salveson, Carollo	Jul-2015
WRRF-12-07	Methods for Integrity Testing of NF and RO Membranes	Joe Jacangelo, MWH	Apr-2016

## Projects Initiated in 2013 – funded by the DPR Initiative and the Metropolitan Water District

### **WRRF-13-02: Communication Plans Increasing Awareness and Fostering Acceptance of DPR**

The Foundation and WRCA are taking a three-phased approach to gain public acceptance of DPR in California:

1. Develop Strategic Communication Plans (state and local)
2. Develop Messaging Material and Methods
3. Implement, Evaluate and Refine Plan



As part of Phase I, focus groups and surveys were conducted mid-2014 to develop key messages critical to educational, awareness and outreach efforts. This phase has been accomplished, and the local and statewide communication plans were published in January 2015.

To kick off Phase II, the Foundation held a workshop in November to develop and refine outreach tools and informational collateral materials as outlined in the Plans. These products will be available for utilities and other groups for use with their constituents, to educate and inform, and to expand their outreach and awareness programs. Some of the materials are still being drafted (FAQs, video edits, white papers) and others are available from the Foundation (brochure, fact sheets, timeline, guidance and tips for outreach). The Foundation is also working with the Australian Water Recycling Centre of Excellence to adapt their informational videos and global map tool. These are expected to be available to our members in the fall.

### **WRRF-13-03: Critical Control Point Assessment to Quantify Robustness and Reliability of Multiple Treatment Barriers of DPR Scheme**

*Duration: December 2013 – April 2016*

The Hazen and Sawyer project team (led by Troy Walker and Ben Stanford) is well underway:

To date, the project has followed in the sequence of the HACCP process with a

#### Objectives:

1. Conduct hazard assessment for key unit operations for two or more direct potable reuse (DPR) treatment trains, including the following:
  - a. MF/UF – RO – UV/H<sub>2</sub>O<sub>2</sub> – Cl<sub>2</sub> – Engineered Storage
  - b. O<sub>3</sub> – BAC – GAC – UV – Cl<sub>2</sub> – Engineered Storage
2. Develop best design, monitoring, and operational practices by evaluating critical process control points in each of the DPR treatment trains evaluated to meet overall system robustness and reliability.
3. Develop standard design approaches and response strategies (i.e., operations plan and standard operating procedures) to mitigate upset events to strive towards ‘fail-safe’ operation of a DPR plant.

HACCP team convened and critical control points identified in a workshop for both the full advanced treatment (MF-RO-AOP-Cl<sub>2</sub>-Engineered Storage) and alternate non-RO (Ozone/BAC-GAC-UV-Cl<sub>2</sub>-Engineered Storage) treatment trains.

A Monte Carlo analysis has been conducted using data from a number of participating utilities including Orange County, Goreangab Namibia, West Basin, and Scottsdale. The project team has developed probability distribution functions for numerous data, and conducted Monte Carlo analysis to determine expected removal distribution across CCP barriers. Full-scale challenge testing was completed in February at the Scottsdale Water campus with testing conditions and analyses consistent with the procedures described in the original project proposal. Detailed results will be available shortly.

### **WRRF-13-12: Evaluation of Source Water Control Options and the Impact of Selected Strategies on DPR**

*Duration: July 2014 – June 2016*

The goals are to evaluate upstream wastewater treatment impacts (e.g. N/dN-nitrification/denitrification, industrial source control) on DPR source water quality and DPR process, and to evaluate impact of hydraulic control mechanisms (e.g. flow equalization and source water storage buffers) on influent water quality and flow variations that "stress" the DPR process.

This project kicked off in July, and the **Black & Veatch** project team (PIs Alan Rimer and Sunny Wang) is currently focused on data analysis of the utility information collected in their initial round of surveys. The format and type of data submitted varied widely among utilities, so they have requested some additional information on Advanced Purification - including pressure, turbidity, etc. This will allow them to more accurately

make comparisons between the different utilities. Data analysis is nearly complete for everything that has been received so far, and will be completed in the next progress report. The literature review will be received the second week of May, and work on the guidelines and guidance document has begun.

### **WRRF-13-13: Development of Operation and Maintenance Plan and Training and Certification Framework for DPR Systems**

*Duration: May 2014 – April 2016*

The contractor-led portion of the project officially commenced on May 5, 2014. The **Hazen and Sawyer** project team is led by Troy Walker and Ben Stanford. The project started with providing detailed reviews of both the local Californian code of regulations and certification & training requirements, respectively. This has provided a useful set of gap analyses prior to engagement directly with utilities to develop case studies on managing within the existing regulatory framework.

The objective of this project is to develop a standard operations and maintenance plan for various DPR treatment processes, including appropriate portions of the upstream secondary wastewater treatment processes providing feedwater to the DPR processes. A DPR Training and Certification framework for DPR system operators will also be developed.

A workshop has been conducted with the City of Los Angeles Bureau of Sanitation at their Terminal Island Facility to both act as a review of our recommendations on DPR regulation

and to provide valuable information as to the current operations framework, important items to consider for DPR, and operator certification and training program. The continued development of the operational framework based on review of existing IPR plans (Australia and Orange County). We have incorporated modifications to the treatment process schemes as a result of the critical control point (WRRF 13-03) project that is underway concurrently.

#### **WRF 4508: Assessment of techniques for evaluating and demonstrating safety of DPR product water**

*Duration: October 2014 – December 2016*

The objectives of this project are to evaluate known techniques/methodologies (and potentially develop new technologies) for the assessment of DPR water safety (work with public outreach group to identify key criteria by which public would evaluate safety); to evaluate the effectiveness of currently accepted and alternative treatment trains for the production of DPR water using the developed techniques; and to develop tools and methods for utilities to demonstrate water safety to the public, elected officials, etc.

This project lead by **University of Arizona and CDM Smith** is just kicking off, with one quarterly report completed, which included a draft literature review. Once minor comments from the PAC are addressed, WRF will publish the literature review as an interim deliverable on its website. The project team is planning to hold expert workshops in August to evaluate the list of methods that would be recommended for the framework being developed as a final deliverable. The draft report is scheduled for July of 2016 with the final complete by December 2016.

#### **WRF 4536: Blending Requirements for Water from DPR Treatment Facilities**

*Duration: October 2014 – August 2016*

This project lead by Andrew Salveson at **Carollo Engineers** has just completed its second quarterly report and is in the process of setting up the pilot systems. The testing plan to guide these pilots and a literature review was completed during the first quarter. Extensive PAC comments on the antibiotic resistant genes testing plan were resolved by the project team. The draft report is expected May of 2016 and the final report by August of 2016.

The objective of this project is to optimize with respect to water quality, the blending of DPR water with existing water supplies based on existing information. Phase II will conduct case studies of selected blending strategies.

## **Projects Initiated in 2014 – funded by DPR Initiative**

There were two rounds of **2014 DPR projects** approved by the Board last year. In the last quarter, one RFP was released (WRRF-14-16) and one report was published (WRRF-14-18). Twelve Tailored Collaboration or contracted projects are underway (WRRF-14-01, 02, 03, 04, 05, 06, 07, 09, 10, 11, 12, WRA-14-01), and 14 projects have RFPs in development.

### **WRRF-14-01: Integrated Management of Sensor Data for Real Time Decision Making and Response**

*Duration: May 2015 – November 2017*

The objectives of this project are to develop an operations support tool that integrates sensors within the treatment process for immediate feedback/alerts. Existing sensors will be integrated into an early warning system for a Direct Potable Reuse (DPR) treatment process. This will provide a real time sensor network for tracking system performance and key quality parameters using a tool for early detection of system anomalies prior to any compromise in water quality.

An award for this project was made in April 2015 to **Black and Veatch** with a team lead by Jeff Neeman. A contract has been signed and work will begin in May.

### **WRRF-14-02: Establishing additional log reduction credits for WWTPs**

*Duration: May 2015 – April 2018*

The objectives are as follows:

- Obtain more accurate picture of the microbial treatment requirements by addressing the major source of uncertainty—the concentration of pathogens in raw wastewater and secondary effluent.
- Establish if there is any correlation between the number of pathogens in raw wastewater and secondary effluent.
- Establish removal credit for biological treatment provided (e.g., activated sludge) for protozoa, bacteria, and viruses.
- Determine validity of pathogen log-removal requirements identified by CA for potable reuse projects.

An award for this project was made in April 2015 to American Water with PI Zia Bukhari. The project officially kicked off on May 1.

### **WRRF-14-03: Methodology for a comprehensive (fiscal/triple bottom line) analysis of alternative water supply projects compared to DPR**

*Duration: January 2015 – December 2016*

The objective of this project is to develop and demonstrate an assessment method (spreadsheet, database, or other) to provide information to decision makers in considering the full economic, social, and environmental impacts of a DPR water supply versus other alternative supplies.

An award for this project was made in January 2015 to **Hazen and Sawyer** with a team lead by Ben Stanford along with the University of New South Wales. Work on this project began with

a workshop in Australia to develop the economic, environmental, and social criteria that will be used to evaluate different water supply options. The different types of water supply options that will be compared to DPR were also outlined.

**WRRF-14-08: The Opportunities and Economics of Direct Potable Reuse**

The objective of this project is to determine how much DPR will cost in comparison to other sources of water. In addition, this project also looks at the amount of water in California that is potentially available for potable reuse.

*Duration: April 2014 – November 2014*

This project began in April and was conducted by **Bob Raucher of Stratus Consulting** and **George Tchobanoglous**. The result of this project was a [White Paper](#) in which DPR is described and compared – in terms of cost,

technical feasibility, reliability, energy requirements, carbon footprint, and potential yields – to other water supply alternatives. Case study information is also provided, to indicate typical “complete advanced treatment” process flow diagrams and indicate costs and site-specific factors in field applications at the municipal utility scale. This white paper was completed and is available on our website.

**WRA-14-01: Developing a Direct Potable Reuse Framework**

*Duration: April 2014 – July 2015*

This project is being conducted through an Expert Panel facilitated by Jeff Mosher at the **National Water Research Institute**. To date, three expert panel meetings have been held in Orange County, CA and an additional meeting was held in Washington,

The objective of this project is to develop a framework focusing on issues such as public health protection, sufficient multiple barriers, risk assessment, water quality monitoring, and operation management that states can use to develop guidelines for Direct Potable Reuse.

DC with members of the Project Advisory Committee and officials with EPA. This framework for direct potable reuse will focus on issues such as public health protection, sufficient multiple barriers, risk assessment, water quality monitoring, and operation management. A draft report has been completed and is currently under revision with a final report expected to be released later in the year.

**WRRF-14-10: Enhanced Pathogen and Pollutant Monitoring of the Colorado Water Municipal Water District Raw Water Production Facility at Big Spring, Texas****Objectives:**

- To expand the project scope and statistical accuracy of the state-of-the-art sampling campaign for the DPR plant at Big Spring, including trace chemical analyses for pharmaceuticals, hormones, and other compounds of interest, a full suite of pathogens (virus, protozoa, and bacteria), and a comprehensive set of both chemical and microbial indicators and surrogates.
- This large data set will enable the creation of a comprehensive, technically sound, and independent verification that potable reuse, as implemented at Big Spring and proposed by others, can be a safe and reliable source of high-quality drinking water.

*Duration: August 2014 – November 2016*

This project, led by Eva Steinle-Darling at **Carollo Engineers**, began in August. The project will provide an evaluation of the current treatment process and develop a testing protocol (part of the TWDB funded project).

The project team has completed two out of four total sampling events, one in July 2014, and one in February 2015. The funding from WRRF has been used to support this sampling effort by adding samples (both additional analyses and limited additional sampling locations) to the original

scope. Results from these two sampling events have been analyzed in part and will be completed in the next progress report.

**WRRF-14-12: Demonstrating Redundancy and Monitoring to Achieve Reliable Potable Reuse**

*Duration: September 2014 – November 2016*

This project will develop and examine a conceptual framework for a DPR facility for the Department of Drinking Water (DDW) and Expert Panel at the City of San Diego’s newly upgraded Advanced Water Purification Demonstration Facility (AWPF). This conceptual framework will address issues beyond the treatment plant, such as source control, required operator training and certification, product water delivery and mixing strategies/requirements, as well as a plan to provide an alternative potable water supply in emergency scenarios and to ensure that extreme events do not compromise public health.

A main initial deliverable of this seminal project lead by **Trussell Technologies** is a comprehensive test plan for DPR, which was developed by an Independent Advisory Committee. It was recently approved by the PAC and other stakeholders and is being implemented at San Diego’s Advanced Water Purification Demonstration Facility DPR Demonstration beginning April 1, in operation for 52 weeks.



WRRF-14-12 Project workshop: Trussell team, panel and PAC members gathering at San Diego’s AWPF on December 10.

**WRRF-14-13: From Collection System to Tap: Resiliency of Treatment Processes for Direct Potable Reuse**

The RFP for this project was released on April 16<sup>th</sup>, and proposals are due on May 28<sup>th</sup>.

The objectives of this project are to assess the resiliency of unit treatment processes while mapping the interdependency of these processes to trace failures and impacts. Both potential acute and chronic impacts affecting performance reliability will be identified including water quality and production capacity along with public health

A design guide will be developed incorporating information from the wastewater source, wastewater treatment, and advanced water treatment assessments including the most practical design features, control systems, maintenance programs, and standard operating procedures.

### **WRRF-14-14: White Paper on the Feasibility of Establishing a Framework for Public Health Monitoring**

The objectives of this project are to determine the feasibility of acquiring specific kind of health data required to address the health issues adequately with implementation of DPR; to aid in the planning the means and methods used in collecting the required data; and to recommend on necessary action to move the framework towards implementation.

The project Request for Proposals is currently being refined by the PAC for release in May/June 2015.

### **WRRF-14-15: Application of Bioanalytical Tools for a Comparative Assessment of Water Sources for DPR**

Water Reuse Research Foundation is soliciting research to evaluate applicability of current bioanalytical tools for monitoring of source waters for direct potable reuse (DPR) as well as indirect potable reuse (IPR) projects.

The project Request for Proposals is currently being refined by the PAC for release in May/June 2015.

### **WRRF-14-16: Operational, Monitoring, and Response Data from Unit Processes in Full-Scale Water Treatment, IPR, and DPR**

Proposals for this project were received on March 19<sup>th</sup> and an award is expected shortly.

The objectives of this project are to assess the failure mechanisms of potential DPR processes that could impact water quality/health risk and the range of times to a failure event associated with specific unit processes. Qualitative operational information will be obtained regarding failure or anomalous events to better understand failures. Recommendations for improving operational and response procedures will be developed along with potential regulations

### **WRRF-14-17: White Paper on the Application of Molecular Methods for Pathogens for Potable Reuse**

Develop a white paper assessing the application and need for using molecular methods for detecting pathogens in evaluating water quality in potable reuse facilities. The white paper will assess the potential applications as well as limitations and challenges to implementation in a purified water matrix.

The project Request for Proposals is currently being refined by the PAC for release in May 2015.

**WRRF-14-18: Ensuring Stable Microbial Water Quality in Direct Potable Reuse Distribution Systems**

Determine if DPR presents unique risks to the stability of the DWDS microbiome due to differences in the seed organisms, the type of organic carbon and other nutrients, and the effect of blending different water types.

This workshop is currently being planned in conjunction with the PAC for fall 2015.

**WRRF-14-19: Predicting RO Removal of Toxicologically Relevant Unique Organics**

Proposals were received on April 21<sup>st</sup> and are currently under evaluation; an award is expected in the next weeks.

The objectives of this project are to predict removal efficiency of compounds identified by state or federal regulatory agencies of potential public health concern by reverse osmosis (RO), and predict removal of compounds that may be precursors of disinfection byproducts (DBPs) of potential health concern.

**Projects Initiated in 2015 – funded by DPR Initiative**

On May 3, the Board of Directors approved 5 new solicited DPR projects. The Foundation welcomes participation on these new projects through utility support or peer review. RFPs can be expected in late 2015/early 2016. Please contact [Julie Minton](#) or the project manager if you would like to [apply](#) to serve on the PAC or if your utility would like to participate on the project (e.g. provide in-kind support). Also represented in the table below are the Tailored Collaboration DPR projects approved by the Board at the same meeting.

**DPR Research approved for funding May 2015**

Project #	Research Project Title	WRRF contribution	Project Manager	Research Focus	Objectives
WRRF-15-01	DPR Research Compilation: Synthesis of Findings from DPR Initiative Projects	\$75,000	Julie Minton	Regulatory, Utility, Community	The project will summarize the results of related projects and communicate the immediate and potential implications of potable water reuse. It will be presented to the DDW Expert Panel as part of the Foundation's ongoing efforts to provide relevant research findings.
WRRF-15-02	Creating a Roadmap for Bioassay Implementation in Reuse Waters: A cross disciplinary workshop	\$75,000	Stefani McGregor	Regulatory	To engage experts that have focused on bioassays in a variety of applications and matrixes (cosmetic, pharmaceutical, oil/gas industry). Engage federal government regulators that have integrated bioassays into risk assessment and identify lessons learned and best practices from previous studies
WRRF-15-04	Characterization and Treatability of TOC from DPR Processes Compared to Surface Water Supplies	\$350,000	Kristan Cwalina	Regulatory	To develop framework for determination of site-specific TOC guidelines for utilities considering alternative treatment for potable reuse and determine the range of acceptable TOC concentrations and characteristics from alternative advanced water treatment approaches on potable water reuse projects
WRRF-15-05	Developing Curriculum and Content for DPR Operator Training	\$100,000	Justin Mattingly	Utility	This project will build upon training and certification framework developed in WRRF-13-13 to create curriculum and content for operator training program in DPR. Content or a content framework will be developed that can be used by universities and colleges to become a part of their undergraduate training programs
WRRF-15-07	Molecular Methods for Measuring Pathogen Viability/Infectivity	\$350,000	Stefani McGregor	Regulatory	Improve sensitivity, reduce analysis turnaround time and reduce cost of measuring pathogens in sewage, treated wastewater and reuse water including IPR and DPR produce water. Ultimately use methods developed in project to replace measurement using viability/infectivity assays, with a specific focus on validating treatment performance and providing starting microbial concentrations for QMRA.
WRRF-15-10	Optimization of ozone-BAC treatment processes for potable reuse applications (PI: Zia Bukhari, American Water)	\$120,000	Stefani McGregor	Utility	To Establish baseline relationships between ozone-BAC effluent TOC levels and disinfection byproducts (DBPs) and/or their formation potential; To conduct pilot scale testing to optimize BAC design variables to maximize nitrosamines (e.g., NDMA) and emerging contaminants (especially flame retardant) removal; To Develop a comprehensive guidance manual for BAC system operators and regulators

WRRF-15-11	Demonstration of High Quality Drinking Water Production Using Multi-Stage Ozone-Biological Filtration (BAF): A Comparison of DPR with Existing IPR Practice (PIs Dr. Kati Bell, CDM Smith & Denise Funk, Gwinnett County)	\$100,000	Justin Mattingly	Utility	To Evaluate DPR with a two-stage ozone-BAF as a cost-effective method for providing drinking water.
WRRF-15-13	NDMA Precursor Control Strategies for DPR (PI Roshanak Aflaki, LASAN)	\$120,000	Stefani McGregor	Utility	To investigate the fate and transport of <i>N-nitrosodimethylamine</i> (NDMA) precursors (e.g. organic nitrogen compounds) through secondary treatment and potential direct potable reuse (DPR) treatment trains and to develop control strategies to optimize removal of NDMA precursors and minimize NDMA formation.