RECLAMATION

Managing Water in the West

RESEARCH AND DEVELOPMENT OFFICE
FY 2018 HIGHLIGHTS

U.S. Department of the Interior
Bureau of Reclamation

RECLAMATION'S RESEARCH & DEVELOPMENT OFFICE

The Research and Development Office (R&D) applies technology and science to advance the agency's mission to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public. R&D's two programs, Desalination and Water Purification Research and Science and Technology address the technical obstacles related to our mission. Learn more at: https://www.usbr.gov/research.

DESALINATION & WATER PURIFICATION RESEARCH (DWPR)

Reclamation's DWPR Program seeks to reduce the cost, energy consumption, and environmental impacts of using desalination and other water purification technologies to develop water supplies from otherwise unusable sources (e.g., brackish groundwater, sea water, produced water from oil and gas extraction, municipal wastewater).

These are the challenges and solutions proposed by FY 2018 funded projects:

Challenges being addressed:

- cost-effective selenium removal
- reduce energy impact
- innovative cost-effective new treatment systems
- concentrate management

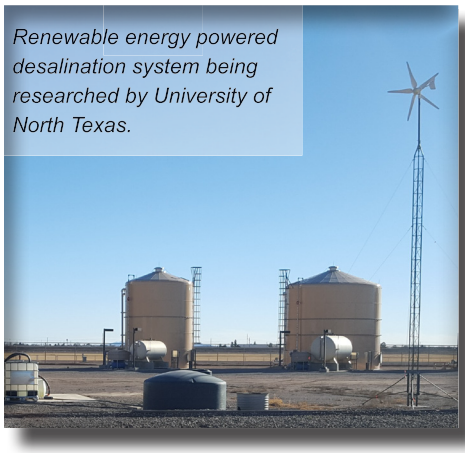
Solutions proposed:

- Biotreatment systems for selenium removal at reduced cost from current treatment systems
- Portable wind turbine powered electrodialysis treatment
- Biocatalytic membranes
- Advancements in capacitive deionization treatment technology

DWPR Projects

FY 2018 By the Numbers

- ***73 Applications***
- ***16 Awarded Grants***
- ***$3.5M Federal Funding***
- ***$4.8M non-Federal Match***



Renewable energy powered desalination system being researched by University of North Texas.

BRACKISH GROUNDWATER NATIONAL DESALINATION RESEARCH FACILITY (BGNDRF)

The DWPR program funds the operation and maintenance of BGNDRF, located in Alamogordo, New Mexico, a focal point for developing technologies for the desalination of brackish and impaired groundwater found in the inland states. The facility supports piloting to full-scale testing of desalination and water purification technologies.

BGNDRF brings together researchers from Federal government agencies, universities, the private sector, research organizations, and state and local agencies to work collaboratively and in partnership.

Since 2017, the facility has operated at full client capacity.

Salt tolerant plants growing at the agricultural plots for concentrate management studies by New Mexico State University.

New brackish water reverse osmosis membranes being tested by LG Chem.

SCIENCE & TECHNOLOGY (S&T)

The S&T program funds innovative development, applied and demonstration research addressing the full range of technical issues confronting Reclamation water and power managers, customers, and stakeholders. Program research is funded in five areas:

- Water Infrastructure (WI)
- Power and Energy (PE)
- Developing New Water Supplies (WS)
- Environmental Issues in Water Delivery and Management (EN)
- Water Operations and Planning (WP)

For the projects highlighted below, "ROI" is estimated as the return on investment reflecting non-federal cost share to-date and estimated benefits during conservative level of adoption.

Synthetic Sheet Piles to Improve Canal Safety (WI)

Problem
Canal seepage and failure

Solution
New sheet pile material

Impact
Improved canal safety
Reduced rodent burrows

Cost: $403,215
ROI: 6.7

S&T Projects FY 2018 By the Numbers

- *186 Active Projects*
- *47 Completed Projects*
- *$5.3M Federal Funding*
- *$5.2M non-Federal Match*

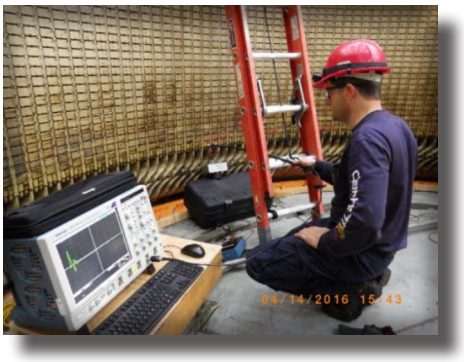
Partial Discharge Attenuation Research (PE)

Problem
Detecting abnormal conditions for large rotating machines

Solution
Development of better partial discharge monitoring equipment

Impact
Reduced maintenance costs
Increased power production

Cost: $100,000
ROI: 6.9



Economic Analysis of Reservoir Sedimentation (EN)

Problem
Economic impacts from reduced reservoir storage capacity from sedimentation

Solution
Economic sediment removal model

Impact
Demonstrating economic feasibility of mechanical sediment removal
Increased reservoir storage capacity

Cost: $315,000
ROI: 8.9

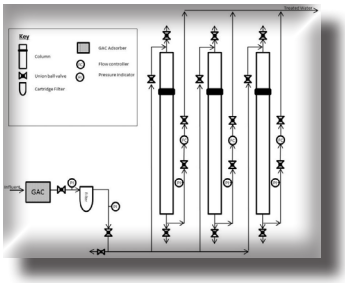
Nanofiltration to Improve Process Efficiency of Hexavalent Chromium Treatment Using Ion Exchange (WS)

Problem
Treatment of waste stream Ion Exchange technology

Solution
Nanofiltration process to remove hexavalent chromium from waste stream

Impact
Augment water supply by treating waste stream and increasing recovery

Cost: $208,805
ROI: 5.7



Runoff Efficiency and Seasonal Streamflow Predictability in the U.S. Southwest (WP)

Problem
Water supply forecast skill limits water management potential

Solution
Add emergent seasonal temperature forecasts into water supply forecast models

Impact
Improved forecast skill
Improved estimates of water availability
Potential for additional agricultural acreage production

Cost: $135,000
ROI: 12.2

S&T TECHNOLOGY TRANSFER

The S&T Program pursues a variety of joint venture research partnership agreements by leveraging Technology Transfer (TT) with the private sector.

This includes Cooperative Research and Development Agreements (CRADA), Materials Transfer Agreements (MTA), and Facility Use Service Agreements (FUSA), among others, where industry plays a role in maturing and transforming research results into usable, manufactured products that can be supplied to Reclamation and the broader water management community.

TT Activity Summary FY 2018 By the Numbers

- *3 CRADAS*
- *9 MTAs*
- *8 Active Patents with*
- *4 License Agreements*

Cavitation Monitoring CRADA with GE

- Reduced outage frequency and duration
- Longer equipment lifetimes
- General Electric and Bonneville Power Administration contributed nearly $1 million, combined

Hydro-kenetic Power Generation in Canals CRADA with Denver Water

- Quantify energy potential in canals
- Identify potential impacts from installations
- Denver Water contributed $356,000

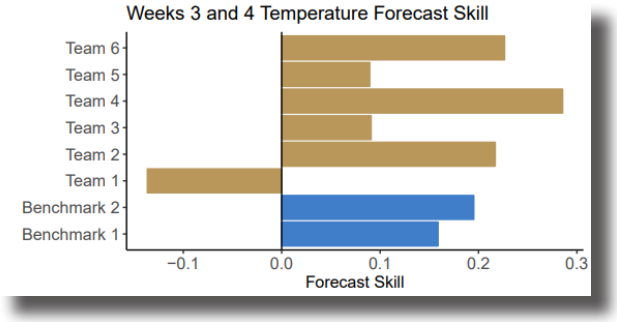
S&T PRIZE COMPETITIONS

Reclamation continues to use prize competitions to harness the innovative capacity of the American public and private sectors to solve problems related to Reclamation's mission and stakeholder interests.

Prize competitions complement traditional research by providing another tool to help find breakthroughs or overcome technical obstacles and complexities. Reclamation is working with prize winners to further develop solutions received from competitions completed in FY 2018 that are related to detection of leaks in pipes, eradication of mussels, and data visualization.

Prize Activity Summary FY 2018 By the Numbers

- *6 Launched*
- *4 Completed*
- *184 Solutions Received*
- *25 Solutions Paid*
- *$760,000 Awarded*



Sub-Seasonal Climate Forecast Rodeo

- Improve precipitation and temperature forecasts at 15 to 42 day lead times
- 13-month competition period with multiple submission requirements aimed to beat benchmark operational forecasts
- Three anticipated winning teams with $525,000 in prize money to be awarded in FY 2019

Eradication of Invasive Mussels in Open Water ~ 3 Winning Solutions

- Genomic modification: Cells transmit lethal cancer specifically within the quagga and zebra mussel species (Next Steps initiated)
- DNA/RNA Aptamers: Bind to quagga and zebra mussel foot proteins interrupting adhesion to prevent mussel establishment
- Genomic modification: Light induced switch disrupting growth in developing quagga and zebra mussels