

RECLAMATION

Managing Water in the West

Fiscal Year 2017

Science and Technology New Research Awards



U.S. Department of the Interior
Bureau of Reclamation

October 5, 2016

Advanced Water Treatment

Project ID	Title	Project Description	Project Lead	Organization	Scoping or Conducting	Recommended FY17 Award	Total Estimated Cost Share	Reclamation Cost Share	Federal Cost Share	Non-Federal Cost Share
1744	Antibiotic Resistance Bacteria in Reused Water	The presence of antibiotic resistance genes in reused water is of concern because bacteria are able to incorporate these genes and acquire resistance to antibiotics. The creation of multi-drug resistant bacteria is of great concern because of the potential for human, animal, and plant impacts. This project has two goals. First, a literature review of the issue of drug resistant bacteria and water reuse. Second, to select several resistance genes and survey Reclamation waters for their presence. As the number of drug resistant bacteria continue to grow this will be an issue that affects every water user.	Jacque Keele	TSC	Conducting	\$61,000	\$0	\$0	\$0	\$0
1757	Quantifying the Cost of Water Treatment	This is a scoping study to lay the foundation for a new water treatment cost estimating tool for water treatment plants to be developed in future years. There is a need to be able to accurately and consistently show the cost of water treatment and the potential cost savings from treatment system changes proposed in research projects. Reclamation's current cost model will be the starting point for the development of a new cost model. Since this work needs significant planning to develop a strategy and estimate cost for the model development, a scoping study is proposed. There is also the question of what costs should be included in the cost model and whether this should be standardized across the water treatment industry.	Steve Dundorf	TSC	Scoping	\$25,000	\$0	\$0	\$0	\$0
1769	Research to identify how to improve existing desalination approaches to reduce primary energy use	Energy is one of the largest annual costs in the desalination process, therefore the need for research to improve the energy efficiency of desalination technologies has been funded for decades. There is no one method being used overall to measure this energy consumption and/or calculate the true cost of desalination. This project will focus on identifying what has been done in improving energy efficiency, the research and advancements already made in this area, the potential of renewable energy coupling with desalination technologies, and capture in one location the data obtained.	Yuliana Porras-Mendoza	RO	Conducting	\$33,000	\$100,000	\$0	\$100,000	\$0
1780	Determining ts of Long Term Use of RO Concentrate on Atriplex Species, Soil characteristics and Microbial Habitats	This research will evaluate and determine if dry land applications of RO concentrate can be managed with native halophytes for economic and environmental benefits. Working with NMSU and BGDRF, with preliminary data collected by ASU, this study will further evaluate soil impacts and native plant quality for cattle feed. This research has rancher support and benefits Reclamation by determining viable alternatives for concentrate discharge.	Denise Hosler	TSC	Conducting	\$50,000	\$287,500	\$50,000	\$5,000	\$232,500
1785	Investigating Biochar as a Water Treatment Filtration Media for Adsorption and Biological Reduction of Dissolved Metals and Fluoride	As climate change and drought continue to negatively impact freshwater availability and quality in the western US, impaired water sources are becoming more attractive to supplement existing freshwater supplies. However, these water sources can be expensive to treat, highlighting the need for more economical forms of treatment. Biochar is gaining attention as a less expensive and more sustainable alternative to granular activated carbon (GAC) for use as an adsorbent and biological filtration (biofilter) media. This project will focus on three case studies in the Mid-Pacific and Great Plains Regions and the use of biochar for the treatment of waters within these Regions contaminated by selenium, metals, and fluoride. Partners include Reclamation Regional Offices.	Anthony Kennedy	TSC	Conducting	\$62,540	\$11,000	\$10,000	\$0	\$1,000
1790	Water Quality Impacts in the Animas and San Juan River Basins: Literature Search, Sampling Plan and Program	The San Juan River is the source water for a planned 40 million gallon per day (MGD) San Juan Lateral water treatment plant (WTP), which will provide potable water to residents of the Navajo and Jicarilla-Apache Nations and City of Gallup. Currently, many communities haul water to meet domestic needs. A recent water quality study completed by Reclamation in response to the August 2015 Gold King Mine Spill highlighted the significant impact that acid mine and acid rock drainage can have on heavy metals concentrations in both the solid (sediment) and liquid phases of the San Juan River near the proposed San Juan Lateral WTP raw water intake. A key finding of this study was that water quality in the San Juan River exhibits large fluctuations, especially in total and dissolved metal concentrations, that are associated with changes in river flow. These highly variable water quality conditions in the San Juan River are a key consideration for the design and operation of the WTP and warrant further investigation. This study would design and implement a sampling campaign to better understand the fluctuations in water quality and develop recommendations for anticipating and managing fluctuations in suspended solids and dissolved metals.	Julie Korak	TSC	Conducting	\$111,556	\$823,228	\$823,228	\$0	\$0
7100	Evaluation of Approaches to Determine Mixing and Assimilation of Reuse Effluent	This research investigates the best modeling approach to simulate mixing and assimilation of reuse effluent, given a wide range of site specific reservoir conditions and a wide range of available modeling approaches. As each respective agency typically has a specific modeling approach and specific needs, this research seeks to support reservoir operational decision making regarding mixing of reuse effluent. Specifically, the research will provide guidelines for hydrodynamic modeling of reuse effluent over a wide geographic area, therefore providing the user the ability to locate intakes based on decisions related to existing and proposed raw water intake locations based on the results of simulated reuse water quality. As such, the research results will include "how to" guidelines; for example, the results will provide direction on how to design a hydrodynamic model mesh in and around effluent discharge points, and in the vicinity of raw water intakes, and will recommend which hydrodynamic models works best for a given reservoir. Model recommendations will take into consideration how near-field (water quality) versus far field (reservoir) models interface, integrating water quality and reservoir hydrodynamic modeling.	Doug Blatchford	LC	Conducting	\$98,500	\$111,928	\$10,000	\$5,000	\$96,928
7106	Refining Interpretation Techniques for Determining Brackish Aquifer Water Quality	This project will define specific research areas required to support geophysical log interpretation for water quality in brackish aquifers. The project will build on the state of practice and methods outlined in the previous scoping level effort by delineating the confounding factors identified by that work and presenting research topics to resolve those factors. This work will be a collaborative effort supported and enhanced by key stakeholders identified in the scoping level effort, including the USGS, Texas Water Development Board, Brackish Water Work Group, and other state and federal agencies. The report produced by this project is intended to supplement the Reclamation S&T Advanced Water Treatment Roadmap and to aid stakeholders in securing funding for and directing future research efforts.	Bethany Jackson	TSC	Conducting	\$70,000	\$1,686,446	\$0	\$0	\$1,686,446

Climate Change and Variability

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1736	Paleoflood Hydrology of the Colorado River System: Implication for Climate Changes	This project seeks to develop a history of extreme paleofloods for the Upper Colorado River basin. The research will use the techniques of paleoflood hydrology, including stratigraphic data collection, hydraulic modeling, geochronology and flood frequency analysis to develop new understanding of the extreme flood history of the Upper Colorado River basin. This information can be used to improve flood hazard assessment and long term water planning for Reclamation dams and reservoirs. Partners include the Bureau of Reclamation Dam Safety Program, University of Arizona, U.S. Geological Survey and Bureau of Land Management.	Jeanne Godaire	TSC	Conducting	\$109,348	\$154,500	\$82,000	\$47,500	\$25,000
1751	Impacts of Grade Control Structure Installations on Hydrology and Sediment Transport as an Adaptive Management Strategy during Climate Change	Installation of grade control structures (GCSs) across a landscape is an ancient practice that is increasingly used by land owners and managers for restoration and ecosystem support. Anecdotal evidence and limited research show that GCS installation reduces storm peak flows, decreases sediment transport, and increases base flow. This project will collect surface water flow, soil moisture, precipitation, and sediment transport data pre- and post- installation of GCSs to assess their impacts on local water resources, downstream surface water rights, and sediment transport. Hydrology and sediment transport monitoring is necessary to assess impacts of GCS installations and to inform policy.	Deborah Tosline	LC	Conducting	\$181,460	\$83,000	\$40,000	\$15,000	\$28,000
1767	Understanding sinusoidal fluctuations in the salinity in the Colorado River below Glen Canyon Dam, 1970-2016	The salinity of the Colorado River below Glen Canyon Dam has demonstrated three long-term sinusoidal fluctuations between 1975 and 2016. Though possible causes of these 10- to 15-year salinity cycles have been hypothesized, a rigorous investigation into the variables controlling the sinusoidal salinity trend, has yet to be completed. This study will use existing total-dissolved solids and specific conductance data to examine long-term (1970 -2016) salinity trends. Sinusoidal fluctuations in salinity will be analyzed in relation to climate variables within the Upper and Lower Colorado Basins, including: drought indices, precipitation, snow pack, and temperature. Salinity fluctuations will also be examined in relation to the anthropogenic variables of reservoir elevations and reservoir releases. Existing data for the stable isotopes of oxygen and hydrogen will be used in conjunction with the existing salinity data to remove the effects of evaporation from the salinity record for the Colorado River below Glen Canyon Dam in order to understand what effect the climatic variable of evaporation controls salinity. This work will produce a better understanding of the effects of climate variables, particularly evaporation, on observed salinity fluctuations. This study is a partnership between Reclamation and the USGS.	Hong Nguyen-DeCorse	LC	Conducting	\$102,553	\$0	\$0	\$0	\$0
1771	Building capacity for addressing climate change uncertainty in Reclamation's long-term planning and decisionmaking process	Reclamation increasingly must address climate change in its long-term water resources planning activities. Standard water resources planning methods, however, may need to be augmented with new approaches to account for the significant uncertainty in future climatic and hydrologic changes. This project will (1) review the needs of Reclamation departments for refined methods for addressing climate uncertainty; (2) develop training material and case studies on new methods for decision-making under uncertainty; and (3) present workshops on these methods to select departments.	Ken Nowak	RO	Conducting	\$126,500	\$25,000	\$25,000	\$0	\$0
1774	National Water Model Assessment for Reclamation's Water Management Needs	This project will provide both a quantitative and reflective assessment of NOAA's new National Water Model (NWM), a major component of the recently launched National Water Center, for one or more basins of interest to Reclamation. The assessment will focus on a range of forecast lead times, extending from weeks to seasons. A major advance of the NWM will be to provide forecast information at high resolution in time and space compared to current official forecast guidance. This work will evaluate the skill/quality of those forecasts as well as the water management value added by the resolution enhancements. Partners include NOAA, NCAR, and Reclamation.	Ken Nowak	RO	Conducting	\$154,867	\$234,000	\$30,000	\$204,000	\$0
1782	Detecting, Interpreting, and Modeling Hydrologic Extremes to Support Flexible Water Management and Planning	Precipitation and streamflow extremes are critical parameters in Reclamation's water resources planning, due to both the management threats and opportunities that they provide, as well as their importance to ecosystems and endangered species. Given climate variability and change, Reclamation needs non-stationary tools to help it characterize these extremes, to improve its water management and planning. This research has two guiding questions: (1) How can we better detect and interpret the variability and trends of hydrologic extremes? (2) How can we incorporate this understanding into non-stationary tools that support flexible water management and improved planning? The research follows a 4-step threshold-based approach to (i) Detect variability and trends of hydrologic extremes using historical records, (ii) Interpret the variability and trends detected using weather types, (iii) Model extreme threshold exceedance characteristics using weather type information to enable non-stationary estimates, and (iv) Support operations and planning by developing a generalized framework. The approach will be developed and demonstrated in NM river basins (e.g., Rio Grande, Pecos, and Canadian), but the generalized framework will be transferable Reclamation-wide. Reclamation PI Dagmar Llewellyn will be working with NCAR scientists Dr. Erin Towler and Dr. Andreas Prein, along with Partner Ariane Pinson from the USACE.	Dagmar Llewellyn	UC	Conducting	\$75,000	\$57,991	\$20,000	\$20,000	\$17,991
1783	West-wide Climate Planning Data Viewer	West-wide Climate Planning Data Viewer (WwCPDV) addresses the need to effectively communicate climate change risks, uncertainties and the effectiveness adaptation strategies. The west-wide template for a data viewer on a web based platform can be used to present results of climate change studies to a wide range of audiences. The user interface is designed to encourage the exploration of results and access to data by individuals and to facilitate widely distributed group interactions in support of long term planning and decision making.	Micahel Tansey	MP	Scoping	\$22,000	\$10,000	\$10,000	\$0	\$0

Climate Change and Variability

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1794	Identifying Sources of Uncertainty in Flood Frequency Analysis	<p>Hydrologic hazard curves and flood hydrographs are required to evaluate risks for Reclamation infrastructure, as well as to support facility design and modification. Current modeling approaches for estimating these large floods can be time consuming, and model parameterization and calibration can be very difficult and vary widely across hydrologic regions. The purpose of this study is to better understand uncertainty in current flood frequency estimates and identify what aspects of the modeling chain have the most sensitivity. This study will rely on advanced hydrologic modeling research developed by NCAR researchers to examine the sensitivity of the modeling chain across multiple basins covering different hydrologic regions in the 17 western states.</p> <p>The primary outcome of this study will be the identification of model structures that perform well for different hydrologic regions so Reclamation can leverage these results for future studies. The final deliverable is a report as well as a tech transfer workshop with Reclamation staff to understand and apply the results.</p> <p>This work will be done in collaboration with researchers at NCAR.</p>	Amanda Stone	TSC	Conducting	\$84,419	\$0	\$0	\$0	\$0
1797	Assessing the relative contributions of hydrologic models to bias corrected future projected climate flows.	<p>Reclamation is charged with understanding how our river systems and reservoirs will be effected by climate change. To evaluate possible impacts, output from Global Climate Models (typically temperature and precipitation) is used as input to hydrologic models to determine possible future streamflows. The possible future streamflows are then fed into water management models that can be used to evaluate when and how reservoirs will fill, the amount of natural and stored water that can be used to meet irrigation and instream flow demands, and the possibility of flooding at control points. This study will evaluate the tools and methods that are used to develop the possible future streamflows to understand if the existing tools are sufficient for future studies or if additional time and funding should be invested in developing more complex or better calibrated tools. More specifically, this study will compare possible future streamflows that are generated using the new GSFlow (PRMS combined with MODFLOW) with flows generated using VIC of the Deschutes Basin. The comparison will be on bias-corrected output from both models, so the question will focus on the relative gain of using a more complex tool given that bias-correction is used on both (i.e. is there a benefit to investing considerable time and funding in developing a more complex or better calibrated hydrologic model or does the bias-correction process produce similar results, thus costing less time and funding for a study). The outcome of this study will help to guide planning for future climate studies because the answer to this question will indicate whether time and funding needs to be directed toward the hydrologic modeling step or if existing tools are sufficient. The Deschutes Basin Study and the USGS are partnering on this study. This study is leveraging existing models or models that are currently under development (i.e. no funding from this study will be directed to model development).</p>	Jennifer Johnson	PN	Conducting	\$19,000	\$0	\$0	\$0	\$0

Environmental Issues in Water Delivery and Management

Project ID	Title	Project Description	Project Lead	Organization	Scoping or Conducting	Recommended FY17 Award	Total Estimated Cost Share	Reclamation Cost Share	Federal Cost Share	Non-Federal Cost Share
1706	Development of Predictive Relationships for Sub-Grid Scale Flow Variability Within 2D Hydraulic Models for Improved Fisheries Habitat Quantification	2D hydraulic models are now commonly used by to quantify habitat availability for fisheries management on regulated rivers to support restoration of anadromous fish populations (McDonald et al., 2010; Wright et al. 2014) as well as non-anadromous species (Gillenwater et al., 2006, Krstolic et al. 2006). Although 2D hydraulic models are widely used in fisheries management, these models assign a uniform depth average velocity to a grid cell and provide no estimate of flow variability within each cell. Data collection in the field will be conducted in locations concurrent will model grid cell locations and consist of spatially distributed profiled measurements. The goal of this project is to develop predictive relationships for sub-grid scale flow variability from 2D hydraulic model grid scale variables to better predict habitat availability for fisheries management.	Robert Stewart	MP	Conducting	\$18,575	\$49,014	\$49,014	\$0	\$0
1709	FISP	The FISP standardizes sediment data collection equipment, techniques, and methods for consistent sediment data collection across the Federal agencies and anyone collecting sediment measurement data. The committee oversees the standardization of sediment data collection techniques, methods, and equipment. The FISP is actively supporting research primarily focused on surrogate sediment measurement methods using acoustic and optic means for continuous data collection as well as maintaining the capabilities of physical sediment sampling equipment.	Rob Hildale	TSC	Conducting	\$25,500	\$158,452	\$0	\$158,452	\$0
1752	Reservoir Sediment Prediction over the Western U.S.	Water resource management in the western U.S. is reliant upon aging reservoirs for critical storage and flood mitigation. One impending concern is the sediment design life of these reservoirs, which remains largely uncertain due to both practical and logistical challenges in sediment monitoring. This work aims to comprehensively estimate historical, current, and projected future sediment loading along with attendant uncertainties through the coordinated application of multiple sediment modeling approaches over the western U.S. at both US Bureau of Reclamation (Reclamation) and US Army Corps of Engineers (USACE). This framework will integrate empirical, conceptual, and process-based models (6 models in total) across all on-stream reservoirs of Reclamation and COE using the overarching 1/16 ^o Variable Infiltration Capacity model structure developed for Reclamation by Livneh et al. (2015).	Blair Greimann	TSC	Conducting	\$30,000	\$0	\$0	\$0	\$0
1754	Prediction of Reservoir Sediment Pressure Flushing	Reservoir sedimentation will increasing become a concern as Reclamation dams ages. Already there are several dams where reservoir sedimentation has become a concern. Paonia Reservoir has had difficult in meeting project deliveries because of sediment and debris blockage at its intake. There is currently an appraisal level study under way that is developing alternatives to sluice sediment through the reservoir in the hope of developing a sustainable alternative.	Blair Greimann	TSC	Conducting	\$65,000	\$0	\$0	\$0	\$0
1756	Representation of Large Wood Structures Using a Two-Dimensional Model	An understanding of the importance and need of large wood in river systems has gained significant strength in the research and applied studies of eco-hydraulics within recent history. Large wood structures are being incorporated into project designs at a more frequent rate today than ever before. Having a better understanding of the resulting hydraulics of these structures would aid in better ensuring the design of stable wood structures for various situations and longevities.	Mike Sixta	TSC	Conducting	\$40,000	\$400,000	\$350,000	\$0	\$50,000
1762	Integrating the Sedimentation and River Hydraulics model (SRH-2D) into the International River Interface Cooperative (iRIC) river simulation framework	SRH-2D is Reclamation's hydraulic and sediment transport model. The iRIC project is a collection of tools for preparing, executing, calibrating, and analyzing simulations of river hydraulics and sediment transport (http://i-ric.org/en/index.html). By incorporating SRH-2D into the iRIC modeling framework as a solver, Reclamation would gain access to iRIC's model development and analysis tools and join the iRIC community of users and developers.	D. Nathan Bradley	TSC	Scoping	\$16,000	\$5,600	\$0	\$5,600	\$0
1775	Nonnative game fish escapement from Reclamation reservoirs	Many Reclamation reservoirs have been developed as recreational fisheries by Federal, State and Tribal game and fish agencies that stock nonnative sport and game fish into Reclamation reservoirs. While the stocking of nonnative game fish into Reclamation reservoirs has occurred for many years, management of nonnative game fish escapement upstream or downstream of the reservoir has not been adequately managed nor understood.	Raymond Bark	TSC	Scoping	\$25,000	\$0	\$0	\$0	\$0
1777	Investigating feasibility of acoustic Doppler methods for monitoring suspended sediment	The focus of this scoping proposal is to address the need for more comprehensive suspended sediment monitoring by exploring the capabilities and limitations of an emerging technique for suspended-sediment surrogate monitoring using hydroacoustic technology. The use of suspended-sediment surrogate methods, such as turbidity, laser-diffraction, and acoustic methods, offer the benefits of continuous temporal monitoring, lower cost, and safer implementation than conventional hand-held methods. The benefit of developing the capability may be widespread within Reclamation; the acquired data could be used to refine computational and theoretical tools, as well as gauge the sediment-related effects of reservoir operations including sedimentation rates and downstream water quality.	Daniel Dombroski	TSC	Scoping	\$31,000	\$0	\$0	\$0	\$0

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1778	Modeling of complex sediment processes using experimental data and laboratory measurements	Sedimentation is inclusive of the processes by which clay, silt, sand, and gravel are eroded, transported, and deposited. Understanding the sedimentation process and how to manage it requires the ability to accurately predict, control, and monitor sediment transport. The development of numerical modeling tools to quantitatively simulate sediment processes is key to Reclamation's ability to understand historical events and predict the effect of future management changes on sedimentation. The challenge is underscored by the increasing priority of maintaining ecosystem function while sustaining water supply and providing flood production. The proposed research builds upon prior work at Reclamation's TSC by incorporating detailed measurements in laboratory flumes to improve ability to numerically model complex sedimentation processes such as created through the interaction with riparian vegetation. Reclamation has a unique opportunity to collaborate with researchers at MIT on a topic of mutual importance. The final model will allow more realistic simulation of sediment transport, erosion, and deposition for use in river restoration design.	Daniel Dombroski	TSC	Conducting	\$31,700	\$100,000	\$0	\$0	\$100,000
1779	Development of Software Tools for Efficient Processing of Bathymetry and Discharge Data	Bathymetric surveys are increasingly becoming an integral part of the hydraulic studies that the Bureau of Reclamation is performing for its clients on a regular basis. Detailed bathymetry data is useful in estimating zones of sediment aggradation and degradation in rivers and reservoirs (with implications to reservoir sustainability), tracking channel and bar migration, and for setup and calibration of numerical models. Reclamation needs to collect depth and velocity data in rivers for numerous habitat and sedimentation investigations. The focus of the proposed research is in implementing key improvements and functionalities that engineers in the Sedimentation and River Hydraulics group have identified in order to maximize efficiency of processing bathymetric and discharge data.	Daniel Dombroski	TSC	Conducting	\$12,000	\$0	\$0	\$0	\$0
1781	Improvement in the accuracy and speed of riparian vegetation simulation	SRH-1DV has been developed to simulate flow, sediment transport, and riparian vegetation to aid in understanding the processes and support predictions of river response, including impacts to vegetation resulting from management actions. While the 1D numerical model can cover a river reach as long as 100 miles over decades, more detailed vegetation information is desired by biologist and hydraulic engineers. The proposed research will improve the accuracy and speed of riparian vegetation simulation, and develop an improved numerical model that will be used to study vegetation response in rivers such as Trinity, Palate, Sacramento, San Joaquin, and Rio Grande.	Jianchun Victor Huang	TSC	Conducting	\$70,000	\$350,000	\$300,000	\$50,000	\$0
1792	Using beryllium-10 derived erosion rates as a proxy for reservoir sedimentation	Understanding rates of reservoir sedimentation is critical to protect our infrastructure and appropriately manage sediment. However, reservoir surveys are very expensive. This proposal seeks to compare basin-averaged erosion rates, derived from beryllium-10 (10Be) measurements in river sands, with measured rates of reservoir sedimentation. Our goal is to develop an inexpensive proxy measurement for rates reservoir sedimentation. This proposal is supported by partners at the Technical Services Center, the Upper Colorado Region, and the Pacific Northwest Region; we expect to collect measurements across all BOR regions.	Melissa Foster	TSC	Conducting	\$59,000	\$13,000	\$13,000	\$0	\$0
7113	Feasibility of in Situ, Passive Groundwater Treatment to Reduce Selenium Impacts from Reclamation Projects	This scoping study is being submitted to investigate available technologies for in situ selenium removal from groundwater and to identify locations within the Uncompahgre Project area best suited for a demonstration project. A literature review will be conducted to understand available technologies for in situ selenium removal and will include past and on going studies. Potential locations within the study area will be identified based on our understanding of groundwater gradients, hydraulic conductivities, estimated groundwater velocities, and saturated thickness of the aquifer. This information will be assessed along with groundwater-selenium-concentration data which has been collected as part of previous investigations. Results will be communicated with the Lower Gunnison Basin Selenium Management Program (SMP) in order to develop multi-agency partnerships and identify potential cost share opportunities that would help to implement a follow-up conducting proposal. Scoping level activities and results will also be documented for any other future work on this topic.	John Sottillaire	UC	Scoping	\$15,000	\$0	\$0	\$0	\$0

Infrastructure Safety and Reliability

Project ID	Title	Project Description	Project Lead	Organization	Scoping or Conducting	Recommended FY17 Award	Total Estimated Cost Share	Reclamation Cost Share	Federal Cost Share	Non-Federal Cost Share
1700	Demonstration of Synthetic Sheet Piles to Improve Canal Safety	Synthetic sheet piles are being considered as a canal safety improvement measure to address embankment flaws (i.e. animal burrows and tree root systems) and to reduce seepage losses. Synthetic sheet piles are about half the cost and more corrosion resistant as compared to steel sheet pile products. Reclamation owns over 8,000 miles of canals. Urbanization near Reclamation's canals has increased the consequences of a future canal failure. Where failures might have impacted undeveloped or agricultural lands historically, failures now have the potential to cause significant economic damages, injuries and loss of life. Each year a number of canal embankment failures or incidents occur throughout Reclamation's canal inventory and are often attributed to animal burrows and tree root systems. When inundated, these flaws provide a shortened horizontal seepage pathway through the canal embankment or foundation. Concentrated seepage along these flaws often leads to rapidly developing seepage related failures. Synthetic sheet piles are being considered by Reclamation to "cutoff" the embankment flaw seepage pathways and thereby reduce the risk of internal erosion and/or piping failures. Seepage loss from canals often occurs vertically from the invert. In most areas this downward seepage eventually encounters a less permeable foundation layer. The seepage then spreads laterally and either infiltrates into the underlying deposits (groundwater recharge) or exits at the surface downslope of the canal alignment. If the low permeability foundation layer is relatively shallow, then a sheet pile cut off wall can be used to reduce lateral seepage loss in the downslope direction. This project will evaluate synthetic sheet piles as a lateral seepage reduction measure.	Chris Ellis	TSC	Conducting	\$246,500	\$215,500	\$140,000	\$0	\$75,500
1701	Condition Assessment of Composite Pipelines	Reclamation is currently responsible for the operation and maintenance of hundreds of miles of composite pipelines, with composite materials being specified as an option for new pipelines more routinely. Implementing new technologies that enable condition assessment and acceptance inspections of these pipelines is critical to their success at Reclamation. The goal of this study is to evaluate non-destructive testing (NDT) methods for detecting and monitoring defects on fiber-reinforced polymer (FRP) composite pipelines. Partners include U.S. Army Corps of Engineers and field partners.	Atousa Plaseied	TSC	Scoping	\$20,000	\$0	\$0	\$0	\$0
1703	Investigation of corrosion inhibitors in protective coatings	Protective coatings prevent corrosion by one or a combination of three mechanisms: barrier protection, sacrificial (galvanic) protection, and corrosion inhibitive pigments. The first two mechanisms can be explained easily: Barrier coatings contain binders and pigments designed to resist the migration of the electrolyte to the substrate; sacrificial pigments corrode preferentially to steel to prevent corrosion. Corrosion inhibitors on the other hand are more complicated. In general, they function by disrupting the corrosion reaction typically through a competing reaction but the exact mechanism or reaction depends on the chemical.	Dave Tordonato	TSC	Scoping	\$25,000	\$0	\$0	\$0	\$0
1710	Investigation of fish screen cleaning by air burst and water jet systems	The primary research question is to investigate literature to determine if current guidance on fish screen cleaning systems outline conditions where air burst systems are advantageous over water jet systems (or the converse). Following that, an inventory of Reclamation facilities will be assembled to be able to allow analysis of the facilities within our organization.	Kent Walker	TSC	Scoping	\$20,000	\$10,000	\$0	\$10,000	\$0
1717	Evaluating Corrosion Protection Methods for Riveted and Bolted Construction	Maintaining aged infrastructure can be challenging, especially when structure designs included difficult to coat features, such as rivets, back-to-back plates, or skip welds. NACE SP0178 does not recommend these construction methods for immersion service. However, many Reclamation structures have these features and require occasional recoating. This research addresses procedures for a long-lasting recoating of these features. Project partners include Parker and Flatiron Powerplants.	Allen Skaja	TSC	Conducting	\$77,560	\$20,000	\$20,000	\$0	\$0
1718	Powering Cathodic Protection Systems with Alternative Energy	Reclamation plays a significant role in developing and maintaining thousands of miles of pipeline in the Western US. Just two of the current pipeline projects that are in either feasibility level analysis or design represent hundreds of miles of pipeline and nearly \$1 billion of installation cost. One method of protecting the investment in these piping systems is to provide impressed current cathodic protection (ICCP) systems. The downside of these systems is that they require electrical power, which can be prohibitively expensive to obtain in many of the rural and isolated locations where the piping systems are installed. A possible solution is to use alternative energy sources, which are generally self-contained, and would eliminate the need for an electrical utility supplied power connection. The goal of this study is to evaluate commercial alternative energy sources for ICCP systems for buried metallic pipelines. Partners will be determined as a part of this research work.	Atousa Plaseied	TSC	Scoping	\$20,000	\$0	\$0	\$0	\$0
1720	Finite Element Modeling of Corrosion of Reclamation Dam, Pipeline, and Water Storage Infrastructure	Finite Element Modeling is currently used by Reclamation for predictive assessments of infrastructure under specific defined conditions and scenarios. Corrosion considerations, effects, and properties have not yet been modeled at Reclamation and would be of great value for prediction and assessment of infrastructure performance. The goal of this research is to model corrosion behavior in Reclamation infrastructure. This will enhance predictive methods and practices.	Christine Henderson	TSC	Conducting	\$30,000	\$0	\$0	\$0	\$0
1721	Photogrammetric Water Surface and Velocity Mapping Near Complex Water Infrastructure	Water Surface elevation and surface velocities can be difficult to track, monitor and analyze because of the need to introduce invasive equipment that can affect the data results. Reclamation has many complex hydraulic structures that nearing or exceeding their design life. These structures will all eventually need repair and/or replacement. Understanding the complex water surface elevations and surface velocities will enable design engineers the necessary data to improve the structures both for structural integrity and hydraulic performance. This scoping proposal is to determine if 4D photogrammetry can be used to analyze complex water surface elevations and velocities in and around hydraulic structures. Research will begin by doing a comprehensive literature review, followed by small laboratory experiments to test any procedure/materials found. Lastly the scoping proposal will identify if the process can be utilized in at field locations.	Bryan Heiner	TSC	Scoping	\$25,000	\$0	\$0	\$0	\$0

Infrastructure Safety and Reliability

Project ID	Title	Project Description	Project Lead	Organization	Scoping or Conducting	Recommended FY17 Award	Total Estimated Cost Share	Reclamation Cost Share	Federal Cost Share	Non-Federal Cost Share
1722	Effect of Electric Fish Barriers on Corrosion and Cathodic Protection	Electric fish barrier is an effective method to control fish movement, yet allow uninhibited passage of boats and debris when used to limit or prevent fish from moving upstream. Electric barriers can be designed to prevent the passage of most types of fish into an area. While these barriers are highly effective, they do pose a number of possible safety hazards. These barriers may also cause stray current corrosion on nearby structures resulting in corrosion. The goal of this study is to examine the interaction between an electric fish barrier and cathodic protection (CP) system. Partners will help with the operation of an electric crowder and assist during a CP field study at Delta Cross Channel.	Atousa Plaseied	TSC	Conducting	\$40,000	\$20,000	\$5,000	\$0	\$15,000
1723	Literature Review of Secondary Effects to Ecosystems and Water Supply of Canal Lining	This scoping proposal will be a literature review into how the overall water supply and ecological systems are affected by seepage reduction through canal lining. This work supports the DOI FY 2014-2018 strategic plan and Reclamation's mission. The outcome will be a conducting proposal submission for FY2018.	Leah Meeks	PN	Scoping	\$13,000	\$0	\$0	\$0	\$0
1726	Design of Low-Flow Ecosystem Features for Urban Flood Control Structures	Many rivers and streams have been severely impacted during the last century by human development and urbanization. Degraded ecological conditions have resulted from alterations to watershed hydrology, sediment yield, and imposed constraints that currently limit natural channel adjustment and floodplain access. In some urban corridors, rivers have been completely channelized and lined with concrete to efficiently convey floods and minimize risk of erosion. However, channelization can severely degrade ecosystem services both for wildlife and humans. Increased low-flows in urban streams has led to opportunities for recreation and habitat features to revitalize ecosystem services. This research proposes to develop and evaluate methods that can be implemented within confined urban channels to improve ecosystem function at low flows without raising flood stage at high flows. Ecosystem function is defined as features that increase recreation opportunities and habitat variability and complexity at low flows. Conceptual alternatives will be generated and tested with a two-dimensional (2-D) numerical model. Habitat suitability and effect on flood stage will be assessed for each of the proposed ecological enhancement methods. More detailed designs will be completed for the most promising methods and tested with a laboratory physical model. The expected outcome of this study is feasible ecosystem feature design concepts and performance data at a variety of flows. We propose to develop the concepts on the Los Angeles River where there is a large group of federal, city, and local partners committed to improving the urban river corridor. Research partners include the Reclamation Southern California Area Office, Phoenix Area Office, the City of Los Angeles Mayor's Office, Council for Watershed Health, Friends of the Los Angeles River, and the Denver Urban Drainage and Flood Control District.	Nathan Holste	TSC	Conducting	\$90,248	\$43,000	\$28,000	\$0	\$15,000
1734	Robust Eco-Hydraulic 3D Modeling Tools for Rivers with Complex In-Stream Structures	In-stream features such as fish structures and large woods are widely used by Reclamation for improving river management through enhanced fish passage and habitat. Design methods or guidelines are rare for predicting their effectiveness as well as the physical response of channels to their placement. The risk and liability of these features are rarely evaluated quantitatively prior to project implementation. Many projects, however, need to learn the effectiveness, risk and liability of the placed structures for planning, design and implementation. At present, computer models have been identified as having the best potential to address the above questions. In response to the needs, Reclamation has been leading a multi-agency effort in FY 2014-2016 to develop a three-dimensional (3D) numerical model (U2RANS) (Lai et al 2016a). The work resulted in a tool that provides accurate predictions of flow around/through large wood structures which is otherwise impossible with 1D or 2D models. U2RANS has since been used for a couple of projects on the Sacramento River (Lai et al 2016b; c). A major bottleneck has since been identified in applications: the need to generate a 3D mesh. 3D meshes around complex geometries such as large wood are almost impossible to generate manually; so a semi-automatic tool was developed in the FY2014-2016 project. Despite success, it was found that the semi-automatic mesh generator works only for moderately complex problems; the method itself may fail or bad meshes are generated making the solver unstable. New novel methods are needed to overcome these issues before U2RANS can be routinely and more widely used by Reclamation engineers. This proposed research aims to build upon the previous experience and develop a novel Immersed Boundary Method (IBM) into U2RANS. IBM has been shown to have the ability to avoid the mesh generation issues and subsequently reduce solver instability (Liu 2014). IBM simulates the effect of solid boundaries with special terms added to the governing equations, not through boundary-conforming meshes. It eliminates the time-consuming and error-prone step of building body-fitted 3D meshes to represent complex geometries. IBM adopts hexahedral mesh cells which are known to reduce and even eliminate solver instability. The expected outcome of this research is that an easy-to-apply, stable, and robust 3D model (U2RANS) is available to engineers to address a wide range of eco-hydraulic issues. The end product, a new version of U2RANS with IBM capability, will be run on desktop PCs and freely available to the public. It will be modeled after the current Reclamation 2D software SRH-2D widely adopted and used in the eco-hydraulic community.	Yong Lai	TSC	Conducting	\$80,000	\$385,000	\$80,000	\$100,000	\$205,000
1743	Reducing Canal Seepage through Long-Term Performance Linings	Water is known to seep from Reclamation canals; this seepage can be characterized as one or more of the following: <input type="checkbox"/> known seepage (water loss from unlined canals), <input type="checkbox"/> increased seepage (water loss from lined canals caused by lining damage or deterioration), <input type="checkbox"/> beneficial seepage (water loss that supports wetlands, fish habitats, groundwater recharge, etc.).	Michael Walsh	TSC	Conducting	\$79,675	\$40,000	\$20,000	\$0	\$20,000
1764	Determining Critical Crack Size and Water Pressure for Sealing Water Leaks using Electro-Osmotic Pulse	Reclamation is using more non-metallic pipe, such as PVC, on many of its new pipe installations and planned installations. This is mainly due to the increased corrosion resistance, being easier to install, and technology has improved so that these non-metallic pipe options can handle much higher pressures at larger diameters. Joints located in the vicinity of directional alignment changes much be restrained but these restraints are fairly new to Reclamation projects and their longterm durability is not understood. This scoping study is designed to gather information from manufacturers and users of these restraints and investigate their performance. This study will determine if there is a need for further investigation later.	Daryl Little	TSC	Conducting	\$75,000	\$5,000	\$0	\$5,000	\$0
1765	Truckee Canal Seepage Study	This project proposes to evaluate seepage from the unlined portions of the Truckee Canal using a newly USGS-developed thermal monitoring method. Improvements to the method will include collaboration with CO School of Mines and the US Army Corp of Engineers to measure unsaturated hydraulic and thermal soil properties in the lab and in the field. By collaborating with other TSC researchers also working on Truckee Canal, additional value and future work from this project is possible by correlating the unsaturated soil properties and seepage patterns identified from this project with rapid reconnaissance geophysical methods from their research.	Bethany Jackson	TSC	Conducting	\$98,928	\$60,000	\$10,000	\$40,000	\$10,000

Infrastructure Safety and Reliability										
Project ID	Title	Project Description	Project Lead	Organization	Scoping or Conducting	Recommended FY17 Award	Total Estimated Cost Share	Reclamation Cost Share	Federal Cost Share	Non-Federal Cost Share
1784	Evaluating TRANSCEND ERC as a Viable Alternative for Carbon Neutral Cementation and Digital Fabrication	Cement production is a leading generator of CO2. TRANSCEND ERC is a new cooperative of researchers who are developing a carbon neutral cement production technology using membranes to capture the CO2 flue gases and modify it for inclusion in the cement. While aimed at the cement production industry, the technology could also be used on power generation plants using coal or natural gas to capture CO2 and then modified for inclusion in cement for concrete. The Bureau of Reclamation has been asked to participate in the cooperative. This scoping effort would be to determine if our participation would be beneficial those served by Reclamation.	Jeffrey Keim	TSC	Scoping	\$30,000	\$0	\$0	\$0	\$0
1786	Cavitation Resistance of Concrete with Varying Compressive Strengths - Scoping	Cavitation occurs in hydraulic structures as water vapor bubbles form and then collapse, creating a very high local pressure drop which can damage concrete. Reclamation has many concrete conveyance structures where geometries and elevation changes make cavitation a concern. It has long been known that both concrete strength and concrete surface tolerances affect resistance to cavitation, but little guidance or tools are available to help the designer choose both a technically adequate and economical concrete mix. This is a scoping study to identify partners and perform a literature search for the collection of past research from which a full proposal will be submitted next FY.	Katie Bartojay	TSC	Scoping	\$20,000	\$10,000	\$0	\$0	\$10,000
1787	Recycled Concrete as Aggregate for Use in New Concrete Construction	Materials can be recycled and used in concrete in order to decrease waste in landfills. Demolished concrete can be crushed and pre-treated and used as a replacement for either coarse or fine aggregate in new concrete. This recycled concrete aggregate (RCA) has been researched extensively over the past decade and has been of interest to State DOTs for pavement applications. Typically, strengths are lower and porosity is higher in RCA concrete compared to normal concrete so it typically is not used for structural applications. However, recent advances in pre-treatment methods have improved the performance of RCA and could potentially increase the range of applications.	Catherine Lucero	TSC	Scoping	\$20,500	\$0	\$0	\$0	\$0
1788	Investigating the Use of Sustainable Alternative Cementitious Materials for Reclamation Concrete Structures	The production of one ton of ordinary Portland cement (OPC) generates approximately 0.9 ton of CO2 and accounts for about 7% of all CO2 production. Fifty percent of the emissions originate from the high-temperature calcination process. This process forms the clinker, which is the coarse form of OPC before it is ground. Traditional means of reducing the carbon footprint of concrete includes substituting cement with supplementary cementitious materials (SCMs), such as fly ash and slag, which are waste products of other industries. Replacements are typically made on the order of 20-30% in structural concrete and up to 70% in mass concrete. While these SCMs reduce the carbon footprint of concrete to some degree, there are still massive amounts of OPC that are needed and produced each year. There are commercially available alternative cements, such as calcium sulfoaluminate cements (CSA) or calcium aluminate cements (CAC) that are produced with raw materials similar to OPC, but the calcination process occurs at a much lower temperature, therefore reducing the energy requirement for production of clinker. Additionally, some cementitious materials do not require clinker at all and rely on other activators such as alkalis. Examples include alkali activated slag or fly ash. There is a push for the use of Alternative Cementitious Materials (ACMs) in the concrete industry and in the Federal government with recent research yielding promising results. There is currently no Reclamation guidance for the use of ACMs in concrete. This scoping study will result in a comprehensive literature review of ACMs and provide recommendations for the appropriate use of ACM for a particular application (structural, mass, repair, etc.).	Catherine Lucero	TSC	Scoping	\$20,500	\$0	\$0	\$0	\$0
1789	Ultra-High Performance Concrete for Concrete Repair and Canal Linings	Reclamation has several concrete structures over 50 years old as well as many miles of canals. Many of these structures and canals require repairs to remain in service and to prevent seepage of water into the ground. Ultra high performance concrete (UHPC) can potentially be used in several applications to keep Reclamation structures working properly and efficiently. UHPC is a specially proportioned concrete comprised of cement, silica fume, various admixtures, a high percentage of fibers, and fine aggregate. It gains strength quickly and has an extremely dense microstructure. UHPC exhibits low permeability which makes this material resistant to most deterioration mechanisms that plague traditional normal strength concrete. UHPC requires fewer joints, (construction and contraction) due to the higher strength and lower shrinkage. This would lower the overall cost of construction for large repair sections. Also, pre-cast sections could be made offsite, then shipped and placed. The improved properties of UHPC can be taken advantage of in several applications: 1. A general repair material, especially in areas prone to abrasion erosion 2. Repair for powerplant decks or structural roof slabs 3. An overlay for an existing concrete canal with leaks or surface deterioration 4. A thin, nearly impermeable liner for unlined canals This research program will investigate the potential for UHPC to be used in various repair applications.	Catherine Lucero	TSC	Conducting	\$85,000	\$8,000	\$0	\$0	\$8,000

Infrastructure Safety and Reliability

Project ID	Title	Project Description	Project Lead	Organization	Scoping or Conducting	Recommended FY17 Award	Total Estimated Cost Share	Reclamation Cost Share	Federal Cost Share	Non-Federal Cost Share
1791	Effects of Self-Healing Concrete on Aging Concrete Structures	<p>Reclamation's aging infrastructure, along with the challenge of budget constraints, has created an opportunity to investigate concrete repair methods that will provide positive long lasting results. Currently, when repairs to critical infrastructure are performed we find that there are several challenges that affect the success of the repair activities. Specifically, those factors include the use of unskilled labor, unsatisfactory weather conditions, and limitations on sizes of repairs due to financial limitations. As a result of these factors and several others, concrete repairs can undergo a short life span due to the development of cracks. These cracks will eventually lead to the deterioration of the repair area as water or debris enter the cracks and increase its susceptibility to damage.</p> <p>Concrete cracking and unsuccessful repair projects are not limited to The Bureau of Reclamation (Reclamation) as the entire repair industry also faces this challenge. Experimentation and application of self-healing concrete technology has shown promise and the benefits include reduction in maintenance costs, increased durability, as well as the elimination of recurring repairs.</p> <p>In contrast to traditional concrete mixes, self-healing concrete can be comprised of polymer capsules within the batched concrete mix that activate when a crack opens the capsule. As water penetrates the crack it activates the polymer solution and fills the crack thereby protecting the repair area from the environment. Other self-healing concretes include the addition of bacteria to the batched concrete mix. This unique bacteria (Bacillus pasteurii, Escherichia coli, etc.) is alkali-resistant and can live in the concrete for 200 years. When a crack forms and water penetrates the repair area, the bacteria activate and produce a limestone that seals the crack.</p> <p>Following the positive results of the scoping study during FY16, and feedback from participating partners from the Great Plains Regional Office, Nebraska/Kansas Area Office, Reclamation's Denver Technical Services Center and new partners from the United States Core of Engineers there is support to acquire the self-healing concrete ingredients and conduct field testing.</p> <p>After acquiring the self-healing concrete ingredients testing will take place in-house at the Reclamation Materials Engineering Research Laboratory to investigate and document the compressive and tensile strength of the material. Field testing will then be conducted in conjunction with the Nebraska/Kansas Area Office at a specified location. The concrete repair panel(s) will be monitored and evaluated during the seasonal changes and results of this study will be presented to Reclamation, participating partners, and outside interest.</p>	Miguel Hernandez	TSC	Conducting	\$59,631	\$0	\$0	\$0	\$0
1793	Long Term Durability of Mechanical Joint Restraints used on Non-Metallic Pipe	<p>Reclamation is using more non-metallic pipe, such as PVC, on many of its new pipe installations and planned installations. This is mainly due to the increased corrosion resistance, being easier to install, and technology has improved so that these non-metallic pipe options can handle much higher pressures at larger diameters. Joints located in the vicinity of directional alignment changes much be restrained but these restraints are fairly new to Reclamation projects and their longterm durability is not understood. This scoping study is designed to gather information from manufacturers and users of these restraints and investigate their performance. This study will determine if there is a need for further investigation later.</p>	Daryl Little	TSC	Scoping	\$25,000	\$0	\$0	\$0	\$0
1795	Evaluating Fiber Reinforced Concrete for Use in Canal Construction and Canal Repairs	<p>Reclamation's inventory of concrete canals has been in service for decades and is in need of repair or replacement. These canals carry water for irrigation to our water district partners. The need exists to find an economical repair solution that will extend the canal service life. Fiber reinforced concrete is a viable solution for the repair or new construction of concrete canals. This research will determine if fiber reinforced concrete is a viable solution for use in canal repair and construction by providing data specific to Reclamation's design criteria for canals.</p>	Jeffrey Keim	TSC	Conducting	\$30,000	\$0	\$0	\$0	\$0
1796	Evaluation of Packaged Concrete Repair Material to Measure Variability between Batches and Packaging Facilities	<p>This research project will evaluate packaged concrete repair materials using the International Concrete Repair Institute Guideline No. 320.3R-2012 "Guideline for Inorganic Repair Material Data Sheet Protocol". The goal of the project is to determine material property variability between batch runs and manufacturing facilities. Due to some recent repair material failures in industry, there is some concern about product variability. Depending on research results and project size, we may need to specify products by manufacturing plant and batch number with corresponding testing to ensure the products meet spec.</p>	Shannon Harrell	TSC	Conducting	\$30,000	\$0	\$0	\$0	\$0
7102	Dynamic Cone Penetration Test for Liquefaction Evaluation of Grevelly Soils	<p>The objective is to assist Brigham Young University (BYU) in their research by providing drilling support from Reclamations drill crews (or others) and supporting data analysis. BYU is actively working with Chinese researchers on developing the dynamic cone penetration test correlations to Becker Hammer tests.</p> <p>Reclamation will provide drilling services and/or funding at one or more sites in the US where liquefaction has occurred and where Becker Rig Penetration and other test data are available to build on the case history data base. We are currently looking at viable sites in north central Idaho where ideal conditions for DCPT testing, exist.</p>	Mike Talbot	UC	Conducting	\$66,600	\$63,600	\$0	\$0	\$63,600

Infrastructure Safety and Reliability

Project ID	Title	Project Description	Project Lead	Organization	Scoping or Conducting	Recommended FY17 Award	Total Estimated Cost Share	Reclamation Cost Share	Federal Cost Share	Non-Federal Cost Share
7103	Development of Practical Guidelines to Achieve Compatibility in Concrete Repairs and Overlays	<p>Over the past several years, Reclamation has been conducting a series of partnered research projects aimed at improving the performance of concrete repair by focusing on the best methods for preparing the substrate concrete prior to repair. That work is largely done, and the work has been documented extensively worldwide and findings incorporated into Reclamation's new Guide to Concrete Repair (August 2015). However, one aspect of concrete repair that has not been extensively studied is concrete repair material compatibility with the existing substrate and service environment. It is a very complex issue. The old rule-of-thumb for compatibility was to replace like with like. But how do you replace old damaged concrete that has been exposed for years in a specific environment with something similar? The old rule is simply not useful.</p> <p>Practical guidelines for an engineer to follow when determining if the repair material will be durable and withstand the loads and stresses that have been imposed on the repaired or overlaid concrete have not been developed. Reclamation Report No. MERL-2014-87- Compatibility Issues in Design and Implementation of Concrete Repairs and Overlays, outlined five compatibility factors that determine if the concrete overlay or repair will be a good fit: dimensional, permeability, electrochemical, chemical, and aesthetic.</p> <p>This scoping study will focus on dimensional, permeability, and chemical compatibility as the compatibility factors that would be of most importance to Reclamation structures. The intent of this study is to work with industry leading experts in determining how we can develop guidelines and what would they look like. This study will consist of meeting with experts to develop a future research strategy which will focus on dimensional, permeability, and chemical compatibility.</p>	Shannon Harrell	TSC	Scoping	\$20,904	\$0	\$0	\$0	\$0
7104	UAS Data Collection at Reclamation Sites	<p>This research project is meant to determine the possible benefits of using UAS's to collect data for structural condition assessment and inspection, foundation and rockfall geologic mapping, and sedimentation studies at Reclamation facilities over traditional methods. The TSC has submitted an Operational Test and Evaluation Proposal (OTE) to SSLE which, once approved, paves the way for TSC owned and operated UAS's. By having the hardware available to TSC researchers, a complete economic and safety evaluation is possible.</p> <p>The research project includes procuring the airframe, gaining operation training, working with targeted project sites, developing a data collection procedure, performing and comparing the aerial data collection operation with traditional methods, evaluating and comparing the quality of the data collected and sharing the results with Reclamation and industry partners.</p>	Matthew Klein	TSC	Conducting	\$180,000	\$30,000	\$10,000	\$20,000	\$0
7108	Critical Review of PCCP at Reclamation	<p>Reclamation's inventory of prestressed concrete cylinder pipe (PCCP) has been in service for 25-60 years, with over 40 installations across all Regions totaling approximately 140 miles of pipe. It is typically found in the water industry as very large diameter, 8 to 20 feet, main and transmission pipelines. After two recent failures, the need exists to survey the history of Reclamation PCCP and the state-of-the-art of inspection, maintenance, and repair. This research will result in a critical review of PCCP infrastructure at Reclamation and provide pipeline managers with options for condition assessment of existing pipe and repair or replacement of distressed sections. This project will work in collaboration with ongoing failure investigations and an effort to inventory all of Reclamation's PCCP installations.</p>	Jessica Torrey	TSC	Conducting	\$76,000	\$30,000	\$25,000	\$0	\$5,000
7109	Explore the Feasibility of using Unmanned Aircraft Systems in managing Rockfall Hazard Areas	<p>A three year project at \$100,000/year to test the economics and practicality of using unmanned aerial systems to support management of Rock Fall Hazard areas to improve the safety of the public and Bureau of Reclamation (Reclamation) employees, the safety/reliability of BOR infrastructure and reduce cost of managing and mitigating rock fall hazards. The project will test the practicality and capability of Unmanned Aircraft Systems to accurately map rock fall hazard areas, evaluate conditions of existing rock fall protection systems (rock bolts, nets etc.), identify potential new rock fall risk areas, identify changes in rock fall hazard areas over time and have predictive capabilities for areas that have the potential to become unstable.</p>	Angela Adams	LC	Conducting	\$100,000	\$22,000	\$0	\$0	\$22,000
7110	Airborne Red, Near-IR, and Thermal-IR Multispectral Remote Sensing for Detecting Canal Seepage	<p>The purpose of this project is to conduct multispectral imaging along canals to detect seepage, thermal anomalies, and animal burrows. The method used in this study is based on the principle that (1) areas of water seepage will have a denser canopy of active, healthy vegetation relative to the surrounding area due to the increased water availability; and (2) areas of water seepage will have a relatively lower temperature during the day with less change in temperature at night. Images will be collected at the South Canal in Colorado and the Truckee Canal in Nevada during spring and fall at a spatial resolution of 0.5 - 1 meters or better.</p>	Audrey Rager	TSC	Conducting	\$99,900	\$0	\$0	\$0	\$0

Regional Director Needs

Project ID	Title	Project Description	Project Lead	Organization	Scoping or Conducting	Recommended FY17 Award	Total Estimated Cost Share	Reclamation Cost Share	Federal Cost Share	Non-Federal Cost Share
7112	Research and Development of a Watershed-Scale Model/Tool for Simulating the Effects of Wildfires on Mercury Contamination of Land and Water	According to the National Interagency Fire Center, more than eight million acres burned in the United States by wildfires in 2015. A major impact of large fires is the increase in soil erosion, which leads to increased sediment, nitrogen, phosphorus and mercury transport into streams and reservoirs during storm events. Such storm events can severely impact the drinking water quality, fish, wildlife and ecosystem health. In particular, mercury pollution from mining has been a widespread concern in California for many years. The dominant organic-Hg form, methylmercury (MeHg), is globally recognized as a threat to people and to wildlife as an agent of neurological damage and toxicity, and oxidized divalent inorganic mercury (Hg(II)) is well known to be an important precursor to MeHg. The goals of this research are (1) to better understand the impact of wildfire on Hg cycling and transport in the aquatic environment through soil erosion during the immediate post-fire period, as well as during the longer term recovery period, (2) to study the relationship between wildfire intensity and inorganic mercury species, including Hg (II), in soils, and (3) to develop a user friendly model/tool for management of Hg in fire-affected watersheds. A thorough literature review of existing mercury models, and watershed-scale hydrological, fate and transport models will be conducted, and the level of model complexity will be determined based on data availability and management requirements in typical target watersheds. The expected deliverable of this research project is a model/tool for simulating the effects of wildfires on Hg contamination of land and water. The model/tool could be a model framework that couples applicable existing models or a GIS based model/tool that integrates key functions of the existing models. This research will be led by the Bureau of Reclamation Mid-Pacific Region, other Reclamation offices, i.e., the Pacific Northwest Region and Denver Technology Service Center will also provide support to the project. The Bureau of Land Management California State Office and its National Operations Center, will contribute in-kind support to the effort. The California Department of Water Resources and United States Geological Survey will provide technical review and guidance to the project. Finally, the Yocha Dehe Wintun Nation will be approached to participate and/or receive notification of the findings of the project.	Jun Wang	MP	Conducting	\$105,000	\$88,000	\$10,000	\$78,000	\$0
1715	Research Opportunities to Treat Impaired Water Sources Associated with Reclamation Projects: A Case Study in the Great Plains Region	Using the Great Plains Region as a case study, we will develop and conduct a survey of each area and field office, as well as the regional office, to identify Project-specific needs that may be addressed through the treatment of impaired water sources for beneficial use. Results will help raise awareness of mission-critical needs while guiding future investments under programs such as Title XVI and Research & Development. Such investments include deploying Reclamation's Technical Services Center and funding targeted projects that result in faster, cheaper, or better ways of accomplishing Reclamation's mission, including the implementation of adaptive strategies that improve drought resiliency.	Collins Balcombe	GP	Conducting	\$65,000	\$0	\$0	\$0	\$0
1727	Study the use of alternative battery chemistry solutions as a replacement for currently installed lead acid batteries within power generation facilities	This is a scoping level proposal to explore the use of alternate battery chemical storage solutions in power generation facilities. Reclamation has a need for battery storage capacity in the powerhouses, currently lead acid batteries are used due to the reliability and know standards of maintenance but they are maintenance intensive and require hazardous materials. This research would look at alternate battery options, the Tesla Powerpack being one example with uses lithium ion battery technology. One or more battery technology will be evaluated in a power generation setting against a criterion of life-cycle costs, maintenance requirements, and reliability. It is expected that alternate power storage means can be found that are more environmentally friendly and produce a safer working environment while having reduced maintenance requirements and lower overall cost of ownership. During the scoping study, industry partners would be contacted as well as generation facilities within Reclamation to build a collaboration team to select and install alternate energy storage capacity.	Jeffrey Lynn	LC	Scoping	\$15,000	\$0	\$0	\$0	\$0
1753	Scoping and Research and Development of an Unmanned Remote Controlled or autonomous Watercraft (ROV) to Collect Water Samples in the River	Water sampling is required to monitor compliance with Title 2 of the Colorado River Basin Salinity Control Act of 1974. Currently field technicians must perform water sampling either by deploying a small boat that requires two employees to work safely or use an antiquated man-basket cableway system to cross the river to acquire water samples for testing. This research proposal addresses several benefits to the current methods of water sampling in a river or reservoir. The strategy for the scoping project is to perform market research on available remote operated vehicles and determine their suitability for water sampling activities. The goal of this study is to develop a remote controlled water sampling watercraft which is expected to improve safety by avoiding the need to have staff in a boat on the river or reservoir or using an antiquated cableway, serve as a replacement for the antiquated cableway system expected to be removed, reduce the number of staff required to conduct sampling from two to one, and reduce the time to collect the sample from three hours to one.	William Bruninga	LC	Scoping	\$17,360	\$100,000	\$0	\$0	\$100,000
1742	Scoping for Water Quality Import Software for Filed and Lab Data	As authorized by the 1974 Colorado River Basin Salinity Control Act, the 1948 Federal Water Pollution Control Act, and in support of the 1944 Treaty Between the United States of America and Mexico, Reclamation conducts ongoing monitoring efforts of numerous and varied water quality parameters. This information is collected and stored across varying formats, from paper records to electronic spreadsheets, and across assorted personnel in different locations and regions. The collection and preservation of this data in an existing Hydrologic Database (HDB), would provide reliability, consistency, and efficiency in maintaining water quality data, yielding improved future analysis with regard to modeling efforts for informed decision making, and supporting transparency through the Department of Interior's (DOI) Open Data Initiative. The goal of this proposal is to categorize collected data and develop a comprehensive data integration plan to HDB. Specifically, this proposal will evaluate readily available commercial software versus a custom developed product for incorporation of historical water quality data and serve as a mechanism for data entry into HDB. Partners include the UC Region and the LC Yuma Area Office. In addition, during the scoping, outreach to external sources, such as, United States water entitlement holders, including municipalities and tribal water users, and the International Boundary and Water Commission will be performed.	William Bruninga	LC	Scoping	\$15,000	\$4,800	\$3,600	\$600	\$600

Renewable Energy and Conservation

Project ID	Title	Project Description	Project Lead	Organization	Scoping or Conducting	Recommended FY17 Award	Total Estimated Cost Share	Reclamation Cost Share	Federal Cost Share	Non-Federal Cost Share
1707	Hydraulic Impacts from Hydrokinetic Installations	While hydrokinetic (HK) units have potential to generate power from water flowing in canals and rivers their impacts to the open flow hydraulics are unknown. Accurately predicting hydraulic impacts is important to address operational, safety, and environmental concerns. Previous testing and analyses were performed on Reclamation's Roza Main Canal to determine impacts from a single HK unit installed in 2013. While results were useful to show hydraulic impacts from a single unit and single design, additional information is needed to predict impacts from other HK designs and arrangements such as arrays. This study will build on previous work by measuring impacts from additional HK designs placed in series and will include physical results in an ongoing numerical modeling effort.	Josh Mortenson	TSC	Conducting	\$60,000	\$1,040,000	\$40,000	\$0	\$1,000,000
1708	Cavitation Detection - Method Development for determining Damaging vs Non-damaging Cavitation	Cavitation damage is a major cause of maintenance and repair for Reclamation Hydropower turbines. Detecting when cavitation begins to erode the metal from the turbine runner is important to establish operational guidelines but is difficult to measure even with sensitive instrumentation such as accelerometers or acoustic emission (AE) sensors. Studying both damaging and non-damaging cavitation in a controlled laboratory setting is needed to identify a difference in these cavitation conditions that can be measured and analyzed. These lab results will hopefully point out trends as the cavitation condition changes that will help further develop analytical methods that can be used to identify damaging cavitation in actual prototype turbines. This study will be conducted in collaboration with Reclamation's Power Resources Office.	Josh Mortenson	TSC	Conducting	\$84,300	\$42,150	\$42,150	\$0	\$0
1711	Feasibility of Rotor Installed Machine Corona Mapping with Patch Antennas	Corona discharge in rotating machines causes insulation system deterioration resulting in reduced lifespan. For this reason, corona probe testing, and the ability to map corona discharge throughout a rotating machine, is one of the best methods of machine health validation currently available. However, the current state of technology and procedures requires the complete removal of the machine's rotor, and test personnel to be feet away from high-voltage potentials. This all costs weeks in machine disassembly, with increased risk to personnel safety as well as potential maintenance induced failures. Moreover, rotor removal is a rare occurrence on most machines, meaning corona probe testing does not happen as frequently as it should, potentially catching problems too late to cost effectively remedy before the next major overhaul. We would therefore like to study the feasibility of using patch antennas to map corona with the rotor still installed. If feasible, we would like to launch a 3 year research project that will implement these methods and technologies in the field. Rotor installed corona mapping would allow for more frequent corona testing, generating a much more complete picture of machine health as problems arise, rather than after they have multiplied. Personnel safety would be greatly increased, as proximity exposure to high-voltage potentials would be eliminated. This research may also result in massive monetary savings in reduced outages, and possible life extensions, as well as potential future technology transfers and patents.	Jacob Lapenna	TSC	Scoping	\$28,772	\$0	\$0	\$0	\$0
1719	Machine Condition Monitoring	Reclamation has developed a machine condition monitoring (MCM) system that utilizes in-house written software and commercially available hardware. The system is installed or in the process of being installed to monitor 40 Reclamation generators. As the use and variety of applications increase the system hardware and software must be updated to meet new demands. A newer version of the software was completed in FY15 and is deploying with new installations starting in FY16. Along with other improvements, the updated program allows multiple users to have accounts on the MCM computer (locally and remotely) and to view recorded data simultaneously. While originally designed to monitor guide bearing vibration and operating parameters, additional features have been incorporated including turbine cavitation monitoring and generator air-gap monitoring. Continued development of these features as well as other enhancements and deployments are proposed in the coming years, which will increase the system's value as an O&M tool. Reclamation also plans make this software program available to other public and private hydro utilities to maximize benefit and reduce costs by broadening the support community.	Jim DeHaan	TSC	Conducting	\$100,000	\$1,101,000	\$931,000	\$70,000	\$100,000
1728	Protection System Testing Improvements	This research effort will seek to find improvements that can be made to Reclamation's protection systems and testing program. This project will look at improving the integrity of the existing protection system and improve protection system testing by looking at common failure modes and adding or improving tests that can identify these failure modes. Improvements reduce operation and maintenance cost by reducing the time required to perform the required tests or reduce the number of tests that are needed, which in turn reduces outages.	Jim DeHaan	TSC	Conducting	\$45,000	\$170,000	\$170,000	\$0	\$0
1737	The Holy Grail of Additive Manufacturing - 3D Metal Printing	Unlike with other materials that can be printed, metal enables the creation of end-use objects via 3D printing. Oftentimes these objects outperform parts produced with traditional casting techniques. In fact companies like General Electric and Airbus are already using metal laser sintering machines to produce parts for anything from aircraft, to fuel nozzles. This project seeks to uncover the state of the art of metal 3D printing and how it can be used in the hydro power industry. With an increasingly aging infrastructure, power plant machine shops are backlogged with orders of everything from OEM to custom parts which have to be machined by hand or parts that must be shipped by the manufacturer which sometimes takes weeks or even months to procure. 3D metal printing could reduce system downtimes by allowing for the production of parts on site in a fraction of the time and costs. Additionally, the Department of Energy estimates that 3-D printing can reduce energy costs by 50 percent and cut material costs by 90 percent.	J. Michael Weems	TSC	Conducting	\$50,250	\$0	\$0	\$0	\$0
1738	Wireless Instrumentation Capability	Recent advances in battery and electronics technology allow wireless instrumentation to record analog data more accurately and take data from previously unreachable locations. This research aims to utilize these advances to create and improve existing instrumentation for monitoring generator rotors and battery banks. The goals of this research will be to produce a light weight, linearized air gap sensor driver and assess the best options for a light weight rotor mounted power supply to allow long term online stator shape analysis. Also, Reclamation's wireless battery test modules will be redesigned with significantly higher accuracy and improved reliability.	Bryan Hampson	TSC	Conducting	\$42,000	\$30,000	\$30,000	\$0	\$0

Open Water Data

Project ID	Title	Project Description	Project Lead	Organization	Scoping or Conducting	Recommended FY17 Award	Total Estimated Cost Share	Reclamation Cost Share	Federal Cost Share	Non-Federal Cost Share
1735	Development of Web-based Stochastic Storm Transposition Toolkit for Physically-based Rainfall and Flood Hazard Analysis	<p>Reclamation's Flood Hydrology and Meteorology Group, housed in the Technical Service Center, produces probabilistic estimates of hydrologic hazards using statistical and numerical methods. Numerically-based methods involve rainfall-runoff models, which require detailed precipitation inputs in the form of storm templates (spatial and temporal precipitation information) and a site-specific precipitation frequency-intensity relationship. The precipitation information is used to force the rainfall-runoff model tens to hundreds of thousands of times to produce probabilistic flood frequency estimates. However, most analyses use between two and 20 different storm templates and assume that such a small pool of historical events is sufficient to encompass the wide range of extreme storms that are possible, particularly in regions of complex terrain and at very low annual exceedance probabilities. Flood modeling studies are also often based on the assumption of "AEP neutrality" whereby a precipitation event with a specified annual exceedance probability (AEP) can be converted to a runoff event of the same AEP. The validity of these assumptions is questionable in many watersheds due to the complex space-time structure of extreme storms, the wide spectrum of possible soil moisture and snowpack conditions, and the joint role of these factors on flood wave propagation through the river tributaries. The objective of the current project is to develop advanced, web-based stochastic software capable of combining gridded precipitation ensemble datasets, stochastic storm transposition methods, and physically-based hydrologic models to estimate precipitation and flood frequency relationships for use in hydrologic hazard investigations without the assumption of AEP neutrality. The tools and methods developed in this project will help identify strengths and weaknesses of watershed hydrologic methods and spatially distributed weather data, two priority areas in Reclamation's long term water resources planning objectives.</p> <p>Reclamation will partner with Daniel Wright at The University of Wisconsin (UW) Madison to explore the application of these tools and products along the Arkansas River above Pueblo Dam, in southeastern Colorado. Additional partners include Theresa Dawson from Reclamation's Fryngpan-Arkansas Pueblo Field Office and John England from the U.S. Army Corps of Engineers Risk Management Center. Deliverables from this project will provide Reclamation's Technical Service Center with advanced stochastic methods and software for developing realistic regional precipitation and flood frequency relationships and associated uncertainty estimates for use in hydrologic hazard assessments that are applicable nationwide, and not just at the demonstration site.</p>	Kathleen Holman	TSC	Conducting	\$86,558	\$0	\$0	\$0	\$0
1758	Environmental Resources Data Mapping Pilot to support Reservoir Operations Planning	Reclamation's Reservoir Operations Pilot Initiative is determining how reservoir operations can be made more flexible to adapt to the impacts of climate change. Reclamation's reservoirs are operated using criteria to meet a number of different water management priorities, including reliable water deliveries, power generation, environmental requirements, navigation, and flood control management. Reservoir operators need to proactively consider environmental compliance as part of their assessment for changing operations. This study would develop a framework for a geospatial tool at a reservoir or within a reservoir system that provides early indication of environmental compliance considerations in the area to bound potential operations actions that may be needed to respond to climate change.	George Herbst	P&A	Conducting	\$75,000	\$84,000	\$84,000	\$0	\$0
1763	West-wide Evapotranspiration Forecast Network	The West-wide Evapotranspiration Forecast Network (WwET4Cast) addresses both short term monitoring and forecasting needs identified by Climate Change and Water Working Group as enhancements for water resource management decisions over the short term (less than 5 years) through improvements in monitoring and forecasting products and by better use of currently available information. This platform combines daily reference ET (ET _o) computed from monitoring of meteorological conditions at agricultural meteorology stations with forecasted ET _o computed from downscaled meteorological conditions from NOAA's Global Forecast System (GFS) weather forecast model. The platform also permits users to use longer lead time seasonal climate outlooks such as those made by the NOAA's Climate Prediction Center (CPC) and their partnership with the International Research Institute (IRI) to forecast daily ET _o up to 6 months in the future. Partners include existing ET networks such as Reclamation's AgriMet network along with additional federal, state and local water management agencies partners joining during the project.	Michael Tansey	MP	Conducting	\$90,778	\$153,000	\$120,000	\$10,000	\$23,000
7105	Open access web-based database of invasive aquatic research and water quality data	he Reclamation Detection Laboratory for Exotic Species (RDLES) has collected a comprehensive dataset on the distribution of invasive dreissenid mussels, and associated water quality data spanning a decade of sampling. The goal of this project is to integrate this data into a searchable web-based relational dataset that will be made open access and available to researchers and the public. There is significant interest in the research community in having these data available for use in analyzing and modeling patterns of mussel invasion. The development of this database will aid in the determination of what factors promote or inhibit the establishment in new water bodies, and provide a basis for managing resources to minimize the possibility of new invasions. The web-based database developed in this project will also serve as an extensible platform that will be designed to incorporate data on other invasive species of concern that are expected to threaten Reclamation in the future. The work will be conducted by TSC staff from RDLES and the Geographic Applications and Analysis Group, and from the Information Resource Office (IRO), including Infrastructure Operations Services Group and Risk Management Services.	Yale Passamaneck	TSC	Conducting	\$120,000	\$0	\$0	\$0	\$0
7107	Quantitative Assessment of Water and Salt Balance for Cropping Systems in Lower Colorado River Irrigation Districts	Water and salt management are vital to agricultural sustainability in Yuma, Arizona, which is located within the Lower Colorado River Basin. Irrigation water contains salts and because the shallow ground water in the valleys, which fluxes up through the fine textured soil by capillarity, also contains salts, some level of excess irrigation (beyond consumptive use) must be applied to leach salts below the crop root zone. This application proposes quantitative assessments of water and salt balance for cropping systems in the Lower Colorado River irrigation districts across a typical Yuma crop production system and rotation. The findings would be available to Reclamation and its stakeholders to evaluate irrigation practices and summer fallow crop rotation. Data would also be used to develop relevant irrigation mobile applications farmers could use. Reclamation's Yuma Area Office will partner with the University of Arizona's Yuma Center of Excellence for Desert Agriculture and with the Yuma County Agricultural Water Coalition on this effort.	Nohemi Olbert	LC	Conducting	\$120,000	\$310,000	\$0	\$210,000	\$100,000

Invasive Zebra and Quagga Mussels

Project ID	Title	Project Description	Project Lead	Organization	Scoping or Conducting	Recommended FY17 Award	Total Estimated Cost Share	Reclamation Cost Share	Federal Cost Share	Non-Federal Cost Share
1712	Impact of UV Treatment on Hydroid Biofouling in Generator Cooling Pipes at Parker Dam	Biofouling due to invasive species is a significant issue at Reclamation facilities throughout the western United States. Hydropower facilities along the lower Colorado River have experienced issues with invasive dreissenid mussels and are now experiencing biofouling as a result of an invasive hydroid, that forms thick mats and can cause filter blockage. Ultraviolet (UV) light treatments have been found to successfully reduced mussel settlement in generator cooling systems. The goal of this study is to determine if UV treatments can also reduce hydroid and other biofouling issues. This study will be conducted at Parker Dam where hydroid biofouling has recently become a problem, and where UV units have recently been installed.	Sherri Pucharelli	TSC	Conducting	\$30,000	\$0	\$0	\$0	\$0
1733	Underwater Imaging for Intake Trashracks at Glen Canyon to Assess of Mussel-Related Impacts	Invasive mussel-related impacts to water and power facilities can be wide-ranging. One aspect involves fouling of intake trashracks and associated cleaning requirements to efficiently deliver power. While it is generally known that power intake trashracks are susceptible to zebra and quagga mussel fouling, the extent of fouling and what it means for headlosses and power generation capacity have not been addressed. This project intends to better define the extent of trashrack fouling using available underwater imaging technologies to assess and potentially track fouling progression at Glen Canyon Dam due to the quagga mussel infestation in Lake Powell. The outcomes are expected to provide an improved understanding of the level of impacts and inform O&M requirements to minimize headlosses and maintain power generation capacity.	Joe Kubitschek	TSC	Conducting	\$49,400	\$0	\$0	\$0	\$0
1746	Using Genetic Manipulation to Control Invasive Species	CRISPR (clustered regulatory interspaced short palindromic repeats) and gene drive are two technologies that have emerged in the last year as ways to perform genetic manipulation on a wide range of organisms. The power of this technology is that it could enable researchers to introduce and spread a gene that could control or even eradicate an invasive species. The proof of concept for this technology was performed in mosquitoes. The issues with controlling or even eradicating the quagga and zebra mussels from western waters with this technology will be considered. Both the technical and regulatory issues that would have to be resolved will be analyzed.	Jacque Keele	TSC	Scoping	\$31,000	\$0	\$0	\$0	\$0
1747	Development of Methods for the Spectrophotometric Analysis of Water Supplies	Reclamations Detection Laboratory for Exotic Species (RDLES) in 2016 purchased a Cary-60 Spectrophotometer to perform a wide range of assays. One of these assays is the quantification of chlorophyll in samples collected from a wide range of locations. This instrument offers RDLES the opportunity to expand its capabilities by incorporating additional assays into our testing of water samples. The goal of this project is to identify additional assays that can be adapted to be performed on this instrument, and develop standard operating procedures that can be used by every member of the laboratory. Identifying assays will enhance the services that we can provide to our clients.	Jacque Keele	TSC	Conducting	\$57,000	\$0	\$0	\$0	\$0
1748	Molecular Methods for the Reclamation Detection Laboratory for Exotic Species (RDLES)	The project has two goals. First, to continue to develop standard operating procedures for the DNA detection of invasive species of concern. Second, to design and validate LAMP (loop-mediated isothermal amplification) assays for quagga and zebra mussel, and Asian clams. This newer amplification technique is robust, uses 2-3 primer pairs, and is performed at a constant temperature. This means that the amplification can be performed in a heat block, and does not require any specialized equipment. In addition, a side by side comparison of both RDLES standard PCR methods and the new LAMP assays will be performed to determine which assay performs the best.	Jacque Keele	TSC	Conducting	\$85,000	\$0	\$0	\$0	\$0
1755	Effective and Safe Decontamination for Underwater Inspection Equipment Exposed to Quagga and Zebra Mussels	Reclamation has maintained underwater inspection teams since the 1960's to carry out mission critical and routine facility reviews of submerged structures. Reclamation underwater inspection activities may serve as a transport vector for quagga and zebra mussels, especially for the microscopic mussel life stage - veligers. The primary goal of this research project is to test the effectiveness and health safety of various disinfection protocols for underwater diving equipment routinely used by Reclamation, such as scuba dive gear, remotely operated vehicles, and surface supplied air equipment. Both of Reclamation underwater inspection teams (LC and PN Regions) are performing this research.	Kevin Kelly	TSC	Conducting	\$59,760	\$20,000	\$20,000	\$0	\$0