

REQUEST FOR PROPOSALS
University of Wyoming Office of Water Programs
Water Research Program
FY2018

The Office of Water Programs/Water Research Program welcomes proposals covering a wide range of topics involved in Wyoming's water resources. Each proposal shall include a detailed explanation of how the study (i) will encourage the development of water facilities, (ii) will facilitate the planning, selection, financing, construction, acquisition, and operation of projects and facilities for the conservation, storage, distribution and use of water; (iii) could be used by any governmental agencies in the management of Wyoming's water resources, (iv) will meet the research needs of State and Federal agencies regarding Wyoming's water resources, and (v) support water related training and education.

Dam Operation and Sediment Management

The accumulation of sediment behind dams presents challenges to their effective operation and to meet water user needs while still protecting downstream uses (e.g., fisheries, aquatic life). In the fall of 2016, over 90,000 cubic yards of sediment were released from behind Willwood Dam. The majority of this sediment was deposited on the downstream Shoshone River channel bed, affecting fish populations and aquatic life. This release event has prompted local, state, and federal agencies and organizations to work together to address impacts of the 2016 release and develop tools to prevent such events from occurring in the future. For example, in response to the 2016 Willwood Dam event, the University of Wyoming completed a study to help determine the potential to use "flushing flows" to hydraulically remove the deposited sediment in the Shoshone River below the dam. Additional research is needed to help understand how to prevent such releases and to effectively respond when they occur. Areas of research include, but are not limited to:

- Additional studies that describe the fate and transport of sediments in Wyoming's erosive watersheds and what measures can assist with reducing sediment inputs.
- Further studies on using "flushing flows" to address downstream sediment deposition following releases.
- Studies on economically feasible ways to remove sediment accumulated behind dams.
- Studies that would help establish water quality regulations for sediment that protect existing designated uses (e.g., fisheries, aquatic life) while allowing for more flexible dam operations—e.g., identifying conditions when a dam could release higher amounts of sediment and not negatively affect downstream fisheries or other uses. Research related to evaluating water quality regulations should include a recommended acceptable limit for turbidity and/or suspended solids, and include applicable seasonal timeframes.

Proposals may be specific to a particular dam, such as the Willwood Dam. However, studies that have broader applicability to dams statewide will be more competitive.

Reservoir Expansion – Wetland Issues/Opportunities

Governor Matthew Mead has issued a State of Wyoming document "Leading the Charge: Wyoming Water Strategy." This document outlines 10 initiatives over 4 themes. Theme 2, Water Development Initiatives 4, 5, and 6 relate to existing and new reservoirs while initiative 7 aims to develop collaborative planning and authorization processes, thereby creating a modular framework for information sharing, planning, and decision making.

The high priority placed by the Governor on reservoir projects would be facilitated by research that enables reservoir projects to develop in a more efficient manner. Research, focused on reservoir expansion, which investigates developing or enhancing wetland community structure and function associated with periods of high inundation and subsequent draw-downs is desired. Enlargement of reservoirs with fringe wetlands typically triggers NEPA (National Environmental Policy Act) and 404 permit requirements due to the potential degradation or loss of jurisdictional wetlands. For reservoir expansions to be feasible, existing wetlands either have to be maintained or mitigated, sometimes at ratios that make the project infeasible. However, it is known that wetland vegetation has varying tolerances to depth and duration of inundation. Therefore, it may be possible to enlarge reservoirs, perhaps only nominally, without significantly impacting existing wetlands through the use of water management, draw-down timing, and growing season. In some instances, there may be opportunity to expand, mitigate, and/or enhance the functionality and value of wetlands.

System Conservation Monitoring and Measurement

The Colorado Basin is facing a host of challenges including increased water demands, prolonged drought and decreased snowpack, all of which lead to declining water levels in Lakes Powell and Mead. To meet these challenges, the Bureau of Reclamation, Colorado River Basin States, and other river stakeholders initiated the System Conservation Pilot Program (SCPP) from 2015 through 2017. SCPP was a temporary, voluntary pilot program that pays willing water right holders to reduce their water use. The overall goal has been to allow the conserved water to stay in the Colorado River system and ultimately flow to Lake Powell and enhance storage. Wyoming had good participation from agricultural producers in the Green River Basin who elected to deficit irrigate for part of the production season. While the SCPP was a pilot program that will terminate at the end of 2017, the effectiveness of any future program relies heavily on the ability to accurately monitor, measure, document and verify conserved water. Research designed to help structure SCCP-type monitoring and measurement tools in support of these efforts would contribute to our understanding if and how much deficit irrigation contributes to keeping water in the system and help us evaluate the possibility of any future program.

Water as a Driver for Economic Diversity in Wyoming

In February 2017 the Wyoming legislature voted to fund the Economically Needed Diversity Options for Wyoming (ENDOW) initiative. It is an effort to develop a 20-year comprehensive and coordinated economic diversification strategy to bolster the state's economy and provide a cushion against the inevitable ebbs and flows of the energy markets. Significant efforts put forth by the Wyoming Water Development Office have focused on opportunities to develop water to meet existing and projected needs within the state. Knowledge could be gleaned to evaluate additional opportunities where Wyoming's water can contribute to the State's economic growth under today's legal and regulatory framework (i.e. Wyoming water law, interstate compacts and court decrees, Orders of the State Engineer's Office, etc.). Research under this topic should evaluate the role of Wyoming's water in community development, expansion of economic sectors with a current presence in the State, as well as the attraction/retention of new sectors to our economy. It could include developing methods to enhance clean and reliable water that stimulate direct, indirect and induced economic impacts, as well as the valuation of water's contribution to sustained growth of gross regional product, job creation, per capita income and labor force participation.

Water Supply Forecasting

The Wyoming Water Strategy identified the need to better understand atmospheric and climate variables and their effects on water supply, as well as the need to update, improve and/or develop water supply forecasts in river basins of Wyoming.

Areas of research that would assist in this initiative include:

- Construction or evaluation of existing flow forecasting tools that analyze the response of various combinations of climate, water demand and land use on streamflow as well as general watershed hydrology.
 - Particular emphasis should be placed on the calibration of forecasting tools in hybrid plains/mountain streams with highly variable climates during low flow years. This could include an evaluation of temperature predictions in relation to water demand factors as well as research aimed at enhancing understanding of transitional zones (i.e.- foothills that typically receive intermittent to seasonal snowpack) and lower-elevation (i.e.- high plains) contributions to streamflow. Two examples of basins of interest in Wyoming that have large datasets that can contribute to the initiation of research are the Tongue River and Upper North Platte River Basins.
- Development of localized crop coefficients appropriate for use with a Penman-Monteith based consumptive use methodology. Research in support of using remote sensed data in the evaluation of the extent of snowpack and snow water equivalent, and resulting streamflow would also support this initiative.
- Identification of areas of Wyoming where additional snow and/or climate instrumentation would benefit water supply forecasting.
- Identification of areas of consistently larger seasonal runoffs for potential siting for future water developments.

Groundwater Analysis/Aquifer Potential Characterization

Governor Mead's Wyoming Water Strategy (2015), Initiative 3, Groundwater Analysis and Control Area Management Framework", seeks to address the challenges of measuring and allocating groundwater in areas of growing population and declining groundwater resources. Priority is placed on developing "information sharing and management tools" and "innovative management plans" in Groundwater Control Areas in collaboration with the Wyoming State Engineer's Office.

Research regarding the integration of recognized modeling techniques with existing hydrogeologic and geophysical measurements to understand aquifer reservoir properties and dynamics is needed. In portions of basins within Wyoming developed for groundwater demands, uncertainty persists regarding the intrinsic nature of aquifers presently pumped and those with future supply availability opportunities. A wealth of information already exists such as extensive hydro-geologic mapping, surface/remote sensing surveys, geophysical logs of boreholes, pump test data & analysis, historic piezometric data, metered discharge reporting, etc. Priority is given to the application of digital/numeric/statistical tools to explore localities or existing well fields to increase knowledge of key aquifer systems of the State.

Energy-Plan Strategy for Produced Water

Governor Matthew Mead has issued a document "Leading the Charge: Wyoming's Action Plan for Energy, Environment and Economy." In this document, 16 strategies are listed. Innovative

Water Treatment and Management Incentives is listed as Strategy 9C. Oil and Gas development in Wyoming raises issues associated with the disposal and treatment of the water produced to facilitate production of oil and gas. To help fulfill the objectives of this strategy, and take a proactive approach to address the interdependence of water and energy development, research is needed in the following areas:

- Development of industrial uses for produced water.
- Improved regulatory standards for reuse.
- Investment in reuse technology.
- Incentives for third-party investment.
- Improve efficiency of existing treatment methods.

In addition to the above priorities, the following are of interest in furthering the goals related to “Leading the Charge: Wyoming Water Strategy”

Surface Water Hydrology: Studies related to the management of surface and connected shallow groundwater formations to better understand, manage, and enhance water availability and uses.

Groundwater Hydrology/Modeling: Studies related to the management of groundwater resources that are hydrologically disconnected from surface waters to better understand, manage, protect, and enhance those resources.

Water Recycling, Reuse, Treatment and Conservation: Studies designed to better understand and manage the quality of surface or groundwater resources for the benefit of humans and other environmental purposes.

Biological Processes: Studies designed to better understand and manage water resources to maintain, restore, or enhance any plant or animal populations or communities that support the State’s interests and authority over the management of those organisms.

Irrigation: Studies to identify methods to improve irrigation efficiencies and related water management to maximize the beneficial use of water, including assessing the hydrologic/ecologic effects of change in irrigation methods.

Atmospheric/Hydrologic Processes: Studies to better understand and/or manage atmospheric conditions and processes to maintain or improve hydrologic yields in Wyoming.

Engineering: Studies that identify potential engineering solutions to water quantity and/or quality challenges.

Economics/Social Sciences: Strategies to improve the cost effectiveness of multi-use water development opportunities.

Multiple Resource Management: Studies designed to reveal opportunities to maximize multiple uses of water that enhance economic and non-economic benefits to the State.

Evaluating Effectiveness of Conservation Practices in Improving Water Quality: Studies that evaluate the effectiveness of conservation practices in reducing pollutant loading to surface and ground water. Particular pollutants of interest are sediment, *E. coli* (pathogens) and nutrients (nitrogen and phosphorus). With regard to nutrients, a further specific area of interest is evaluating effectiveness of advanced septic system treatment for nutrient removal.

River Restoration: Research related to improving stream and river restoration planning, implementation, and assessment in order to improve the effectiveness and sustainability of

restoration efforts. Of particular interest are studies related to the use of remote sensing technology to better understand fluvial geomorphology.

E. coli and Water Borne Pathogens: Research related to evaluating the use of indicators such as *E. coli* to establish water quality standards for protection of human health against exposure to water borne pathogens during recreation activities. Of particular interest are studies related to understanding the ability of *E. coli* to persist in the environment (i.e., fate and transport) and epidemiological studies relating *E. coli* levels to incidence of water borne pathogen exposure and illness in streams and rivers.

Ditch/Canal Conveyance Losses: Conveyance efficiency is of considerable interest to irrigators and water resource managers since it can significantly affect the amount of water delivered to the point of use (crop) from the diversion. To better develop hydrologic models meant to determine volume, location, and timing of irrigation shortages and available water for development, perhaps in the form of new reservoirs, water developers desire to have a better understanding of conveyance (ditch/canal) efficiencies in various settings. The study objective would be to evaluate conveyance efficiencies of a variety of ditch/canal sizes in a variety of soil conditions, geographic locations, and settings in an attempt to develop general efficiency information that could be applied to hydrologic models developed throughout the State when specific ditch information is unavailable.