

REQUEST FOR PROPOSALS

University of Wyoming

Water Research Program

FY2012

The Water Research Program (WRP) invites faculty members and affiliates of the University to submit research proposals under the National Institutes for Water Resources (NIWR) annual allotment program funded jointly through the U.S. Geological Survey and the State of Wyoming Water Development Commission. Proposals responding to the priority areas described below are sought. The available funds for new FY12 projects are estimated at approximately \$218,000, dependent upon the level of the USGS appropriation.

Proposals for research projects of one to three years in duration will be accepted, but can only be funded on a year-by-year basis. The WRP Priority and Selection Committee will monitor progress and act on continuation annually. Annual and final reports on all projects are required. Also, results of research under the WRP are expected to be published in peer reviewed publications.

Proposals must include University faculty or affiliates as Principal Investigators. Student training is a high priority of the WRP, thus student participation is expected. In addition, most projects are expected to include personnel from a State Sponsoring Agency as a coordinator and/or participant.

Selection will be based on the results of peer reviews and the decision of the WRP Priority and Selection Committee. Final approval must be obtained through the NIWR annual allotment program. All proposals must be submitted for review in both hard copy (10 copies required) and electronic format. Final submission of selected projects to the NIWR program will be in electronic format.

Timeline for Proposal Submission, Selection, and Start-up:

- **Proposal submission due date:** Tuesday, Oct. 4, 2011, by 5:00 P.M., Engr. Bldg., Rm. 2095
- Project selection by Priority and Selection Committee: Tuesday November 29, 2011
- Submission of FY12 application to USGS: Mid-January, 2012*
- Tentative project start date, pending USGS approval: March 1, 2012*

*These dates, along with the dollar amount available for supporting new projects, are dependent upon approval of the FY12 Federal Interior Appropriations Bill.

All researchers interested in submitting proposals must contact the Director of the UW Office of Water Programs for formatting requirements (e.g., the narrative portion of the proposals is limited to 6 pages single spaced, Times New Roman 12 font, Microsoft Word), mandatory Excel sheet for preparing budgets, submission guidelines, reporting requirements, and other information. A minimum of 20% direct matching funds (e.g. PI time) is required on all proposals.

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WRP Research Priorities for FY2012

The Water Research Program welcomes proposals covering a wide range of areas involved in Wyoming's water resources.

General areas include, but are not limited to the following:

- **Surface water hydrology**
- **Groundwater hydrology**
- **Water quality**
- **Biological/Social Sciences**
- **Climate/Hydrologic Processes**
- **Engineering**

In addition to the general areas proposals may address, State and Federal agencies have also provided more specific water related topics of concern as listed below.

Irrigation Efficiency Improvements Through Irrigation System Operations Management Opportunities

Improving the efficiencies of large canals to better match on-farm efficiencies is desired. Most large irrigation projects in Wyoming were constructed by the Department of the Interior, Bureau of Reclamation. These canals were designed to accommodate flood irrigation practices. Due to labor savings, flood irrigation practices are yielding to the use of center-pivots, side-roll irrigation systems, gated pipe, installation of piped laterals and surge valves, which have drastically improved on-farm efficiencies. The purpose of the research project would be to determine whether delivery system efficiencies could be improved by using mechanical automated checks in combination with lower canal flows to discourage operational waste due to filling canals to an elevation needed to service farm turnouts and irrigation laterals. Other issues include seepage losses versus canal head and whether opportunities may exist within canal reaches to lower operating levels to discourage seep and to determine whether the "checked" canal may be used as a re-regulation facility. With respect to seep, this may require installation of pumped turnouts or laterals to service those facilities residing at a respective higher elevation with other similar facilities within a specified canal reach at a lower elevation with respect to the canal's surface water elevation. Economics (benefit vs. cost), quantitative impacts to groundwater recharge, effects on water quality and aquatic communities in associated streams, and other related issues should be addressed.

Guernsey Reservoir Silt Run

During mid-summer of each year the US Bureau of Reclamation conducts a rapid draw-down of Guernsey Reservoir on the North Platte River. This rapid draw-down results in large quantities of accumulated silt in the reservoir being sloughed into the river downstream. The purpose of this activity is to help seal irrigation canals and increase the efficiency of water delivery. However, this activity is disruptive to recreation on the reservoir during a high use period. In addition, there may be adverse environmental effects in the reservoir and on the downstream stretch of the river. A special exemption in Wyoming's water quality standards allows for the silt run; however, an independent socio-economic/environmental analysis of the silt run would be beneficial to allow decision makers to determine whether the silt run benefits outweigh the costs.

River and Stream Conveyance Losses

Proper accounting of stored and natural flows becomes an important component in the administration and enforcement of Wyoming water laws and is vital to any regulation that may occur. Conveyance loss is an important quantity to measure in order to understand the distinction between natural and stored flows. Conveyance losses may be affected by length of reach, natural flow in the river, size of flow increase, bank storage, channel storage, precipitation, elevation and slope of the water table, stream channel characteristics, evaporation, evapotranspiration, hydraulic characteristics of the aquifer, irrigation return flows, inadvertent diversion and valley cross sections. Conveyance losses are also becoming important with the prospect of interstate stream regulation such as may occur on the Green River.

Bark Beetle Epidemic Effects on Forest Water Yield

The ongoing epidemic of bark beetles is causing unprecedented changes to forests around the state of Wyoming. The rapid death of trees and resulting change in canopy structure has been shown to moderately increase snowpack and soil moisture. However, it is unclear if these changes will result in quantifiable increases in water yield because of potential issues including less mortality as scale increases from stands to mountain ranges, composition and growth of understory vegetation and the lack of complete water balances at watershed and larger scales. It is also unclear how long these potential increases will last. Forest succession after bark beetle infestation is fundamentally different from better-studied hydrologic effects of clearcutting and fire. These successional changes may result in a shorter time scale of increased water yield compared to clearcutting and fire. Appropriate research to address these issues will utilize tools such as remote sensing to address the scaling problem which can then interact with mechanistic models of forest water yield during forest succession. Any model used or produced should be calibrated by data at appropriate spatial and temporal scales. The products from this research should be able to address bark beetle impacts on forest water yield from headwater to basin spatial scales while predicting these impacts beyond decadal time scales.

Effects on Stream Flows and Water Quality from Irrigation Return Flows

Previous studies indicate that significant quantities of water are stored during early summer irrigation and then slowly released back to riparian areas and streams during the following months, supplementing late summer flows. In addition to questions of hydrology, irrigation return flows have potential water quality impacts on receiving streams in some situations that can have significant negative effects on biotic communities in those waters. Impacts may include increases in temperature, sediment, nutrients, and salinity. In addition some return flows may carry elevated levels of pesticides and herbicides. Quantification and documentation of return flows are needed to assess the validity of these assumptions and to address potential impacts. Important questions to be answered include (1) what is the contribution of return flows to sustained late-season flow (baseflow), (2) what is the quality of the return-flow water, (3) how do changes to water quality affect riparian and aquatic communities receiving this water, and (4) how do return flows vary in quantity, quality, and timing among crop types?

Water and Energy/Mineral Development and Extraction

Information is desired on hydrologic relationships/constraints associated with energy development. Studies to be considered should take a proactive approach to address the interdependence of water and energy development. Some suggested areas of interest include:

- Water quality and hydraulic properties of potential underground carbon sequestration targets.
- Water quality and management associated with underground coal gasification projects.
- Determining water resource needs and issues for commercial development of oil shale.
- Water quality and runoff management related to surface disturbance from energy development, including wind and solar.

- Water quality and quantity implications of the development of in-situ uranium.
- Natural gas development impacts on shallow aquifers.
- Water issues pertaining to shale gas development.

Coalbed Methane

Continuing coalbed methane (CBM) development in Wyoming raises difficult issues associated with the disposal of the water pumped out of the coal seams to facilitate production of the gas. Needed areas of research include:

- Methods of gas removal which require no (or reduced) water pumping.
- Enhanced and economically feasible methods for re-injection of CBM produced water.
- Water treatment technologies for reduction of total dissolved solids, sodium adsorption ratio, barium, iron, and whole effluent toxicity in CBM produced water surface discharges.
- Changes to native vegetation due to increased water flow from CBM produced water discharges.
- Changes to the hydrology and habitat of naturally intermittent and ephemeral streams by perennial CBM water discharges.
- Reclamation of CBM water holding ponds once they are abandoned.
- Surface water contamination caused by the subsurface horizontal movement of CBM water out of holding reservoirs into the downstream natural drainage.
- Water quality requirements for the irrigation of naturally occurring vegetation in NE Wyoming.
- The geochemistry and fate of CBM water discharged via subsurface drip irrigation systems.
- A determination, at the Wyoming/Montana state line, of the percentage of Tongue River flow and salt load that is being contributed by CBM discharges.
- The possible relationship of CBM surface containment ponds to providing mosquito habitat and the subsequent possible connection to the transmission of West Nile virus to sage grouse.
- The biological effects of discharging cold, clear CBM produced water directly to the main stem of the Powder River.
- Whole Effluent Toxicity (WET) Testing and Toxicity Identification Evaluation (TIE) on CBM produced water.

E. Coliform

Currently (2008), 62 stream reaches are listed on the DEQ's 303(d) list of impaired water bodies, with coliform bacteria as the impairment. Several groups are working to implement best management practices (BMPs) to reduce coliform counts in listed waters; however, it is not known to what extent the source of the coliform contamination is a predictor of human health effects. Areas of research needed include:

- Identification of the sources of e. coliform contamination in high altitude streams in Wyoming.
- Evaluation of various grazing and land management practices on e. coliform contamination of high altitude streams in Wyoming.
- Fate and transport of "x"-coliform bacteria in Wyoming streams. "X"-coliform bacteria appear to be over-wintering in Wyoming streams and showing up in samples collected during the spring runoff. This research would help in design of BMP's to reduce contamination levels in streams.

Oxbow Storage Properties/Opportunities

Information is desired on the potential benefits/costs of diverting high river flows for storage in old river channel and oxbow features. Potential benefits to examine should include, but not be limited to: supplemental water supply, fish and wildlife habitat, recreation and flood control; while costs evaluated could include not simply the possible expense of the diversion and storage, but the impact of this new use

on the functions the old channels and oxbow features already perform, including flood control. Ideally, the investigation should look at the use of old river channel and oxbow features on Wyoming rivers that include at least one river with a major dam or dams and one that has not been significantly dammed.