

Final Report

Product Accessibility and Dissemination for the Water Research Program at the University of Wyoming

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Project Duration: 03/01/2000 - 02/28/2003

Abstract:

The National Institutes for Water Resources (NIWR)/State of Wyoming Water Research Program (WRP), placed at the University of Wyoming, oversees the coordination of Wyoming's participation in the NIWR program. The WRP was established in late 1999 as a cooperative Federal, State, and University effort. Funding sources include the annual NIWR program allotment, the Wyoming Water Development Commission, and the University of Wyoming.

This project was initiated to provide support while developing and implementing the WRP. The Director, Larry Pochop, was appointed in October 1999. The WRP was completely reformulated compared to the State's NIWR program as it existed previously, since 1964, within the Wyoming Water Resources Center. Accomplishments of this project address each of the three objectives of the project, which were to: (1) supplement administrative support for development of the WRP, (2) support the training of students in water resources related areas, and (3) establish an effective way to disseminate information developed by the WRP.

Overview:

The State Water Resources Research Institute (WRRI) program places an Institute at the land-grant universities or at another college or university in each of 54 states or territories. The WRRI program evolved from the Water Resources Research Act of 1964, as amended, the Water Research and Development Act of 1978, Public Law (P.L.) 96-457, and section 104 of the Water Research and Development Act of 1984. The institutes authorized by the Act are organized as the National Institutes for Water Resources (NIWR) which, since 1983, cooperates with the United States Geological Survey (USGS) in establishing and monitoring programmatic direction, reporting Institute activities, and facilitating regional research, information transfer, and student training. The NIWR is a Federal-State partnership which (a) plans, facilitates, and conducts research to aid in the resolution of State and regional water problems, (b) promotes technology transfer and the dissemination and application of water-related research results, (c) provides for the water-related training of scientists and engineers through their participation in research, and (d) provides for competitive grants to be awarded under the Water Resources Research Act.

Since inception of the NIWR program in 1965, Wyoming's designated program participant has been the University of Wyoming. Until 1998, the Wyoming NIWR program was housed in the Wyoming Water Resources Center (WWRC). However, in 1998 the WWRC was closed. In late 1999, the Wyoming Water Research Program (WRP) was initiated to oversee the coordination of Wyoming's participation in the NIWR program. The WRP is a cooperative Federal, State, and University effort with Federal funds from the NIWR program and State funds provided by the Wyoming Water Development Commission (WWDC) and the University of Wyoming.

Objectives:

This project was initiated to provide support while developing and implementing the WRP which was completely reformulated compared to the State's NIWR program as it existed under the WWRC. In addition, Wyoming's NIWR program was placed on probationary status in the fall of 1999 as the result of a 5-year evaluation (covering the period 1992-1997) mandated by the Water Resources Act. Thus, there was also the need to address the probationary status of the Wyoming NIWR program. The overall intent of this project aligned with goals of the WRP, which include minimizing administrative overhead while maximizing funds allocated to research and training. Thus, during development of the WRP, the Director employed students for administrative assistance rather than creating permanent administrative positions. This approach also enhanced overall student support and water-related training. The specific objectives of this project were:

1. Supplement administrative support for development of the WRP.
2. Support the training of students in water resources related areas.
3. Establish an effective way to disseminate information developed by the WRP.

Accomplishments:Objective 1

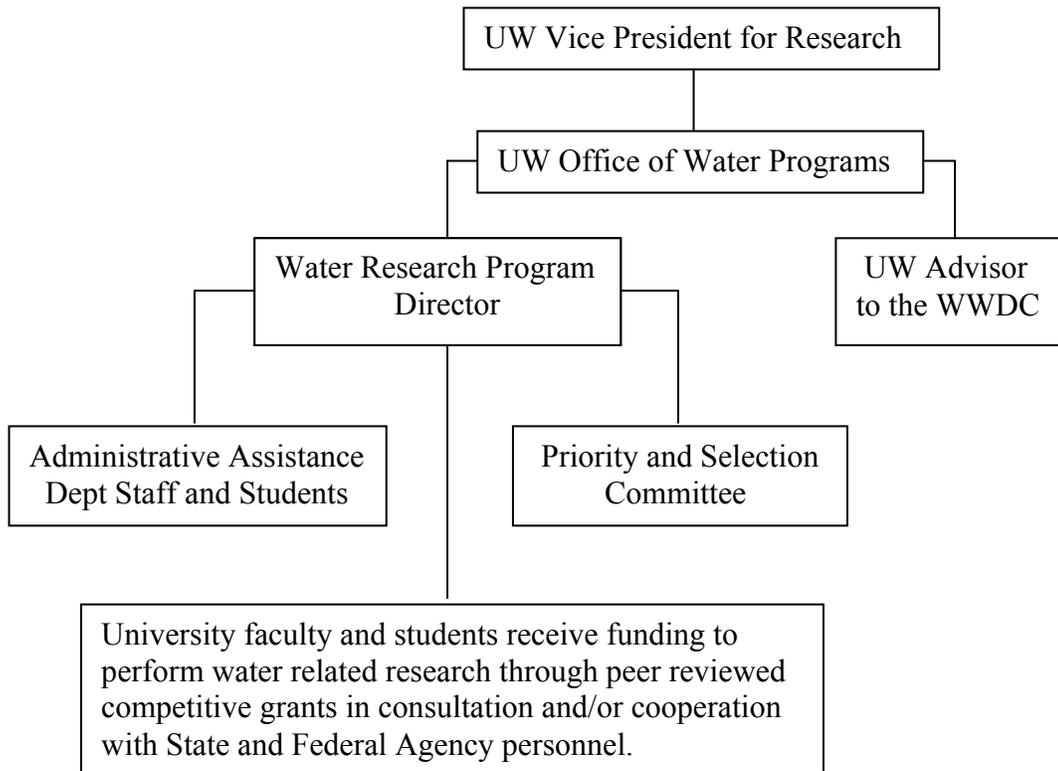
The accomplishments under this objective basically summarize the major steps taken to initiate the WRP.

The WRP Director, Larry Pochop (Professor of Civil Engineering), was appointed in October 1999. While the WRP is physically housed in the Civil and Architectural Engineering Department, the Director reports to the Vice President of Research. A Priority and Selection Committee (P&S committee), consisting of representatives from agencies involved in water related activities in the State was formed. The P&S committee solicits and identifies research needs, selects projects, and reviews and monitors progress. P&S committee members include representatives from the Wyoming Water Development Office, Wyoming State Engineer's Office, Wyoming Dept. of Environmental Quality, Wyoming Dept. of Agriculture, Wyoming State Geological Survey, Wyoming Association of Conservation Districts, and the USGS Wyoming Water Science Center office in Cheyenne. The Director serves as a point of coordination for all activities and serves to encourage research by the University of Wyoming addressing the needs identified by the P&S Committee. An Organization Chart of the Wyoming Water Research Program is as follows:

The WRP was organized to support faculty and students in University of Wyoming academic departments. Faculty acquire their funding through competitive, peer reviewed grants, submitted to the WRP. Benefits of the Water Research Program (WRP) to the State of Wyoming include: (1) support of water related research, both short term and long term, addressing water issues important to the State and Region, (2) support of water related training and education, (3) availability of personnel with water expertise to assist in addressing technical questions, and (4) coordination of agency and UW personnel.

As requested by the USGS, a strategic plan to guide the revitalization of Wyoming's NIWR program was prepared and submitted to the USGS in June 2000. The strategic plan outlined the WRP approach to addressing the three principal NIWR program objectives of research, education, and information transfer. An implementation report describing the status of efforts in implementing the strategic plan was prepared and submitted to the USGS in December 2000, also as requested by the USGS. Notice of removal from probationary status was received March

2001, ensuring Wyoming’s eligibility to participate in the NIWR program including applying for annual funding.



A major step in initiating the WRP was the re-establishment of the participation and funding support of the Wyoming Water Development Office which had been discontinued in 1998. Support from the Wyoming Water Development Office assured that the WRP became a cooperative Federal-State-University effort.

In conjunction with the WRP, an Office of Water Programs was established by Legislative action beginning July 2002. The duties of the Office, which provides for the administration of the Wyoming Institute, are specified by the legislation as: (1) to work directly with the director of the Wyoming water development office to identify research needs of state and federal agencies regarding Wyoming’s water resources, including funding under the National Institutes of Water Resources (NIWR), (2) to serve as a point of coordination for and to encourage research activities by the University of Wyoming to address research needs, and (3) to submit a report annually prior to each legislative session to the Select Water Committee and the Wyoming Water Development Commission on the activities of the office.

WRP Projects completed, ongoing, and approved to date (through February 2003) include:

1. “Hydrologic Impacts of Improved Irrigation Efficiencies and Land Use Changes”, Drew Johnson, Assistant Professor; Civil and Architectural Engr., UW, Mar 00 – Feb 02.
2. “Erosion Potential Model Development and Channel Monitoring”, Gregory V. Wilkerson, Assist Prof, Civil and Architectural Engineering, UW, Mar 00 – Feb 03.
3. “Testing of Hydrologic Models for Estimating Streamflow in Mountainous Areas of Wyoming”, Bruce R. Brinkman, Adjunct Professor, UW; Hugh W. Lowham, Consultant; and Lawrence Ostresh, Professor, Geography and Recreation, UW, Mar 00 – Feb 03.

4. "Product Accessibility and Dissemination for the Water Research Program at the University of Wyoming", Dennis Feeney, Coordinator, Wyoming Water Resources Data System and Larry Pochop, Director of Water Research Program, UW, Mar 00 – Feb 03.
5. "Field Evaluation of the Fate of Wastewater Components from Septic Systems", Marjorie E. Bedessem, Assistant Prof, and Thomas V. Edgar, Associate Prof, Civil and Architectural Engr., UW, Mar 01 – Feb 02.
6. "Combining Modern and Paleo-Climate Data to Enhance Drought Prediction and Response", Stephen Jackson, Associate Prof, Botany, UW; Stephen Gray, Student, Botany, UW; Kenneth Gerow, Associate Prof, Botany, UW; Christopher Fastie, Consultant, Middlebury College, Mar 01 – Feb 03.
7. "The Wyoming Climate Atlas", Jan Curtis, Wyoming State Climatologist, Water Resources Data System Coordinator, Civil & Architectural Engineering Dept, UW, Mar 02 – Feb 04.
8. "Real-Time Monitoring of E. Coli Contamination in Wyoming Surface Waters", Paul E. Johnson, Physics and Astronomy, UW, Mar 02 – Feb 04.
9. "Drought Prediction Model Development and Dissemination in Wyoming", Michael A. Smith, Prof, and Thomas L. Thurow, Prof and Head, Renewable Resources Dept. UW; and Philip A. Rosenlund, Senior Univ Ext Educator, UWCES, Cheyenne, WY, Mar 02 – Feb 05.
10. "Geochemistry of CBM Retention Ponds Across the Powder River Basin, Wyoming". K. J. Reddy, R. A. Olson, and D.E. Legg, Dept. of Renewable Resources, UW, Mar 03 – Feb 06.
11. "Subsurface Drip Irrigation Systems: Assessment and Development of Best Management Practices". Drew Johnson, Civil Engineering; Renduo Zhang and George Vance, Renewable Resources, UW, Mar 03 – Feb 06.
12. "Water Scarcity and Economic Growth in Wyoming". Edward B. Barbier, Dept. of Economics and Finance, UW, Mar 03 – Feb 05.
13. "Conveyance Losses and Travel Times of Reservoir Releases Along the Bear River from Woodruff Narrows Reservoir to Cokeville Wyoming". Drew Johnson and Greg Kerr, Dept. of Civil & Architectural Engineering, UW, Mar 03 – Feb 06.

Objective 2

Four students received support and training through this project. Two (Crystal Lesmeister and Ray Alexander) were Civil Engineering students, one (Liz Woods) was a Geography student, and the other (Jeff Baxter) was a Geology student. The student positions provided considerable project management training. Among other activities, the students provided administrative assistance through file and web-site management and preparation and/or review of the annual applications, reports, surveys, RFPs, budgets, and proposals. In addition, Crystal Lesmeister and Ray Alexander performed research and received their Masters degrees with support and supervision as a result of this project.

Summary of Lesmeister's Research:

The effectiveness of measuring lawn sprinkler application rates using the catch-can test was evaluated. A survey of sources recommending the catch-can test for measuring application rates show that catch-can test procedures differ in the collector type, collector placement, number of collectors, and test duration. Analyses of catch-can tests were performed to address these procedural differences, with emphasis on the type and number of collectors required to provide a reasonable level of confidence in test results. The accuracy of the catch-can test generally improves as the number of randomly placed collectors increases. In order to achieve an

accuracy of $\pm 25\%$ for ninety out of one-hundred catch-can tests, the number of randomly placed collectors required ranged from 6 to over 50 for hand-move systems while for in-ground systems the number of randomly placed collectors required ranged from 2 to 8, depending on the pressure and percent overlap of the water distribution pattern. As long as a reasonable number of collectors were used when performing a catch-can test, no consistent differences were observed in catch-can test results due to type of collectors when using tuna fish cans, soup cans, or coffee mugs.

Details of this research are given in the Lesmeister thesis and publication listed at the end of this report.

Summary of Alexander's Research:

Irrigation water in Wyoming has become especially limited due to the continuing drought that started in the winter of 2000. In the North Platte basin, unusually low average snowpack conditions and low carryover storage in Pathfinder and Guernsey reservoirs have led to the management of junior water rights. Compounding the problem of low water availability in the North Platte drainage is that in 1997 the States of Colorado, Nebraska, and Wyoming signed a cooperative agreement to settle the long-term litigation concerning Platte River water. The objective of this study was to develop models for performing crop production loss estimates under deficit irrigation for application to Wyoming conditions. The models were to be developed by integrating existing information and data from Wyoming with recently published information. The first model combines monthly CU and CIR estimates and definition of the growing seasons from the "Consumptive Use and Consumptive Irrigation Requirements in Wyoming" bulletin, with crop growth stage information and the relationship of yield to moisture stress from FAO publications. The second approach uses the FAO-56 Penman-Monteith formula to estimate adjusted ET under deficit irrigation on a daily basis. The model uses wind adjustment factors, growing seasons, and the crop curves provided in the "CU and CIR in Wyoming" bulletin. In addition, the model uses the FAO crop growth stage information and yield vs. moisture stress relationship to estimate yield losses under deficit irrigation.

Details of this research are given in the Alexander thesis listed at the end of this report.

Objective 3

As the project title implies, objective 3 was a primary goal of this project. A critical component of the Water Research Program is the coordination of research activities between researchers, agency personnel, and private interests. In addition, in order to produce quality research, coordination is required for determination of research priorities, dissemination of information on research opportunities, and identification of research expertise. This coordination serves as an information transfer activity through meetings, conferences, and informal communications. An example is the service of the WRP Director as University of Wyoming advisor to the Wyoming Water Development Commission which often conducts joint meetings with the Wyoming Legislature's Select Water Committee. The Director reports annually to the Commission and the Select Water Committee. The Water Research Program has been developed upon the concept that it is the responsibility of the PIs of the research projects supported by 104 funds to participate in the information dissemination activities. Peer reviewed publications are expected from all projects and PIs are encouraged to present results to various groups. In addition to PI participation during the duration of research projects, the Director, through the Office of Water Programs, provides travel support for PIs of completed 104 projects. To date,

this has been a very successful approach. For example, PIs have attended the State's Basin Advisory Group meetings and presented results of their research at these meetings. As part of the State's Water Planning effort, Basin Advisory Groups have been formed. A Basin Advisory Group represents a cross section of the basin water users groups – agriculture, local government (municipal water, county or Joint Powers Board), recreation, industry, and environmental. Examples (not all-inclusive of the presentation given) of PI participation in information dissemination through meetings with users groups and agencies are:

- Wilkerson, G. V., Baxter, J. C., Johnson, J., 2000. GIS Erosion Potential Model for CBM Water Impacts. Paper presented at the 2000 Fall Geology Conference; Coalbed Methane in the Powder River Basin.
- Hamerlinck, J.D. and J.H. Johnson, 2000. Applying GIS Technology to Hydrologic Resource Assessment in the Powder River Basin, Northeast Wyoming (poster). Wyoming Geology Conference, University of Wyoming, Laramie, Wyoming, Oct.
- Wilkerson, G. V., Baxter, J. C., Johnson, J., and Montgomery, J. 2000. Burger Draw Erosion Potential Mapping Project. Invited presentation at the August meeting of the Methane Operators Group in Casper, WY.
- Brinkman, B., H. Lowham, and L. Pochop, 2000. Progress report to the WRP Priority and Selection Committee, Nov.
- Wilkerson, G.V., 2001. GIS Erosion Potential Model for CBM Water Impacts. U.S. Geological survey NAWQA Liason Meeting.
- Brinkman, Bruce; Hugh Lowham, Winter 2001, Winter Flow Modeling for the Mountainous Areas of Wyoming, Wyoming Water Flow, Volume LXIV, Issue 1, Pages 13-14.
- Wilkerson, G.V., 2002. Modeling CBM Surface Water Impacts Using Erosion Potential Modeler. Invited presentation to the Department of Civil Engineering and the Department of Geology, University of Minnesota, Minneapolis, MN.
- Pochop, L.O., 2002. Wyoming's water research program, presentation at the Wyoming Water Association Education Seminar, Casper, WY, Oct.
- Wilkerson, G.V., 2002. Modeling CBM Surface Water Impacts Using Erosion Potential Modeler. Geological Society of America Annual Meeting, Denver, CO.
- Wilkerson, G.V., 2002. GIS Model for Evaluating Coal Bed Methane Surface Water Discharges. Invited presentation to the Basin Advisory Group, Dayton, WY.
- Ostresh, Lawrence M., James D. Riley, Hugh Lowham, and Bruce Brinkman, 2002. Gridding winter precipitation data in Wyoming mountains, poster session presented at Great Plains/Rocky Mountain Division of the Association of American Geographers, Missoula, MT, Oct. (presented by Ostresh), availability referenced in Volume 2, Supplemental Information Report.
- Wilkerson, G.V., 2002. GIS Model for Evaluating Coal Bed Methane Surface Water Discharges. Invited presentation to the Basin Advisory Group, Lusk, WY.
- Wilkerson, G.V., 2002. GIS Model for Evaluating Coal Bed Methane Surface Water Discharges. Invited presentation to the Niobrara Conservation District, Lusk, WY.
- Wilkerson, G.V., 2002. Modeling CBM Surface Water Impacts Using Erosion Potential Modeler. Invited presentation at the CBM Water Management Conference, Jackson Hole, WY, Sept..
- Wilkerson, G. V., Baxter, J. C., Johnson, J. H., and Konrad, S. K., 2003. A GIS model for assessing the impact of increased channel discharges on hydraulic geometry. Manuscript in preparation.

Ostresh, Lawrence M., James D. Riley, Bruce Brinkman, and Hugh Lowham, 2003. Effect of land cover on winter streamflow in southeastern Wyoming mountains, poster session presented at the National Meetings of the Association of American Geographers, New Orleans, LA, March, (presented by Ostresh), availability referenced in Volume 2, Supplemental Information Report.

Wilkerson, G.V., May 2003. Modeling CBM Surface Water Impacts Using Erosion Potential Modeler. Invited presentation to the State Water Forum, Cheyenne, WY.

Wilkerson, G.V., Jan. 2003. Modeling CBM Surface Water Impacts Using Erosion Potential Modeler. Invited presentation to the Niobrara Conservation District and the U.S. Natural Resources Conservation Service, Lusk, WY.

Water Research Program Web Site:

A web site for the WRP was created and maintained initially by the Wyoming Water Resources Data System. This site is used to disseminate information about the WRP, including posting of the Program's Section 104(b) Request for Proposals, contact information, listing of abstracts and program products, useful links, and announcements, such as the Announcement/Request for Proposals for the National Competitive Grant Program authorized by Section 104(g) of the Water Resources Research Act of 1984, as amended. The WRP web site was transferred from the University of Wyoming Water Resources Data System) to the Civil and Architectural Engineering Department in the Engineering College and can be viewed at the following URL: <http://www.eng.uwyo.edu/civil/research/wwrp/> The main reason for the move was to permit easily access for the Director for updating information. Considerable work was done in revising the site, with more planned.

Report to Program's Priority and Selection Committee:

A Priority and Selection Committee (P&S committee) reviews and approves all proposals submitted to the USGS for consideration under the Wyoming Water Research Program. The P&S Committee is a group of Federal and State representatives which also prepares the Section 104(b) Request for Proposals each year. The P&S Committee has recognized the importance of information dissemination to the overall WRP. Since the P&S Committee represents seven agencies actively involved in water planning and management, they are well informed with respect to information needs. In addition to identifying research priorities and recommending projects for funding, the P&S committee monitors project progress. The committee receives reports at its summer meeting from PIs of projects completed during the year and reports at its winter meeting from PIs of projects continuing into the next fiscal year. .

Project Publications:

Lesmeister, Crystal, Dec 2004. Crop Production Under Deficit Irrigation, M.S. Thesis, Dept. of Civil and Architectural Engr., UW.

Alexander, Ronald Ray, May 2005. Crop Production Under Deficit Irrigation, M.S. Thesis, Dept. of Civil and Architectural Engr., UW.

Lesmeister, Crystal K., L. Pochop, G. Kerr, Shaun S. Wulff, and D. Johnson, 2007. Evaluating the "Catch-Can" Test for Measuring Lawn Sprinkler Application Rates, J. of the American Water Resources Association, Vol. 43, No. 4, August, pp. 938-946.

Student Support and Training:

Four students received support and training through this project. The students assisted with the administrative responsibilities of the program, with two of the students also conducting research. The students included one undergraduate, two graduate students, and one who was both an undergraduate and graduate student.