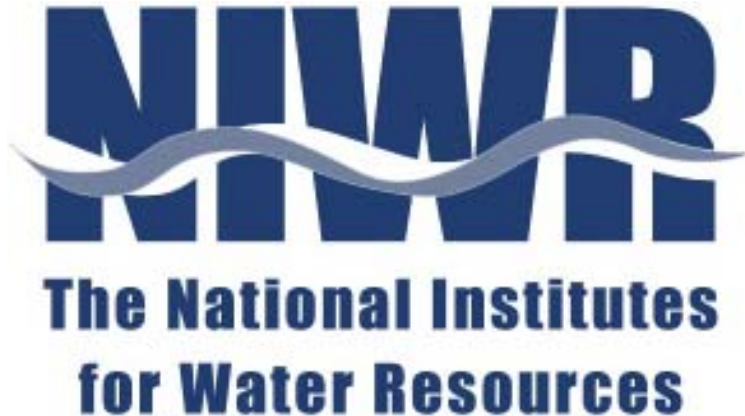


2003
Program Highlights



***THE FUTURE OF
WATER
RESOURCES:
INNOVATIVE
RESEARCH AND
CREATIVE YOUNG
PROFESSIONALS***

**An
Overview of the
Projects of the
Nation's 54
State
Water Resources
Research
Institutes**



*The Water Resources Research Act's State Institutes at Work
on the Nation's Water Problems
<http://wrrri.nmsu.edu/niwr/niwr>*

Alaska Institute begins development of monitoring program for underground nuclear testing site on Amchitka Island.

The underground nuclear testing site on Amchitka Island, Alaska is highly contaminated with radionuclides and hazardous materials but is the most likely site likely one of the only potentially highly contaminated (in terms of mass of radionuclides and hazardous materials) in the United States that does not have a comprehensive monitoring program. The **Alaska Water and Environmental Research Center** is in the early stages of developing a monitoring program for the Amchitka Island underground nuclear testing site.

Arizona Institute develops a comprehensive water sustainability plan for Tucson.

The **Arizona Water Resources Research Center** wrote and published a comprehensive report on Tucson water issues, addressing such topics as water quantity, water quality, treatment options, water uses and conservation, etc. The report was done at the request of University of Arizona President Peter Likins, to provide information to the public about critical Tucson water issues. The report contributed to the public debate that was at that time in progress. The report objectively provided the scientific and public policy background to enable citizens to make an informed decision. The 150- page publication, "Water in the Tucson Area: Seeking Sustainability," is the best single reference on Tucson water issues. Information from the publication was condensed into a newspaper supplement published by Tucson Newspapers, Inc. in a Sunday edition of the Arizona Daily Star.

Arkansas Institute balances phosphorus for the Illinois River.

Arkansas Water Resources Center investigators Marc Nelson, Kati White and Thomas Soerens recently compiled a phosphorus mass balance for the Illinois River system in northwest Arkansas. These data are critical input to a Decision Support System being developed for watersheds in northwest Arkansas that have been impacted by point and nonpoint source contaminants. Contaminant load to the Illinois River was estimated to be 43 percent from point sources (municipal effluent) and 57% from nonpoint sources (animal manures, poultry litter, commercial fertilizer, and natural sources) within the watershed. These data are important because excessive phosphorus has resulted in eutrophic conditions in impoundments on the Illinois and other rivers in region. The Illinois flows west into Oklahoma where a new phosphorus standard of 0.37 mg/L

has been proposed. Based on the mass balance estimations prepared by Nelson and others it is clear that this limit is being exceeded during base flow conditions due in large part to the point sources within the watershed, and during storm pulses due primarily to the nonpoint source contribution. Basing planning and management decisions on quality data is the key to successfully reducing impacts of eutrophication in this and other watersheds throughout the Ozarks.

California Institute builds new research bridges with key state regulatory agencies.

California Center for Water Resources researchers, Kate Scow, Graham Fogg and David Hinton, have been working with department heads from key state regulatory agencies to improve the interaction between state agencies and the University of California research faculty. This bridge-building resulted in a memorandum of understanding between the University, the California Resources Agency and the California Environmental Protection Agency. Kate Scow is working with a microbe to neutralize MTBE, the controversial fuel additive threatening water supplies. Graham Fogg is working with California's threatened groundwater and David Hinton is working on aquatic toxicology in the Bay-Delta region.

Colorado Institute develops indispensable groundwater mapping software.

The **Colorado Water Resources Research Institute**, with support from the U.S. Geological Survey, South Platte Basin water users associations, the State Engineer's Office, the Northern and Central Colorado Water Conservancy Districts, and the Lower South Platte Conservancy District, continues to develop and enhance its South Platte Mapping and Analysis Program (SPMAP). SPMAP is used to evaluate ground-water recharge systems and to develop and operate plans whereby junior water right holders can augment flows to ensure that senior water right holders can utilize the full amount of their rights. The Northern Colorado Water Conservancy District has said that "In this current severe drought ...the computer software of SPMAP has become indispensable." The Central Colorado Water Conservancy District has said "it is committed to the use of the tools developed [to provide] assistance in the Water Court application of its Plan for Augmentation for its 1000 member wells." The Groundwater Appropriators of the South Platte River Basin, Inc. (GASP) has been involved in the development of SPMAP from the project's inception.

Connecticut Institute convenes a conference to convey Golf Course “Best Management Practices” to golf course operators, state regulators and public interest groups.

The **Connecticut Institute of Water Resources**, working cooperatively with the Connecticut Department of Environmental Protection developed guidelines for the best water resources management of golf courses. Assembling a broadly based Advisory Committee, the Institute developed the guidelines and presented a conference for industry professionals.

Delaware Institute supports state water quality commission and expands internship program.

Results of research by the **Delaware Water Resources Center** on improved phosphorus and nitrogen management techniques influenced recommendations leading to the development of Delaware’s Nutrient Management Act. Research conducted by three DWRC Graduate Fellows is supporting the work of the new Nutrient Management Commission created by the act.

The DWRC has expanded its water resources undergraduate internship program. The “hands on” program supports students conducting research of direct value to state efforts to solve problems related to water quantity and quality. During 2000 - 2002, twenty-two interns have been funded to investigate diverse topics such as water quality modeling and monitoring; establishing an “experimental watershed” for undergraduate research projects; wetland identification; water scarcity pricing; and nutrient management education for youth. Interns are mentored by university faculty or technical staff employed by state water resource agencies.

Georgia Institute addresses water problems in the mid-east’s largest watershed.

In partnership with United Nations agencies and the Nile Basin governments, the **Georgia Water Resources Institute** is developing a tool to aid basin decision-makers in finding “win-win” policies for future water resources development. The Nile Decision Support Tool (Nile DST) is a comprehensive water resources planning tool that includes applications focusing on hydrologic simulation, reservoir management, hydropower, remote sensing, and agricultural planning.

The Nile river basin is spread over ten countries covering an area of 3.1 million km³, or approximately 10 percent of the African continent. The river discharge per unit drainage area is small, and almost all of the Nile water is generated from only 20 percent of the basin, while the remainder of the basin is arid or semi-arid. Few basins surpass the Nile in its diversity of geography and culture and the complexity of its hydrology and politics.

Riparian nations must consider water resources as they plan their future economic and social development. These nations have elected to enter into negotiations to establish cooperative water resources development strategies. The Nile DST is designed to aid in the negotiations. Five applications, using of state of the art models, constitute the core of the Nile DST: 1) Reservoir Simulation and River Basin Management, 2) Remote Sensing, 3) Hydrology, 4) Database and 5) Agricultural Planning. In addition, one of the underlying tenets of the Nile DST development is integration of these separate applications in order to provide a comprehensive decision support tool.

Hawaii Institute research saves Honolulu over \$200 million.

For more than ten years, the **Hawaii Water Resources Research Center** has monitored the quality of waters near ocean outlets from Honolulu’s major sewage treatment plants. The program checks polychaete, mollusk, crustacean and fish species and abundance and performs histopathological examinations of fish caught near the outlets and a reference station. The program has found no indication of deterioration in the sediment quality, despite years of wastewater emissions. Indeed, the species and quantities of certain mollusks appear to be about the same as in samples taken by the Challenger expedition in its late-19th century visits to the Islands.

The work is a condition attached to Honolulu’s waiver of EPA’s secondary treatment rule. Using secondary processes would have cost the City over \$200 million in capital plus substantial annual operating and maintenance costs.

Indiana Institute works closely with state.

Dr. Ron Turco, director of the **Indiana Water Resources Research Center** has been serving as a technical reference and committee member for a task force on water quality standards for Indiana Department of Environmental Management (IDEM) as the agencies reviews and develops new water quality guidelines for dealing with E. coli or other pathogenic microorganisms. Also, members of the IWRRC staff and faculty from Purdue University are in frequent contact with state water agencies, serving on

other task forces. The Indiana Water Center is working to reenergize its relationship with the state, private business and with federal agencies in Indiana.

Iowa Institute explores fate of antibiotics in soil.

The **Iowa State Water Resources Research Institute** has been successful in assisting with many aspects of water resources research and education in Iowa since it's establishment. It currently sponsors research programs with funds appropriated to the Institute by USGS and Iowa State University. These projects have addressed major water issues facing Iowa today. Because of the major agricultural industry, many of the water research priorities address agricultural impacts on water quality and quantity. Recent research emphasis has addressed nutrients, animal waste, and sediment impacts on water quality. The Institute is currently supporting research on antibiotic fate in soil and water regimes, nitroso compound formation potential with treatment of organics in drinking water supplies, impacts of animal waste applications to surface and subsurface water quality, impact of wetlands on water quality in agricultural watersheds, phosphorus reduction strategies, and model evaluation for TMDL analysis.

Kentucky Institute receives award for excellence in environmental education.

The state fair educational exhibition of the Kentucky Water Resources Research Institute 2001: A Water Odyssey received a Spirit of the Land award recognizing international excellence in Environmental Education. The award was presented at the 2002 Olympic Winter Games in Salt Lake City, Utah on February 18, 2002. Funding for the project was provided by an EPA Section 319(h) Nonpoint Source Implementation Grant administered by the Kentucky Division of Water (Water Quality Branch, Nonpoint Source Section).

Louisiana Institute keeps New Orleans' head above water.

The City of New Orleans lies below sea level and is at extreme risk from Hurricanes and other major storm events. The Louisiana Water Resources Research Institute, under the direction of Joe Suhayda, has led an effort to model the magnitude of the storm surge threatening New Orleans with inundation and ways of mitigating the effect. This research has been sponsored by many organizations and agencies including the New Orleans Army Corps of Engineers, Jefferson Parish Office of Emergency Preparedness, and the Louisiana Office of Emergency Preparedness. It has been featured in Scientific American, the New York Times, on National Public Radio, CNN, and elsewhere.

Maine Institute focuses on agency and stakeholder partnerships.

The **Senator George J. Mitchell Center for Environmental and Watershed Research** has established successful partnerships with a number of key stakeholders and agencies. Director Steve Kahl co-authored a major report for US EPA ORD that examined the status and trends of water resources as affected by acid rain in the eastern US. (www.umaine.edu/waterresearch/Publications).

John Peckenham, Assistant Director, is developing source water protection methodologies in partnership with the Maine Drinking Water Program and US EPA. Mitchell Center researchers operate long-term gauged research watersheds in Acadia National Park working closely with NPS, USGS, and EPA. The Center is also the home of PEARL, the Maine environmental information database (<http://pearl.umaine.edu>), a collaboration of 7 agencies and 4 environmental non-profits.

Maryland Institute trains award winning student.

The **Maryland Water Resources Research Center's** student researcher, Eunyong Hong, has been selected as a winner of a 2002 Student Research award by the research Committee of the Pennsylvania Water Environment Association (PWEA). Eunyong was awarded with a check for \$300 and engraved plaque at the conclusion of her presentation.

Massachusetts Institute seeks environmental justice for multicultural city lake users.

In cooperation with the City of Springfield on an EPA EMPACT grant, the **Massachusetts Water Resources Research Center** helped establish neighborhood lake monitoring groups to encourage active stewardship of the 16 ponds and lakes in greater Springfield and to make subsistence fisherman from several cultural groups aware of fish consumption health concerns.

Michigan Institute helps state protect groundwater sources for individuals and communities.

In partnership with the Michigan Department of Environmental Quality (MDEQ), the **Michigan Institute of Water Research** coordinates the statewide Source Water Assessment Program for non-community water supplies. Working with six University subcontractors throughout the state, the Institute of Water Research provides technical assistance and facilitation support for the more than 10,000

assessments that are being submitted by local and regional health departments. Currently, a public information campaign is being developed that will distribute the results of the assessments to the local communities.

Institute of Water Research staff members also provide outreach support to communities working on wellhead protection programs. In addition to providing training sessions at the request of the MDEQ, in 2002 the IWR coordinated the development and organization of a wellhead protection conference, *From Vision to Reality, Planning and Implementing Successful Wellhead Protection Programs*, which was attended by over 150 individuals representing public groundwater supplies statewide.

Institute of Water Research staff members also serve as members of Michigan State University's Wellhead Protection Program team. The University's efforts in protecting the groundwater supply that serves 50,000 people daily were recognized by the Michigan Department of Environmental Quality in a Wellhead Protection Program recognition ceremony in 2002. Also in 2002, Michigan State University became the first university in the U.S. to be recognized as a Groundwater Guardian Community by the Groundwater Foundation, a nonprofit organization that promotes proactive groundwater protection activities.

Mississippi Institute enhances sustainability of small drinking water systems in Southeast.

The Southeastern Regional Small Drinking Water Systems Technical Assistance Center (SE-TAC) adopted a fairly unique approach to technical assistance. Specifically, the SE-TAC is a forum to build partnerships and collaboration to identify and apply all available federal and state technical and financial assistance programs to enhance small drinking water systems' capacity and sustainability and to protect source water. The SE-TAC has a fifteen member Advisory Board composed of state primacy agencies, state rural water associations, and small system or other technical assistance providers from 5 states (Alabama, Louisiana, Mississippi, North Carolina, and Texas) to identify regional needs and priorities for an eleven state region. The Board ensures that SE-TAC funding fills gaps in existing programs or tailors existing programs and materials to fit particular needs without duplicating other programs. The SE-TAC solicits proposals region-wide to enhance or expand technical assistance or training programs with customized material or classes; to take training directly to small systems; train the trainer programs or to support applied research. The multi-state Advisory Board has been very supportive and helpful in maintaining funding for this project.

Montana Institute works to restore wild fisheries.

Habitat degradation is one of the principal reasons for the listing of wild fish under the Endangered Species Act. The detrimental effects of fish predators and diseases are exacerbated by habitat degradation. Private landowners and Federal land management agencies that host threatened or endangered fish populations must adhere to rigorous habitat conservation plans, which often restrict possible land uses. Economic opportunities are foregone when land uses are restricted and resources are directed toward fish restoration.

Many techniques of habitat enhancement and fish restoration have been implemented, but overall their efficacy under different conditions is not well understood. The Montana Water Center has undertaken a multi-year program of research and information transfer designed to identify key fish- or habitat-restoration measures, define their successful implementation, and actively disseminate the information to those who manage coldwater fisheries in the western U.S. Four projects are underway: definition of the thermal tolerances of west slope cutthroat trout, testing of fish-screening methods and devices for irrigation diversions, control measures for bacterial coldwater disease, and technology transfer. The overall goal is to enhance the success of habitat-restoration and fish-reintroduction projects over a very wide area.

Nebraska Institute research demonstrates benefits of sprinkler irrigation in reducing groundwater nitrate.

Irrigating crops with sprinkler instead of furrow irrigation systems can substantially reduce shallow ground-water nitrate contamination, according to results of a 6-year study conducted by the **Nebraska Water Resources Center**. The research consistently found higher average nitrate-nitrogen levels under furrow and surge-irrigated plots than beneath the center pivot-irrigated plot. There also were larger fluctuations in nitrate-nitrogen concentrations associated with the furrow irrigation method, suggesting that center pivots are vastly superior in applying uniform amounts of water.

Nevada Institute develops tools for water conflict resolution.

The **Desert Research Institute** recently completed an Environmental Impact Statement of the Walker River Basin analyzing the effects of a proposal to buy upstream water rights from willing sellers in order to bring more water to the teetering ecosystem of Walker Lake. That same water could also aid the recovery of the threatened Lahontan

cutthroat trout in the Walker River Basin and help address issues related to the United States' water rights claims in the basin. The proposal is controversial, since more water for Walker Lake would mean less water for irrigation in agricultural communities upstream. Without the water, however, the current Walker Lake ecosystem will collapse, taking with it a large chunk of the economic base of communities nearer the lake. This evokes a lot of passion on both sides.

During a series of public meetings and workshops held in communities throughout the area, DRI faculty attempted to get to the bottom of those strong feelings, pinpointing citizens' most pressing concerns and using their input to develop potential strategies to help meet those concerns.

The findings were then incorporated into a computer model developed by DRI researchers to show how each possible course of action might be likely to play out in the real world. It's a tool that will give all sides a chance to see a little more clearly into their possible futures and, perhaps, narrow the divide between opposing viewpoints. While this tool can't provide an ultimate solution, it can provide reliable data and realistic alternatives – just the tools that decision-makers will need to help make those choices.

New Hampshire Institute assesses biosolids impact.

The **New Hampshire Water Resources Research Center** assessed the impacts of biosolids management on groundwater quality. University of New Hampshire researchers showed that in several wells at the study site, nitrate levels frequently exceeded safe levels. The project director has testified to the state legislature regarding the study findings, and the project results will play a role in determining biosolids management practices in New Hampshire.

New Jersey Institute conference asked how water demand and supply limits economic development.

“Water for South Jersey – Will the Supply Meet the Demand” – funded by the **New Jersey Water Resources Research Institute** and Southern New Jersey Development Council represented a multi-agency collaboration among federal, state and local groups to present timely information on aspects of the growing demand for water in South Jersey and its emergence as a limiting factor for development. Trends, alternatives, perspectives and solutions were presented to a group representing a cross-section of those most concerned with water use including industry, developers, builders, environmental advocates, academics, government officials, politicians, attorneys, and environmental consultants. News coverage in several local and state papers was extremely favorable.

New Mexico Institute cooperates with Mexico on water planning map.

New Mexico Water Resources Research Institute staff joined forces with the Universidad Autónoma de Ciudad Juárez and the University of Texas at El Paso to develop and create a regional geographic information system (GIS) to support regional water planning in the Paso del Norte borderland area of the southwestern United States. The map incorporates several components: geodetic control, orthoimagery, elevation, transportation, hydrography, governmental units, and cadastral information. The widespread use of the map will remind water managers in the border area of the regional character of water in the Paso del Norte, rather than the more common partial perspectives derived from county, municipal, state, or national maps. The effort also stimulated cross-border cooperation, within the framework of the Paso del Norte Water Task Force.

New York Institute plays lead scientific role in New York City Watershed Program.

The **New York State Water Resources Institute** has continued to play a lead scientific and educational role in the New York City Watershed Program. The high environmental and economic significance of this program attracts a high degree of national and international interest. With the assistance of WRI, Delaware County has now obtained over \$7.0 million to conduct scientific and technical work on the Cannonsville Reservoir Basin. A particular success is the innovative integrated nutrient management program that the WRI has facilitated. This program, led by faculty at Cornell University, is developing and applying integrated models for animal nutrition, field crops, soil and water. By using the models, imports of phosphorus can be reduced by up to 50% and the amount of phosphorus in manure reduced by 25%. This environmental gain is accomplished with economic benefits to the farmer. The models also improve the recycling of nutrients on the farm and promote more efficient applications of manure resulting in greatly reduced losses of the nutrients to watercourses. WRI is also assisting in extending the adoption of the management methods elsewhere in New York State through the NYS Agricultural and Environmental Management Program. The Cannonsville Reservoir Program conducted through Delaware County is also receiving a high level of acknowledgement. The recognition is due in large part to the solid scientific credentials upon which the watershed program is based. This is an excellent example of how the academic scientific community: faculty, staff and students, can assist in meeting a critical water resources challenge.

North Carolina Institute develops stream identification methodology to implement buffer requirements.

The North Carolina Environmental Management Commission has implemented rules requiring that forested buffers be left undisturbed along streams in water supply watersheds and in two river basins: the Neuse and the Tar-Pamlico. In water supply watersheds, buffers must be left along perennial streams. In the Neuse and Tar-Pamlico buffers must be left along intermittent and perennial streams. Local governments responsible for implementing these rules discovered that existing maps do not always identify these streams accurately, and the North Carolina Division of Water Quality's stream identification method was shown to be unreliable in identifying the origin of perennial streams, particularly in urbanized areas of Piedmont North Carolina. The City of Greensboro, NC, through the North Carolina Water Resources Research Institute's Urban Water Consortium, enlisted Dr. James D. Gregory of NC State University to cooperate with the North Carolina Division of Water Quality to develop a stream identification methodology for consistently identifying intermittent and perennial streams. Through several months of field investigation and input from stakeholders and citizens, a methodology was determined.

This stream identification methodology and a stream mapping project based on the methodology provide a critical tool and a model for implementing buffer requirements for local governments across Piedmont North Carolina.

North Dakota Institute fellowship program provides research and water professionals to agencies.

North Dakota Water Resources Research Institute Fellowship projects for the year 2002 include comparison of two local ozonation systems in terms of their disinfection by-products formation, modeling feedlot runoff quantity and quality, biomanipulation of fish species in wetlands, phosphorus transport through wetlands, influence of timber harvesting on wetlands and habitat use. Another ecological research on periphyton communities in the Sheyenne River provides baseline data for the Devils Lake outlet project.

One Fellow was hired by the U.S. Geological Survey North Dakota district, and another by the North Dakota State Water Commission. Several work for municipalities and watershed districts and water resources engineering firms in the region. A Fellow is involved in pilot testing of ultraviolet disinfection systems for drinking water treatment. The U.S. Forest Service has shown interest in a

study on forested wetlands to develop ecologically based Best Management Practices. One Fellowship permitted the development of a screening method that can determine total PCB and PCDF in water sample and tell before hand whether the sample merits detailed chromatographic analysis. In another Fellowship project, a new species found in the Sheyenne basin indicates that the algal communities in North Dakota are diverse and not well documented. The results will contribute to a better understanding of the algal communities and the environmental factors that affect them.

Oregon Institute enters water conflict fray.

The **Oregon Center for Water and Environmental Sustainability (CWEST)** participated in a research project and sponsored two conference sessions on water conflict in Oregon's Klamath Basin. During spring 2001, federal agencies shut off irrigation withdrawals in order to prevent jeopardizing two endangered fish populations. The dispute brought national attention and debate over the Endangered Species Act. CWEST's co-director, Denise Lach, contributed her expertise in environmental sociology to a study of the effects of the water shut-off on the basin's people and society, natural environment and economy. The study was conducted jointly by Oregon State University and University of California – Davis.

CWEST also organized two conference sessions on the water conflict. One session, at the Cordilleran Section of the Geological Society of America 2002 meeting, focused on science communication and used the Klamath Basin as an example. A second session, at the Regional Vomocil Water Quality Conference, focused on the divergent views in the basin and included presentations by scientists, Native Americans, farmers, and educators.

Pennsylvania Institute creates clean water from old tires.

A new exploratory research project funded through Penn State-Harrisburg and the **Pennsylvania Water Resources Research Center** was initiated last year to study an innovative filter media for wastewater consisting of crumb rubber from recycled tires. Crumb rubber as a filter media is far more effective than conventional dual-media sand-anthracite filters and helps to reduce tire disposal problems. Crumb rubber allows for greater depth filtration and a higher filtration rate and has a much lower weight than conventional media. Filtration with crumb rubber is proposed for use with domestic wastewater and ship ballast water.

South Carolina Institute projects impacts of urban sprawl.

The **South Carolina Water Resources Research Institute** recently completed more work on urban area growth projections. These projections have stimulated policy discussions across South Carolina related to sustainable growth, sprawl and the environmental impacts of rapidly urbanizing areas on the watersheds within and adjacent to those urban areas. This work is intended to be used in resource planning and management as well in the policy-making arena.

Two important research projects were funded by the Institute this past year. The first one is comparing land use patterns to impaired stream segments within the Saluda and Reedy River Watersheds. The effort is intended to trace the impairments to their sources. The second project is working to design, construct and monitor the performance of a full-scale constructed wetland and analogous pilot-scale constructed wetlands for tertiary treatment of domestic wastewater for reuse. This particular project has been measuring the performance of specifically designed constructed wetlands to remove nitrogen, phosphorus, organics, solids and fecal coliforms from secondary and primary treated wastewater; and characterizing the outflow water from the constructed wetland treatment system in terms of its suitability for reuse in golf course irrigation or for plantings for shoreline erosion control, wildlife, and power line beautification and enhancement.

South Dakota Institute provides guidance to agriculture on phosphorus control.

The most significant recent accomplishment of the **South Dakota Water Resources Research Institute** began in 2000 with the completion of a literature review titled "A Literature Review of Phosphorus Accumulation in Soils and the Impact on Runoff Water Quality". The literature review led to a conference in 2001 that brought together producers, regulators and experts in the field of soil phosphorus and runoff. Research began in 2002 to gather data currently not available in order to establish regulations to protect water quality without creating undue hardships for livestock producers. Bringing livestock producers and regulators together, and establishing a partnership between them is a major step forward for the state of South Dakota. This partnership has the potential for creation of a phosphorus index that could be used as a tool to guide manure applications in a way that will protect water quality. Results of this research could be used to develop regulations that are specific to South Dakota. This research also supports a PhD student in the SDSU Atmospheric, Environment and Water Resources program.

Texas Institute works to conserve water.

Recognizing the importance of improved coordination and expansion of current research and Extension activities, the Texas A&M University System Board of Regents established the Irrigation Technology Center in the **Texas Water Resources Institute** to provide a focus for improving irrigation efficiency throughout the state. The center will coordinate efforts in urban programs, agricultural crops, wastewater reuse, and equipment testing and certification.

The Rio Grande Basin Initiative is a joint effort of the Texas A&M University System Agriculture Program and New Mexico State University coordinated by the Texas Water Resources Institute. The goal of this Congressionally-funded initiative is to increase irrigation efficiency and water conservation in the Rio Grande Basin through research and Cooperative Extension activities.

Coordinated by the Texas Water Resources Institute, the Texas A&M University System Agriculture Program and the Texas A&M College of Engineering are collaborating with the University of Texas to develop better simulation tools. The goal is to improve water management by the Army Corps of Engineers and River Authorities.

Virginia Institute contributes to stream TMDL methods.

The **Virginia Water Resources Research Center** received a two-year grant from EPA through the Virginia DEQ to develop Total Maximum Daily Load (TMDL) plans for streams impacted by aquaculture farms in Virginia. This study was coordinated with the Center's DEQ Academic Advisory Committee. The Water Center fulfilled the contract through careful monitoring and modeling, the use of best professional judgment from an advisory team of experts, and input from the public. In April 2002, the Water Center submitted six TMDL reports to DEQ, which were reviewed and approved by EPA. The report is expected to have national implications for developing benthic TMDL plans.

West Virginia Institute seeks quicker way to measure mercury.

The **West Virginia Water Resources Research Institute** is developing the technique of electrochemical detection of Hg to less than 10^{-10} M levels in solutions using DBB electrodes and adapting the technique for the rapid quantification of mercury at power plant sites.

During the project's first year, efforts were directed primarily at developing calibration curves for mercury detection in laboratory prepared solutions. Experiments

focused on the effects of chloride and nitrate ionic species on the sensitivity for Hg detection. Presence of chloride ions was found to improve the sensitivity more than the nitrate ions, but the formation of mercurous chloride was found to affect the reproducibility of the results. By co-deposition of gold in the ppm range on the BDD electrodes, the formation of mercurous chloride is avoided and reproducible curves for Hg detection in the 1-50 ppb range have been obtained. Square wave anodic stripping voltammetry was used to detect Cd and Pb up to 1 ppb level and mercury up to 50 ppb levels in 0.1M KCl solution. The calibration curves were found to be non-linear at lower concentrations but linear at higher concentrations.

Wisconsin Institute removes groundwater arsenic.

Arsenic contaminates public and private groundwater supplies in high concentrations in 23 of Wisconsin's 72 counties, particularly those in southeastern Wisconsin and the Fox River Valley. The **Wisconsin Water Resources Institute** (WRI) supports a comprehensive package of university and state agency projects that address the sources of arsenic, the mechanisms of its release to groundwater, public health effects of arsenic, and specific treatment and removal strategies. To comply with new arsenic reduction standards set by the U.S. Environmental Protection Agency, many groundwater pumping stations need to install treatment units to remove excess arsenic. The American Water Works Association estimates the cost of meeting the new arsenic standard nationwide at \$6 billion in initial capital costs and about \$600 million annually thereafter. Clearly, cost-effective arsenic removal techniques are urgently needed. A Wisconsin WRI project completed in 2002 developed and tested an inexpensive, high-performance photoactive adsorption media for the simultaneous removal of two toxic species of arsenic (arsenite and arsenate) from groundwater without adjusting for pH nor adding other chemicals. This study indicated that photocatalytic adsorption may offer an effective single-step method for removing both species of arsenic without requiring separate oxidation and adsorption processes.

Wyoming Institute focuses on stream flow.

Stream flows that originate in the mountainous areas of Wyoming are receiving increased interest in relation to allocation of water rights. This is a major source of water for non-consumptive instream flow rights and numerous consumptive water rights located within and downstream of the high mountain basins of Wyoming. To properly plan for and manage this remote resource, there needs to be a way to determine the yearly cycle of volume and time of year that determines water availability. The **Wyoming Water Research Program** is examining the hydrologic impacts of water right allocation, including changes in instream flows, resulting from changes in irrigation practices and land use. The study area is the Salt River drainage basin (Star Valley). The methodology used incorporates comparing flows in the Greys and Salt Rivers. The Greys River, due to lack of agriculture in its drainage area, can be used as a control and flows in the Greys River can be compared to flows in the Salt River where changes in land use and irrigation have occurred. Comparing flows in the Greys and Salt Rivers allows effects due to changes in land use and irrigation practices to be quantified.

The primary purpose of this project is to determine and document the accuracy of the available methods for estimating streamflow values in the mountains of Wyoming. Of particular interest are winter flows, which are sometime difficult to measure. The secondary purpose of this project is to review the possibilities of using emerging technologies such as remote analysis using Geographic Information Systems (GIS), that may help in the determination of the basin's properties.

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