About the Center...

The Pennsylvania Water Resources Research Center (WRRC), founded in 1964, is one of 54 federally funded state and territorial water research centers and institutes nationwide designated to conduct research and technology transfer programs. The Center operates under the authority of the Water Resources Research Act of 1984 and in cooperation with the U.S. Geological Survey, U.S. Department of the Interior. The Center has three objectives:

• To plan, facilitate, and conduct research to help resolve local, state and national water resources problems;
• To train water scientists and engineers through participation in water resources research and outreach; and
• To promote technology transfer and the dissemination and application of research results.

With a focus on water problems pertinent to Pennsylvania and the mid-Atlantic region, research areas include water quality and quantity management; hydrologic model development and assessment; and fate and impact of pollutants.

The center maintains a fully equipped and staffed inorganic water quality laboratory. Additionally, the water resources extension specialists associated with the College of Agricultural Sciences, serve as a liaison between the scientific and technological community and the public. More information is available on the Center’s website: www.pawatercenter.psu.edu.

Recent research activities...

Using its FY2007 funds, the PaWRRC provides administration and funding for a program of small grants in support of exploratory water resources research, public education, and training. Funds are provided on a 2:1 non-federal: federal matching basis. Recently funded projects for FY2007 are summarized below.

Web-Based Learning for Private Water System Owners

More than three million rural residents of Pennsylvania rely on private wells, springs and cisterns for drinking water and 20,000 new private wells are drilled each year. More than 50 percent of private water systems in Pennsylvania have been found deficient in drinking water quality for at least one health standard. To help safeguard drinking water quality, a web-based educational program for private water system owners that will assist with education about private water system maintenance and management is being developed by Bryan Swistock and Stephanie Clemens with the School of Forest Resources at the Pennsylvania State University. An on-line educational program and videos will be produced that will detail methods to protect and enhance private water systems. Marketing of these materials will be accomplished through extension educators, well drillers, water testing laboratories and volunteers from the Master Well Owner Network.
Microbial Cycling of Iron in Acid Mine Drainage

Pennsylvania has more than 3800 miles of streams impacted by acid mine drainage (AMD) associated with past or current coal mining activities and AMD represents Pennsylvania’s single largest water quality problem. AMD is formed when coal bearing sediments that contain abundant pyrite – an iron containing mineral – are exposed to oxygen-containing waters via the mining process. Neutralization and removal of dissolved iron represent the most pressing targets of AMD treatment. While passive treatment strategies may involve various levels of engineering, they all involve the neutralization of iron-containing waters using limestone. However, during the process, precipitates of iron oxide coat the limestone thereby reducing further neutralization capacity. A possible solution to increase the effectiveness of passive treatment would be to remove the iron before neutralization with limestone. Bacteria communities in one AMD-impacted seep (Gum Boot seep in north-central Pennsylvania) appear to be removing iron prior to neutralization. Penn State researchers Drs. John Senko, William Burgos with the Department of Civil and Environmental Engineering and Mary Ann Bruns with the Department of Crops and Soil Science are characterizing the microbial activities, community structure and oxygen requirements of bacteria in the Gum Boot system to identify the organisms that are catalyzing iron removal from AMD to potentially improve the design and efficiency of passive treatment systems.

FAME Profiling to Trace Sources of Microbial Pollution in Streams

Despite significant progress since the passage of the Clean Water Act in 1972, the water quality in the U.S. is still a major concern with nearly 270 thousand miles of rivers, 8 million acres of lakes, and 16 thousand square miles of estuaries being polluted. Microbial water quality is one of the leading water quality issues threatening bodies of water that serve as drinking water sources, recreational environments, and sources of food. Sources of microbial contamination must be identified before effective watershed management and treatment practices can be instituted.

Dr. Metin Duran with the Department of Civil and Environmental Engineering at Villanova University has been conducting laboratory studies researching host-specific differences in the fatty acid methyl ester (FAME) profiles of indicator organisms and has developed a large database containing over 1,700 isolates of total coliform (TC), fecal coliform (FC), Escherichia coli, and Enterococcus using samples from six possible sources of fecal matter: sewage, cow (dairy and beef cattle), poultry, swine, deer, and waterfowl. The high accuracy of this novel process in distinguishing sources of fecal matter when there are known-source libraries is significant but the susceptibility of FAME profiles to temporal variations and possible changes in FAME profiles of indicator organisms once they are in their secondary habitat, i.e. the water environment, needs to be tested. Duran is field testing the effectiveness of FAME profiling of microbes from various sources in Chester Creek in southeast Pennsylvania and if FAME profiles are conserved in field environments, the method offers a simpler, lower-cost alternative to genotypic methods for tracking microbe sources.

Detection of Stream-Aquifer Interactions Using Fiber-Optic Distributed-Temperature Sensors

Up to half of nitrate loading to the Chesapeake Bay comes from groundwater in streamflow, but determining the location and timing of groundwater inputs to streams is difficult using conventional approaches. New fiber-optic distributed temperature sensing cable systems hold promise to detect even small groundwater inputs to streams with a high degree of spatial and temporal resolution. Drs. Kamini Singha and Fred Day-Lewis with the Dept. of Geosciences at Penn State and the US Geological Survey, respectively, are using FO-DTS cable to pinpoint groundwater inputs on the E. Mahantango Creek in central Pennsylvania. They will use this technology to study stream-aquifer interactions and to relate those inputs to nitrate variations in stream water.