Drinking Water News For America's Small Communities

On tap

Published by the
National Environmental Services Center

Spring 2007, Volume 7, Issue 1

Working Together

FACTORS LEADING TO WATER SYSTEM MERGERS

Also in this issue:

Assessing Your Watershed

RUS Loans and Grants Program

Energy Audits May Offer Cost Savings

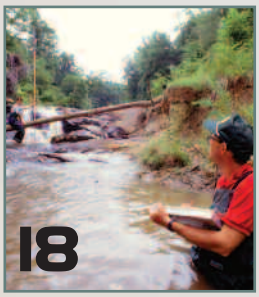
A New Measure of Success

This photograph of Farm Spring in Berkeley County, West Virginia, was taken by Dorothy Vesper for the West Virginia Water Research Institute and is used with their permission. Learn more about the WVWRI by visiting their Web site at *http://wvwri.nrcce.wvu.edu*

On tap MAGAZINE

Drinking Water News & Information for America's Small Communities

Spring 2007, Vol. 7, Issue 1



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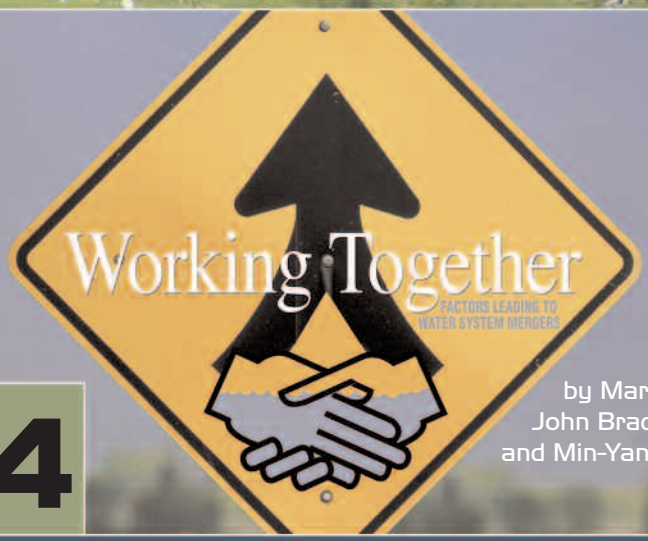

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Tech Brief

Line Pigging

Line pigging is an internal pipe-cleaning process used to remove biofilms or other foreign matter from the inside of water pipes. If performed correctly, line pigging will renew the flow rates to restricted piping systems and reduce pumping pressures. This Tech Brief discusses some of the techniques and processes used in cleaning waterlines in distributions systems.

On Tap

Drinking Water News and Information
for America's Small Communities

Spring 2007 • Volume 7 • Issue 1

Sponsored by USDA Rural Development

James Andrew, Administrator

Lorrie Davis, RUS Loan Specialist

Rural Development

USDA's Rural Development Utilities Service strives to serve a leading role in improving the quality of life in rural America by administering its electric, telecommunications, and water and waste programs in a service-oriented, forward-looking, and financially responsible manner. Founded in 1947 as the Farmer's Home Administration, Rural Development has provided more than $35 billion for water and wastewater projects. For more information, visit their Web site at *www.usda.gov/rus/*.

The National Environmental Services Center

The National Environmental Services Center (NESC) is a nonprofit organization providing technical assistance and information about drinking water, wastewater, infrastructure security, utility system management, solid waste, and environmental training to communities serving fewer than 10,000 people.

To achieve this mission, NESC offers a toll-free technical assistance hotline, hundreds of low-cost or free products, magazines and newsletters, and several searchable databases. We also sponsor conferences, workshops, and seminars. Visit the NESC Web site at *www.nesc.wvu.edu* or call toll-free (800) 624-8301and request an information packet.

NESC is located at West Virginia University, one of the nation's major doctoral-granting, research institutions.

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It's a phenomenon that has many names: regionalization, consolidation, and merger, to name the most familiar. Although each situation has subtle differences, all the descriptors in essence are referring to two or more water systems joining together in some fashion.

Opinions about these mergers tend to be polarized. Proponents cite better efficiency, cost savings, and improved ability to meet more stringent regulations as prime reasons to support system consolidation. Opponents resent what they see as meddling and bemoan the attendant loss of autonomy, and note that, in many cases, merging is simply impractical given the isolation of many rural communities

Regardless of how you feel about mergers, most experts agree that the trend is likely to continue. To shed light on this subject, University of Illinois researchers **Martin Jaffe**, **John Braden**, and **Min-Yang Lee** examine five historical factors that resulted in water systems moving from privately owned business to municipal endeavors in the 19th and 20th centuries. They believe that these five factors—(1) public health concerns, (2) public finance pressures, (3) contractual conflicts between private providers and their customers, (4) corruption, and (5) transaction costs—are influencing consolidation and regionalization efforts today.

If your small system needs money for improvements (including consolidation), chances are you've heard about Rural Development Utilities Service loans and

grants. In *All You Need to Know, From Idea to Funding* beginning on page 26, we walk you through the process for getting an RDUS loan or grant. And, if you're the recipient of grant money, odds are your being asked to explain better how the funds result in positive change. NESC Staff Writer **Caigan McKenzie** examines this topic in "A New Measure of Success: Federal Programs Use Program Assessment Rating Tool."

Elsewhere, I continue our series about watershed planning and restoration with the second article in the four-part series we're featuring in *On Tap* this year. The first article, as well as a wealth of other information about watersheds, is available in a special section of our Web site. Go to *www.nesc.wvu.edu/ndwc/ndwc_watershed.htm* for more information. Finally, because just about every system is looking for ways to save money, **Natalie Eddy** shows how trimming energy expenses can add up to significant savings for many utilities.

As always, we welcome your constructive criticism and suggestions for future topics. Contact information for our staff may be found to the right.

Regards,

Mark Kemp-Rye
On tap Editor

National Environmental Services Center
NESC Assistance. Solutions. Knowledge.

Who We Are

A number of people are responsible for putting *On Tap* magazine together each quarter. We encourage our readers to contact us with ideas and suggestions. An e-mail address is provided for each staff member below, as well as their phone extension. Call our main number toll free at (800) 624-8301 and enter the appropriate extension at the prompt.

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Special Thanks
Marilyn Noah

CALENDAR of EVENTS

JULY

National Association of Counties Annual Conference and Exhibition

July 13–17, 2007
Richmond, VA
Phone: (202) 393-6226
Fax: (202) 393-2630
www.naco.org

AUGUST

2007 American Rainwater Catchment Systems Association Conference

August 15–17, 2007
Kilauea Military Camp
Volcanoes National Park
Island of Hawaii, Hawaii
808 974-7555
www.arcsa07.com

Photo courtesy of usgs.gov

SEPTEMBER

National Association of Towns and Townships Annual Conference

September 5–6, 2007
Capital Hilton
Washington, DC
Contact: Andrew Seth
Phone: (202) 454-3954
E-mail: aseth@tfgnet.com
www.natat.org

2007 Clean Water Partnership Summit

September 5–6, 2007
EPA's Andrew W. Breidenbach Environmental Research Center and the Marriot Kingsgate Conference Hotel
Cincinnati, OH
Phone: (866) 483-4764
Fax: (304) 230-7290
Email: etprogram@wvhtf.org
www.etprogram.org/summit07

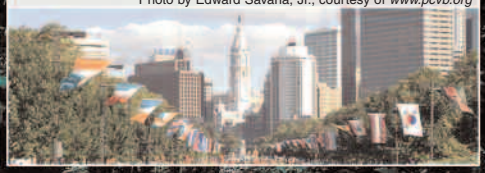
American Public Works Association Annual Conference

September 9–12, 2007
Henry B. Gonzalez Convention Center
San Antonio, TX
Contact: Dana Priddy
Phone: (800) 848-2792 or (816) 595-5241
Fax: (816) 472-1610
Email: dpriddy@apwa.net
www.apwa.net

Annual National Rural Water Association Convention

September 23–26, 2007
Philadelphia, PA
Contact: Dawn Meyers
Phone: (580) 252-0629
Fax: (580) 255-4476
www.nrwa.org

Photo by Edward Savaria, Jr., courtesy of *www.pcvb.org*



OCTOBER

Water Environment Federation WEFTEC '07

October 13–17, 2007
San Diego, CA
Phone: (800) 666-0206 or (703) 684-2452
Fax: (703) 684-2492
www.weftec.org

Photo courtesy of PDPhoto.org

NOVEMBER

Groundwater Foundation Annual Conference

November 29–30, 2007
Sheraton Denver West Hotel
Lakewood, CO
Contact: Zoe McManaman
Phone: (800) 858-4844
Fax: (402) 434-2742
www.groundwater.org

DECEMBER

National Ground Water Association Annual Conference

December 5–7, 2007
Orange County Convention Center
Orlando, FL
Contact: Kathy Butcher
Phone: (800) 551-7379
Fax: (614) 898-7786
www.ngwa.org

Sponsoring an event?

If you are sponsoring a water-related event and want to have it listed in this calendar, please send information to Mark Kemp-Rye, National Environmental Services Center, West Virginia University, P.O. Box 6064, Morgantown, WV 26506-6064. You also may call Mark at (800) 624-8301 or (304) 293-4191 ext. 5523 or e-mail him at *mkemp@mail.wvu.edu.*

EPA Release Small System Guidance

The U.S. Environmental Protection Agency (EPA) has developed guides for small systems about the Long Term 2 Enhanced Surface Water Treatment (LT2) and the Stage 2 Disinfectants and Disinfection Byproducts Rules (DBPR).

Complying with the Long Term 2 Enhanced Surface Water Treatment Rule: Small Entity Compliance Guide is intended for small public water systems and contains a general introduction and background for the LT2 rule, describes the specific requirements of the rule, and provides information on how to comply with those requirements. Download the guide from the EPA Office of Ground Water and Drinking Water site at: *www.epa.gov/OGWDW/disinfection/lt2/pdfs/guide_lt2_stepguide_smallentitycomplianceguide.pdf.*

Complying with the Stage 2 Disinfectants and Disinfection Byproducts Rule: Small Entity Compliance Guide contains a general introduction and background for the Stage 2 DBPR, describes the requirements of the rule that apply to systems serving fewer than 10,000 people, and provides step-by-step guidance on how small systems can comply with Stage 2 DBPR requirements. Examples of actions systems might take to comply with the rule are given throughout the guide. Download this guide at: *www.epa.gov/OGWDW/disinfection/stage2/pdfs/guide_st2_stepguide_smallentitycomplianceguide.pdf.*

Both manuals are also available from EPA's Water Resource Center. Write to 1200 Pennsylvania Avenue NW, Washington DC 20460, call (202) 566-1729, or e-mail *center.water-resource@epa.gov.*

Water Operators Wanted

Demand for water and wastewater treatment plant and system operators is expected to increase nine to 17 percent between now and 2014, according to Bureau of Labor Statistics projections. The current median income for these workers is approximately $35,000 annually.

Learn more about employment on the Bureau of Labor Statistics Web site at www.bls.gov.

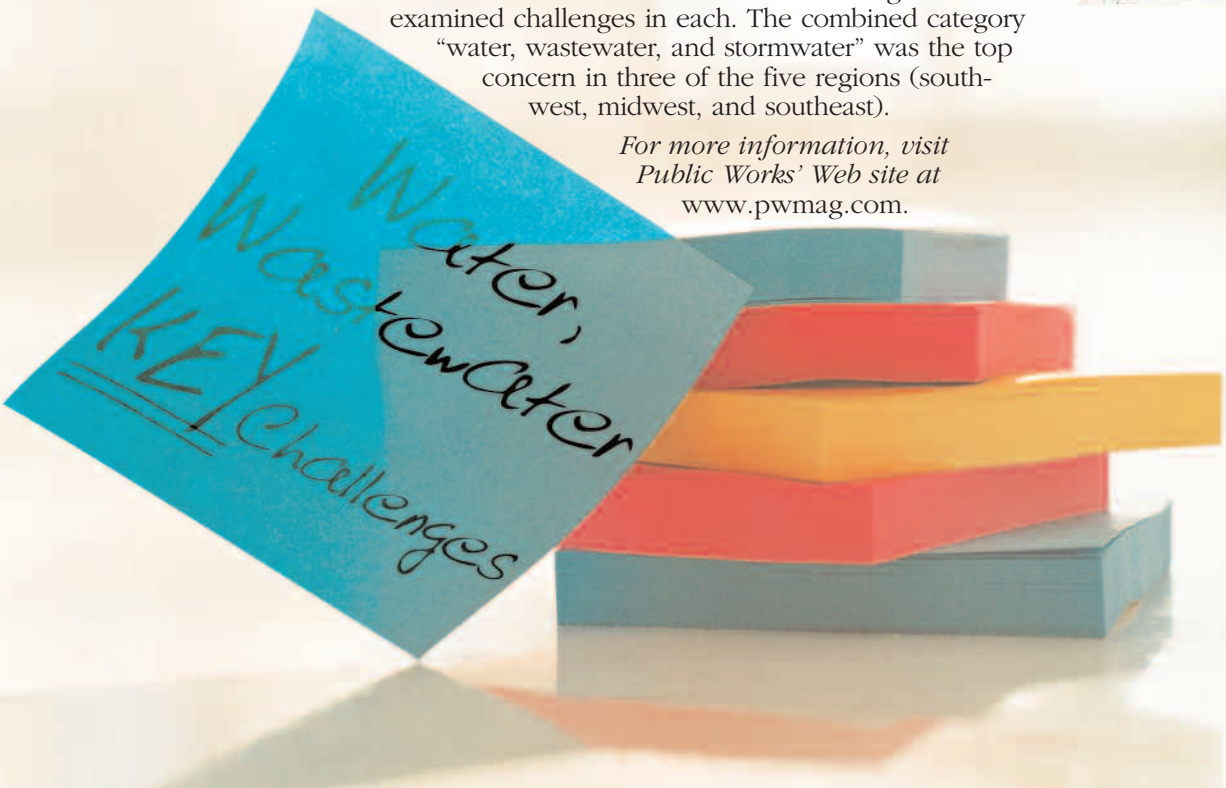
Poll Finds Water, Wastewater a Key Challenge

In November 2006, *Public Works* magazine conducted a poll to determine budget trends and infrastructure challenges for communities across the country.

Generally, budgets for both operations and maintenance, and capital improvements were expected to increase in 2007. But, the results show, size matters. "The bigger the better—at least where funding is concerned," writes Stephanie Johnson in the January 2007 issue of the magazine. "The larger your community, the more likely your budget for both daily operations and major improvements increased from 2006 to 2007."

Public Works divided the nation into five regions and examined challenges in each. The combined category "water, wastewater, and stormwater" was the top concern in three of the five regions (southwest, midwest, and southeast).

For more information, visit Public Works' Web site at www.pwmag.com.



Water Wars Heat Up

The ongoing drought in the U.S. West—eight straight years in some areas—has exacerbated the already contentious issue of water rights in the region. As the worst dry spell since the 1930s continues, states are bickering with each other and federal agencies, bills are being introduced in state legislatures and Congress, and lawsuits are going as far as the U.S. Supreme Court.

Some recent battles in the water wars include:

- Montana and Wyoming are wrangling over the Bighorn, Tongue, and Powder rivers.
- Nebraska and Kansas are squabbling over irrigation water from the Republican River.
- South Dakota has asked the U.S. Army Corps of Engineers to stop drawing down reservoirs because of the impact of recreational fishing while in Iowa, barge companies want more water released so that river traffic can continue.
- In Idaho, the governor wants to build more dams and expand existing ones to retain Snake River water and help replenish the Eastern Snake Plain Aquifer.
- The booming Las Vegas metropolitan area recent won approval for a controversial $2 billion pipeline project that will transport rural groundwater to southern Nevada. Because treated wastewater will then be discharged to Lake Mead, the plan allows the state to potentially receive a greater share of Colorado River water, currently shared by seven states. The increased share plan is being reviewed by the U.S. Department of Interior.

Despite several large snows in the Rocky Mountains this winter, overall precipitation is below normal, according to the U.S. Drought Monitor in a March 2007 report. Therefore, water flows this spring and summer are not likely to improve. The water wars, it seems, are far from over.

For more information about drought in the U.S., visit the Drought Monitor Web site at http://drought.unl.edu/dm/monitor.html.

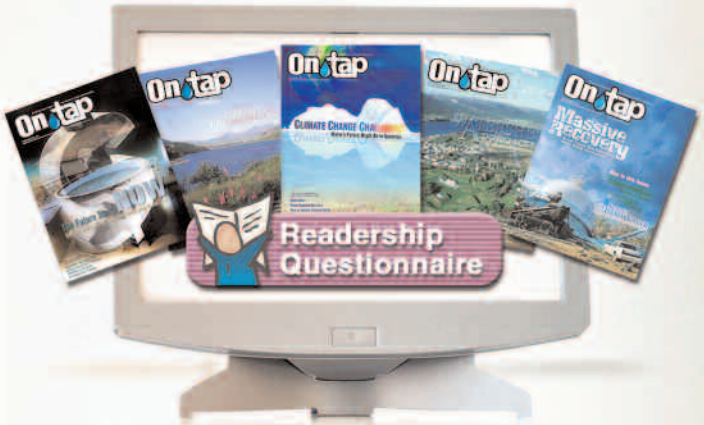
USDA Funds $180 Million for Rural Infrastructure

U.S. Department of Agriculture (USDA) Under Secretary Thomas C. Dorr announced $180 million for water and wastewater loans and grants at an April 23, 2007, press conference. This investment, celebrated in conjunction with the 37th anniversary of Earth Day, will benefit 61 rural communities in 29 states.

"These projects will build and improve rural water and sewage systems, and rural communities will benefit through cleaner water, recreation, and wildlife resources," Dorr said. "USDA is working with communities across America to provide investment financing and an improved quality of life for local residents."

Earth Day is observed annually on April 22 to inspire awareness of and appreciation for the environment. According to Dorr, "the USDA funding will help communities upgrade sewage systems to better manage storm runoff, expand and upgrade water treatment plants, extend water service to new residents, and build a renewable energy generation facility."

To learn more about USDA water and wastewater loans and grants, visit the USDA Rural Development Utilities Service Web site at www.rurdev.usda.gov/rus *or contact your state Rural Development office. For the phone number of your state Rural Development office, contact the National Environmental Services Center at (800) 624-8301 or (304) 293-4191. The list is also available on the Rural Development Web site at* www.rurdev.usda.gov/recd_map.html.



We need your opinion

To improve *On Tap* and other National Environmental Services Center products and services, we would like to hear from our readers. Please take a moment to complete the Online Readership Questionnaire at *www.nesc.wvu.edu* (look for the purple tab toward the top of the page.) Your comments, suggestions, and article ideas are welcome. We look forward to hearing from you!

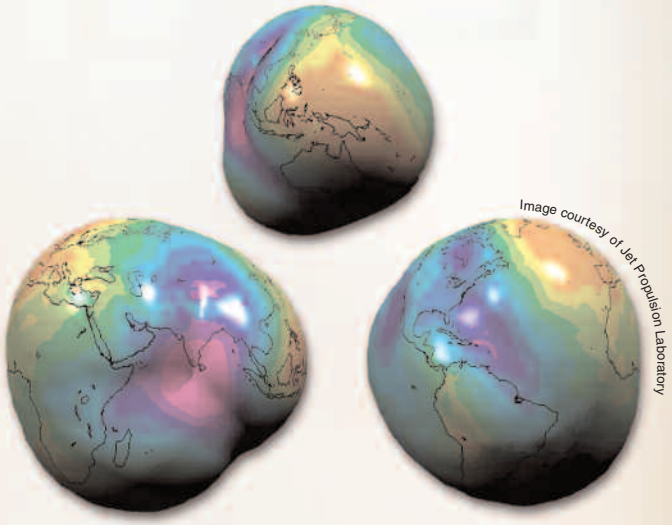


Image courtesy of Jet Propulsion Laboratory

Satellites Track Water Supply

For the last three years, the National Aeronautics and Space Agency (NASA) has been using satellites to study parts of the world that are experiencing water shortages. The Gravity Recovery and Climate Experiment (GRACE) consists of a pair of satellites, orbiting 130 miles apart and measuring everything from rivers to aquifers to water contained in snow.

Initial data from the GRACE mission show that, over the past three years, the Congo River level is losing approximately 21.6 millimeters (mm) of water per year, while the Zamebezi and Nile Rivers are losing 16.3 mm and 9.3 mm, respectively. NASA reports that the drop in the Congo's water level represents two years worth of drinking water for people who depend on this water source.

In the U.S., the satellites have documented groundwater depletion in California's Central Valley.

To learn more about the GRACE, visit the mission's Web site at http://www.csr.utexas.edu/grace/

RDUS Loans Rates Unchanged

Interest rates for Rural Development Utilities Service (RDUS) water and wastewater loans have been announced. The market and intermediate rates are up slightly, while the poverty rate is unchanged.

RDUS interest rates are issued quarterly at three different levels: the poverty line rate, the intermediate rate, and the market rate. The rate applied to a particular project depends on community income and the type of project being funded.

To qualify for the *poverty line rate*, two criteria must be met. First, the loan must primarily be used for facilities required to meet health and sanitary standards. Second, the median household income of the area being served must be below 80 percent of the state's non-metropolitan median income or fall below the federal poverty level. As of April 1, 2007, the federal poverty level was $20,650 for a family of four.

To qualify for the *intermediate rate*, the service area's median household income cannot exceed 100 percent of the state's non-metropolitan median income.

The *market rate* is applied to projects that don't qualify for either the poverty or intermediate rates. The market rate is based on the average of the Bond Buyer index.

The rates, which apply to all loans issued from April 1 through June 30, 2007, are:

- **poverty line: 4.5 percent** (unchanged from the previous quarter);
- **intermediate: 4.25 percent** (unchanged from the previous quarter); and
- **market: 4.125 percent** (unchanged from the previous quarter).

For this quarter, all loans will be obligated at the lower (4.125) rate. RDUS loans are administered through state Rural Development offices, which can provide specific information concerning RDUS loan requirements and applications procedures.

For the phone number of your state Rural Development office, contact the National Environmental Services Center at (800) 624-8301 or (304) 293-4191. The list is also available on the Rural Development Web site at www.rurdev.usda.gov/recd_map.html.

ON THE WEB

The U.S. Environmental Protection Agency

www.epa.gov

The U.S. Environmental Protection Agency (EPA) provides a variety of information about watersheds.

Water Quality Report
www.epa.gov/305b
Includes National Water Quality Inventory reports to Congress, fact sheets, and a brochure.

State Source Water Assessment and Protection Programs
http://cfpub.epa.gov/safewater/sourcewater/
Provides information about each state's source water assessment program, including background about the program and contacts in each state.

STORET
www.epa.gov/storet/
Has raw water quality data, including where and when samples were taken, sampling methods used, and the laboratory that performed the analysis.

Total Maximum Daily Load Program
www.epa.gov/owow/tmdl
Provides general and state-specific information about the maximum amount of pollutants that a waterbody can receive and still meet water quality standards.

Water Quality Information Center

www.nal.usda.gov/wqic

The U.S. Department of Agriculture's Agricultural Research Service maintains a Web site with information about water and agriculture. The Water Quality Information Center site includes searchable databases, bibliographies, discussions lists, and news.

From aquatic and wetland plants to water conservation, information is available on numerous water-related topics. The site features a section titled "Funding" that provides a comprehensive list of federal money available for water projects. This section may be accessed at *www.nal.usda.gov/wqic/funding.shtml.*

Science Daily

www.sciencedaily.com

Each of the last three years, Science Daily has been the winner of Popular Science magazine's "Top 50 Web Sites." This free, advertising-supported service brings you breaking news about the latest discoveries and hottest research projects in everything from astrophysics to zoology. The Earth and Climate section is of particular interest for people dealing the water and wastewater issues.

The site's articles are selected from news releases submitted by leading universities and other research organizations around the world. Each news release is posted in its original form, with a link to the organization's home page, to help those interested in finding up-to-date and relevant background information about a topic.

Management Help Available

www.mapfornonprofits.org

Running a nonprofit organization like a business is easier said than done. The Management Assistance Program for Nonprofits (MAP) provides management and board development services for nonprofit organizations and governmental agencies, such as water utilities.

From financial management and accounting to strategic planning, MAP will conduct an assessment of your needs at no charge and with no obligation. They will then give you a cost estimate for services. Call MAP at (651) 647-1216 or visit their Web site for more information.

Located in St. Paul, MAP provides services in Minnesota. Their Web site provides links to similar training in other areas, although not all states are represented.

The MAP Web site also provides a link to the Free Management Library (www.managementhelp.org). With more than 675 topics arranged in 75 categories, this site provides comprehensive coverage of management issues. Whether it's problem solving or public relations, customer service or computers, risk management or research methods, you'll find the information you need for your system presented in an easy-to-comprehend style.

Watershed Info on the Web

There are numerous Internet sites devoted to watershed issues. Here are several that have information about field assessment techniques, monitoring, and stream restoration.

Water Footprint

www.waterfootprint.org

The water footprint of an individual, business, or nation is defined as the total volume of freshwater that is used to produce the goods and services consumed by the individual, business, or nation. This site provides information for national water footprints and a calculator for leaning how much water an individual uses.

Izaak Walton League

www.iwla.org

For more than 30 years, the Izaak Walton League has been involved in watersheds through their Save Our Streams program. This part of their site has different tools for effective watershed improvement projects, including a stream monitoring and restoration database.

U.S. Geological Survey

http://water.usgs.gov/nawqa/

The U.S. Geological Survey has a wealth of information about water issues. The National Water Quality Assessment Program monitors various rivers and streams around the country, including pollutant levels for pesticides, nutrients, and volatile organic compounds.

The National Environmental Services Center

www.nesc.wvu.edu

The National Environmental Services Center—home to both the National Drinking Water Clearinghouse and the National Small Flows Clearinghouse—has devoted a section of its Web site to watershed issues. Included are articles about watersheds (including the first two installments of the four-part series currently running in *On Tap* magazine), information about source water protection and onsite wastewater management, and links to other sites devoted to watershed issues. NESC water and wastewater engineers are also available to answer questions. Call toll-free (800) 624-8301 and select option "3" to speak to one of our technical staff.

Each issue, we ask members of the *On Tap* Editorial Advisory Board to answer a drinking water-related question. We then print as many responses as space permits. The opinions expressed are not necessarily those of NESC.

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Fort Lewis, Washington

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Water Supply Division Director
Vermont Department of Environmental Conservation

Across the country, small water systems are joining together or they are being purchased by larger systems. Whether it's called consolidation, regionalization, or mergers, these systems seem less and less likely to go it alone and many experts see this trend continuing for the foreseeable future.

Q: Are water system mergers happening more often in your region?

Does this trend help small communities?

Consolidation Is a Dirty Word

This is a very contentious issue for most small water systems. In the West, where water is in short supply and the distances between systems large, there is very little incentive to consolidate. In fact, it is considered a nasty word, and people that espouse the principle are considered meddlers. Even though state revolving loan funds often offer to move systems up on the eligibility list if there is consolidation, it very rarely happens. Usually it is only where the system must begin treatment with an expensive process for a contaminant such as nitrate or arsenic, and there is another system near by with excess water (very rare) do you see consolidation.

Jerry Biberstine
Senior Environmental Engineer
National Rural Water Association

Lisa Hardcastle, P.E.
Army Contractor,
Fort Lewis, Washington

State Support for Regionalization

Since 1994, Washington State has had a regulation supporting and regulating regionalization of public water systems. This regulation addresses water purveyors—called Satellite Management Agencies (SMA)—that want to manage or own multiple water systems. Additional drinking water regulations require newly created public water systems that fall under the federal Safe Drinking Water Act and smaller water systems that fall under state regulations to be managed or owned by an SMA. Currently, there are 46 state-approved SMAs.

Existing water systems generally seek out an SMA when they are having trouble that may be beyond their financial or technical expertise. However, some systems with fewer than 100 connections also seek SMA services or other certified operators to take the place of grandparented operators.

Municipal water systems (including SMAs) in Washington have a financial advantage available to them for acquiring other water systems. The state approved $4 million for the Water System Acquisition and Rehabilitation Program (WSARP) in 2003 and $2 million in 2005.

Under the WSARP, grants ranging up to $500,000 could be used to pay for a portion of planning, design, and other pre-construction activities; system acquisition; and capital construction costs. Applicants with sound drinking water utility management that own at least one municipal Group A public water system (small community, including non-transient, non-community, and transient, non-community systems) were eligible for funding.

The program received 43 applications for assistance worth nearly $13 million. The Department of Health reviewed, ranked, and prioritized the eligible applications. Then, the Public Works Board approved grant funds for 18 projects that were ready to proceed. Twenty-eight water systems were acquired and rehabilitated as the result of 2003 WSARP projects. An additional 12 water systems were acquired and rehabilitated as a result of the 2005 WSARP projects.

Kevin Kundert
President and Chief Instructional Systems Mechanic
eTRAIN ONLINE, Inc.

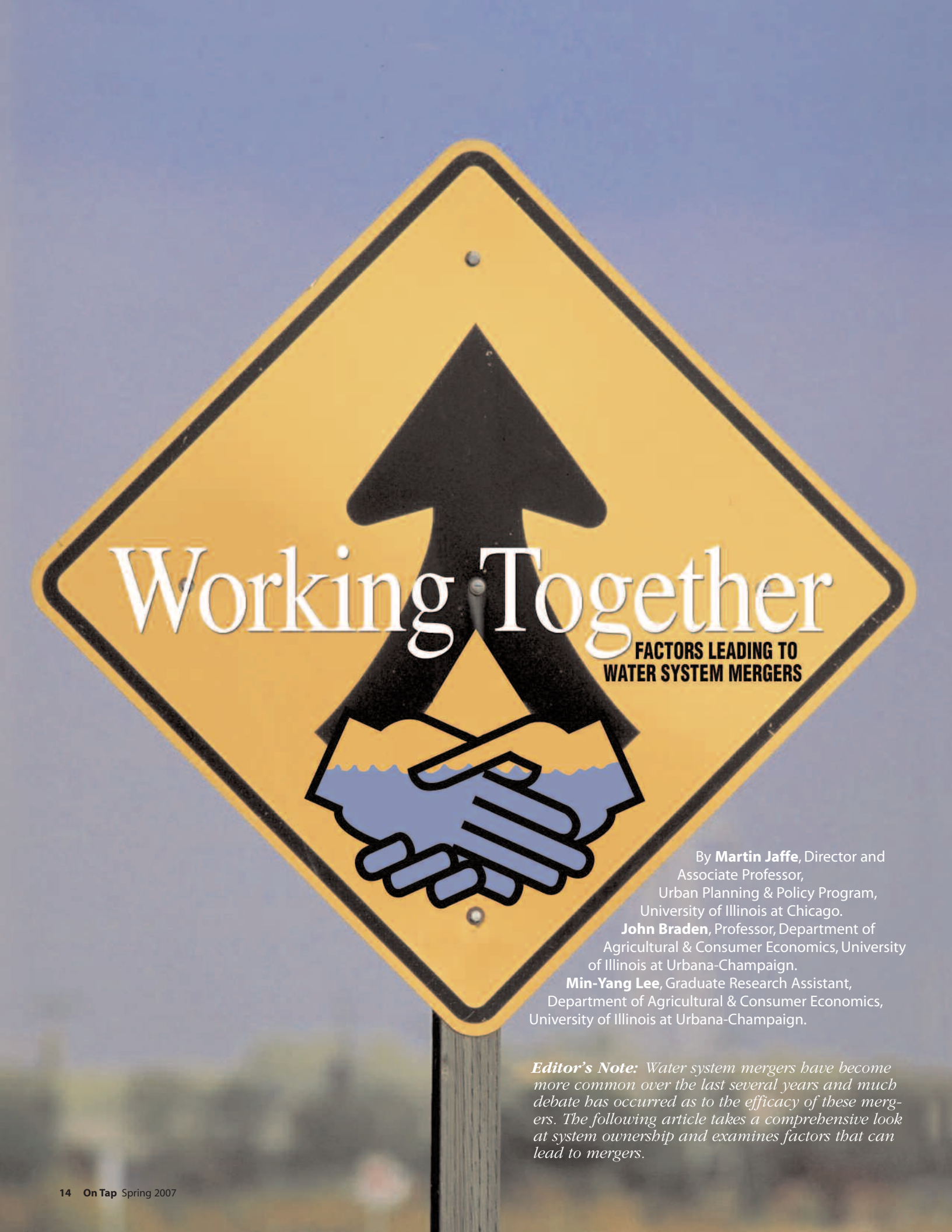
Give Consolidation a Chance

In western states, small water systems are joining together into regional systems for a variety of reasons, including access to better quality source water, economic viability, and to ensure operation by qualified staff. There has also been an increase in the number of contract operators who are responsible for several individual systems.

These consolidations have helped in the short term. In most cases I know of, changes were made as a matter of necessity to provide a reliable, safe supply of drinking water. Sometimes this was accomplished at a significantly higher cost but the resulting quality supply of water has been worth it.

Today, there is more reliance on technology solutions to monitor water system operating parameters from a central location. Operators must be well acquainted with the instrumentation and the equipment must be properly maintained. Centralized operations also come in with a built-in risk: Increased distance from remote locations and longer response times to handle emergency situations are dangers that these regionalized systems assume.

The individual attention of a competent operator focused on one water system (that he or she knows very well) is hard to beat. Yet, an operator that has other system experience may bring more to the job in knowledge and experience. Times are changing. Let's see how well these regional systems and contract operators do over time.



Working Together

FACTORS LEADING TO WATER SYSTEM MERGERS

By **Martin Jaffe**, Director and Associate Professor, Urban Planning & Policy Program, University of Illinois at Chicago.
John Braden, Professor, Department of Agricultural & Consumer Economics, University of Illinois at Urbana-Champaign.
Min-Yang Lee, Graduate Research Assistant, Department of Agricultural & Consumer Economics, University of Illinois at Urbana-Champaign.

Editor's Note: *Water system mergers have become more common over the last several years and much debate has occurred as to the efficacy of these mergers. The following article takes a comprehensive look at system ownership and examines factors that can lead to mergers.*

In recent years, the U.S. Environmental Protection Agency (EPA) has devoted millions of dollars to programs aimed at strengthening the technical, managerial, and financial (TMF) capabilities of small systems. These concerns are driven by differences in Safe Drinking Water Act (SDWA) compliance rates: a higher percentage of smaller water systems have water quality and reporting violations under the SDWA than do larger water systems. However, solutions are not always found in additional TMF investments. Sometimes it makes more sense to turn the systems over to new owners.

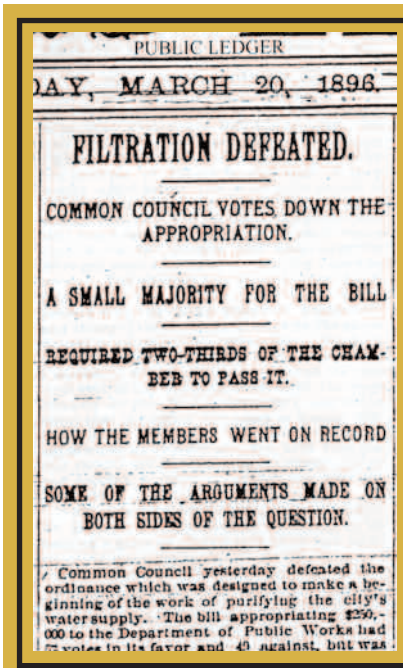
Compliance problems arise for many reasons. Some are attributable to limited customer bases. Fewer customers usually mean lower revenues to cover fixed costs, lower bond ratings (making borrowing more costly), and higher per-customer service costs. In such cases, encouraging underperforming systems to combine resources and administrative structures can reduce overhead while also gaining economies of scale. Larger systems generally can afford greater technical sophistication. They also have greater attractiveness in bond markets. Thus, encouraging small water system mergers and reorganizations can be an important strategy for improved compliance.

Most water utilities in the U.S. underwent enormous transformation in the late 19th and early 20th centuries. Within a period of two or three decades, most urban water systems changed from being predominantly privately owned to being predominantly publicly owned. This historical transformation is relevant today because, at the time they were initially acquired, many of these private waterworks had service areas and customer bases similar in size to those served by small water systems today. Further-more, many of these municipalized systems were also perceived as underperforming in meeting the water quality and quantity demands of their eras.

Historians and economists have proposed five reasons to explain this historical transformation: public health concerns, public finance pressures, contractual conflicts between private providers and their customers, corruption, and transaction costs. Each of these historical factors—especially transaction costs, as shown by our research on contemporary small water system consolidations—may also influence contemporary small water system acquisitions and mergers.

On Tap Online

For more information about water system consolidation, see the articles "Regionalization: Forced, Voluntary, and Somewhere In Between" and "Regional Water Authority Helps Western New York" on the National Environmental Services Center Web site at *www.nesc.wvu.edu.*



PUBLIC LEDGER

DAY, MARCH 20, 1896.

FILTRATION DEFEATED.

COMMON COUNCIL VOTES DOWN THE APPROPRIATION.

A SMALL MAJORITY FOR THE BILL

REQUIRED TWO-THIRDS OF THE CHAMBER TO PASS IT.

HOW THE MEMBERS WENT ON RECORD

SOME OF THE ARGUMENTS MADE ON BOTH SIDES OF THE QUESTION.

Common Council yesterday defeated the ordinance which was designed to make a beginning of the work of purifying the city's water supply. The bill appropriating $250,000 to the Department of Public Works had [illegible] votes in its favor and 49 against, but was

As this Philadelphia newspaper article from 1896 shows, community water issues are often contentious.

Courtesy of *www.phillyh2o.org*

Public Health and Safety

During the 19th century, public health crises often sparked outcries for municipal water services. For example, Chicago built its new water distribution and treatment facilities and initiated its project to reverse the flow of the Chicago River to protect its Lake Michigan water supplies after 80,000 citizens died of typhus in 1885. Public concerns over fire risks also generated public dissatisfaction with private water companies. As York University economist Letty Anderson notes, many also thought that privately owned waterworks made most of their water supply decisions only to generate short-term profits from residential water sales rather than providing sufficient water to public hydrants for municipal fire protection.

Recent studies dispute the presumed public health deficiencies of private waterworks, including one by University of Pittsburgh economic historian Werner Troesken that found that the transition of ownership did not bring about a significant reduction in water-borne disease outbreaks. In addition, private companies more frequently used filtration. Nevertheless, the move to public ownership probably indicated a strong public demand for change and improvement and a prevailing sentiment that public ownership was more likely to produce results.

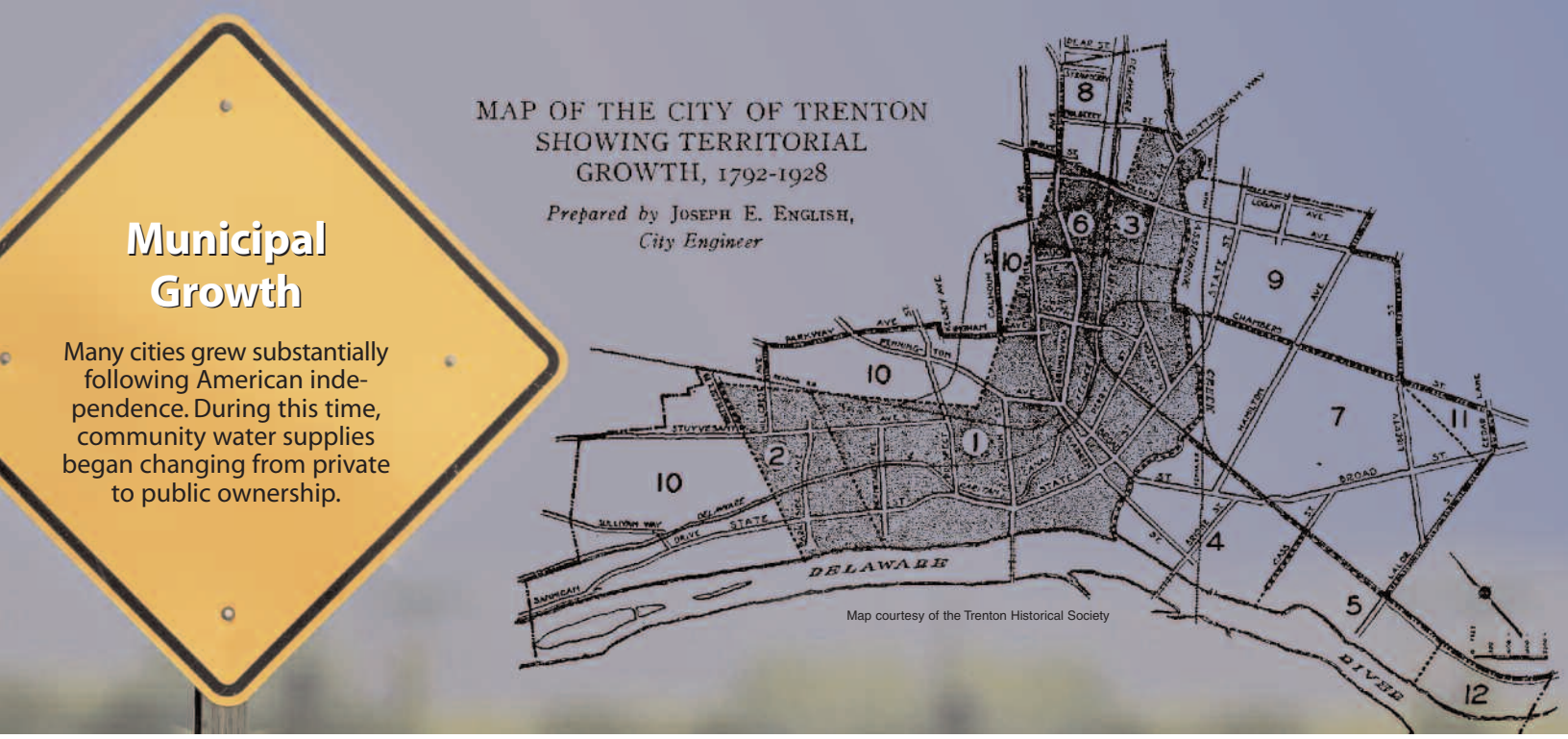
Municipal Finance Pressures

A second set of forces contributing to the municipalization of urban water supplies involves the rapid rate of municipal annexation in the late 19th and early 20th centuries. These municipal expansions greatly increased the service areas of urban waterworks, especially after modern indoor plumbing was introduced to residential dwellings in the late-19th century.

According to Harvard economists David Cutler and Grant Miller, this rapid rate of municipal annexation was associated with the ability of publicly owned and financed municipalities to tap financial resources that were unavailable to private water suppliers. After the development of modern bond markets, private investor and special-assessment

Municipal Growth

Many cities grew substantially following American independence. During this time, community water supplies began changing from private to public ownership.



Map courtesy of the Trenton Historical Society

financed waterworks simply could not raise capital as efficiently as municipalities could. Bonds provided savvy municipalities with the financial resources needed to meet rising demand for potable water at a time when the costs of constructing modern water systems to serve entire urban populations were too large for private firms to assume.

The ability of government to enforce universal payment for services and innovations in the bonding of public investments undoubtedly increased the capacity of municipalities to take over and operate water supplies. Nevertheless, private water companies have historically offered safe and significant returns to shareholders, so poor performance and financial weaknesses are not necessarily results of private ownership.

Contractual Conflicts

At the turn of the 20th century, franchise arrangements between cities and private water companies often required the companies to improve water treatment or expand their service areas without being able to increase their rates sufficiently to offset these additional expenditures. These fiscal limitations reduced dividends and thereby lowered the perceived value of their stock to their investors. This decline in stock values, in turn, enabled municipal officials to later acquire the private water systems at reduced prices either by purchase, franchise revocation, or through eminent domain, or by simply building a public waterworks to undercut the private system.

The growing threats of public appropriation removed economic incentives for private water companies to expand their operations or improve their facilities. Foregoing these improvements was a rational investment decision intended to bolster the private waterworks' short-term profits; however, this inaction further reduced both the long-term value of the systems and the compensation received by the owners, when they were later expropriated and municipalized by public officials.

Contractual conflicts contributed to the simultaneous growth of state utility regulation, municipal ownership, and especially frequent litigation. Troesken and Cornell University economist R. Rick Geddes correlated these factors with later expropriation, also noting that the substantial metering costs commonly required of private waterworks by many municipal franchises created a quandary for privately owned water utilities: Unit prices of water were often too low to justify a privately owned waterworks to spend money to install and read water meters, while failing to meter customers made it harder for the private waterworks to justify asking for increases in their usage charges and connection fees. Further, as noted by Scott Masten, a professor of Business Economics and Public Policy at the University of Michigan, many private water companies that couldn't adequately recover their metering fees had to rely on revenue transfers from government, further increasing the private utility's exposure to contractual conflict and appropriation.

Corruption

History has amply demonstrated the need for regulation of privately owned utilities by state utility commissions and through municipal franchise contracts. Syracuse University historian Nelson Blake's classic book *Water for the Cities: A History of the Urban Water Supply Problem in the United States* spells this out in detail. Examining the emergence of municipal water systems in New York, Philadelphia, Boston, and Baltimore in the early 19th Century, Blake showed how public water boards and commissions were pitted against speculative private water companies, with the battle played out in

Growth History of Trenton, New Jersey

1. 1792–Areas 1,2,3,6 show territory included by the first municipal charter
2. 1831–Taken from the City of Trenton and annexed to Trenton Township (later returned to Trenton)
3. 1844–Taken from the City of Trenton (later returned to Trenton)
4. 1851–Annexed Borough of South Trenton
5. 1856–Annexed part of Nottingham Township
6. 1858–Taken from Trenton and annexed to Ewing Township (later returned to Trenton)
7. 1888–Annexed Borough of Chambersburg
8. 1888–Annexed Millham Township
9. 1900–Annexed Borough of Wilbur
10. 1894 & 1900–Areas marked 10, along with 2 and 6, were annexed from Ewing Township
11. 1900–Annexed part of Hamilton Township
12. 1921–Annexed part of Hamilton Township

the backrooms of the state legislatures as they granted lucrative service franchises to private water systems.

In some cases, as in New York City's, the private water companies were merely corporate shells through which wealthy investors engaged in banking and other financial enterprises unrelated to water supply provision. Troesken later cited this concern over corruption by private water suppliers, and the larger national reform movement at the end of the 19th century, which embraced the cause of utility regulation, as a significant contributor to municipal expropriation of private water companies.

Troesken also notes that many public water systems themselves became instruments of urban machine politics, where patronage and politically determined rate structures filled the pockets of the well-connected while infrastructure maintenance was short-changed. A major reason that corruption theories remain so relevant in explaining institutional change is that water supply history might have come full circle, with the alleged operational inefficiencies and fiscal deficits of "corrupt" public water systems providing the justifications for the growing interest in water supply privatization today.

Transaction Costs

A recent statistical study of Midwestern water system mergers by Min-Yang Lee, a University of Illinois researcher, examined how the costs of reorganization affect the probability of merger. Lee found that the two factors having the greatest influence on the transaction costs of water system mergers are the system's form of ownership and the extent to which the water system is already interconnected with an adjacent system. Publicly owned water systems were six percent less likely to be acquired than privately owned ones. This finding suggests that the transfer of public assets is fraught with greater political complexity and higher bureaucratic costs than transfer of privately held assets. Water systems that purchased water were 13 percent more likely to be acquired than systems that were not already interconnected to an adjacent system. The existence of an operating relationship between two water systems almost surely reduces the costs of further system integration through merger.

Lee also found that small water systems located within wealthier metropolitan areas were slightly more likely than average to be acquired. Even though urban systems are theoretically more expensive to acquire than water systems in more rural locations due to land costs and the number of parties interested in the transaction, their greater density of service connections also implies a relatively high ratio of operating income to fixed costs, which may offset some of the higher transaction costs. Lee found that an increase in the service connection density by 10 connections per square mile increased the likelihood of merger by approximately 0.2 percent.

Small System Mergers

Times were certainly different at the turn of the last century, when the regulatory context (rampant corruption, open-ended and perpetual franchises, and lack of regulatory oversight) and capital markets differed so extensively from the institutional framework under which small water suppliers currently operate. But the ongoing importance of safety, utility regulations, and financing makes these factors relevant today.

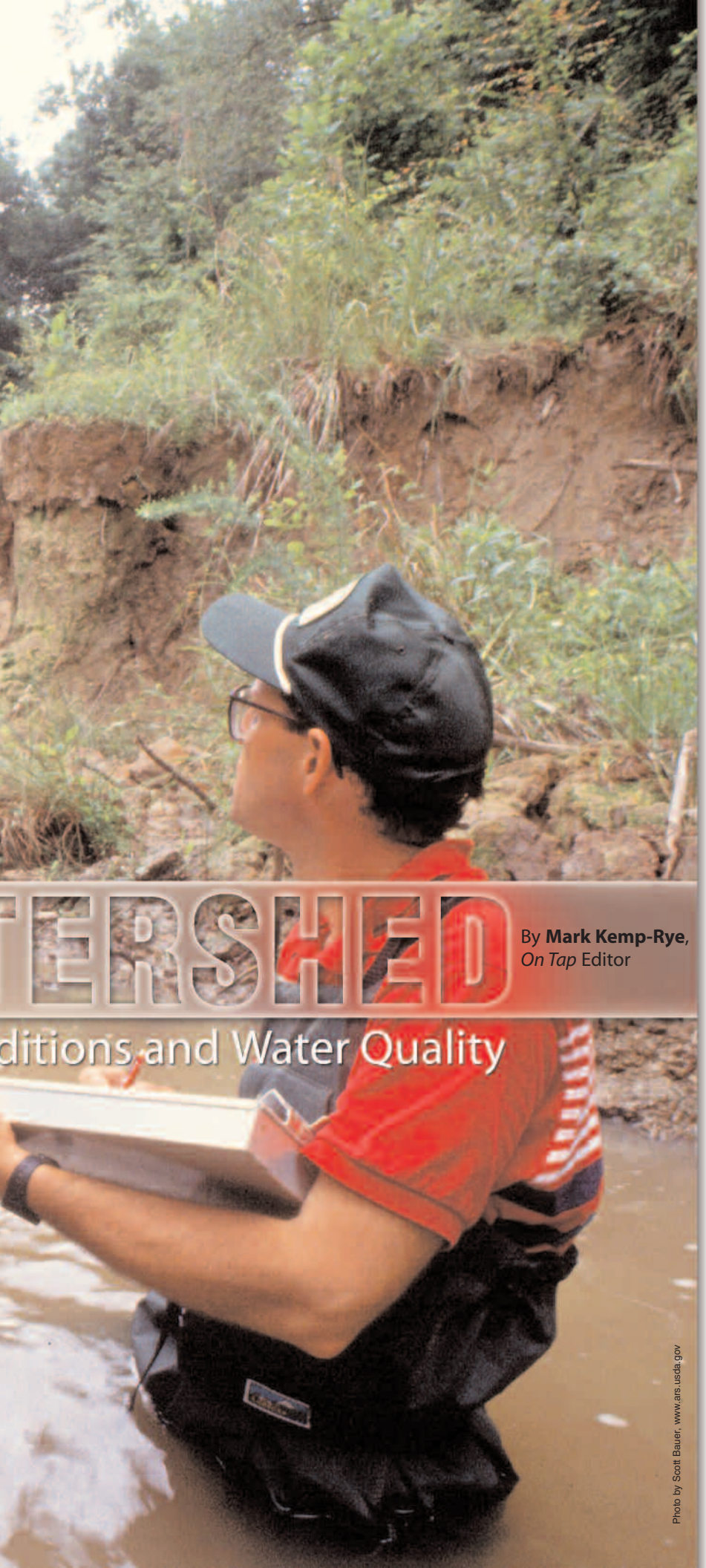
Health and safety concerns still account for most of the short-term pressures for change within the water industry. Public disclosure requirements expose systems to increased public scrutiny. EPA and states mandate and monitor water system compliance with new drinking water standards

Continued on page 34.

Assessing Your WAT

Techniques for Measuring Con

Editor's Note: *Many experts see watershed planning and management as being an effective way to deal with water and wastewater issues. In* On Tap *during 2007, we are presenting a four-part series about watersheds that will provide an overview about how to start a watershed initiative, how to assess problems, how to develop a workable plan, and how to implement these watershed efforts. This article is the second of the series; the first is available on the National Environmental Services Center Web site at* www.nesc.wvu.edu/ndwc/ndwc_watershed.htm.



TERSHED

ditions and Water Quality

By **Mark Kemp-Rye**, *On Tap* Editor

Photo by Scott Bauer, www.ars.usda.gov

Once your fledgling watershed group has formed and come up with some ideas about what it wants to accomplish, it's time to get a better understanding of the actual conditions in the watershed. Although the particulars will vary from project to project, most groups will need to know more about water quality and the sources of pollution in the water, and then go on to delineate the scale of the project and begin documenting the issues at hand.

In this article, we'll take a look at ways of assessing the health of a watershed so that planning and restoration can proceed in a logical fashion. First, though, we need to understand some basic watershed concepts and terminology.

The Geography of Watersheds

"A watershed is the area of land where all of the water that is under it or drains off of it goes to the same place," says Dale Kemery, press officer, U.S. Environmental Protection Agency (EPA). Sounds simple enough but those who work in watershed planning have specific terms and concepts that they employ.

Typically, the largest watershed management unit is a *basin*, which drains to a large river, estuary, or lake. Basin drainage areas—such as the Ohio or Mississippi Rivers—often encompass thousands of square miles.

Basins are then made up of *sub-basins*, which can be several hundred square miles. Sub-basins consist of groups of *watersheds*, which in turn comprise *subwatersheds*. Watersheds typically range from 20 to 100 square miles, while subwatersheds are most often 10 square miles or less.

Within subwatersheds, *neighborhoods* are geographic areas that share similar land uses and other characteristics. The *project site* is the smallest watershed management scale and is the location where a single restoration project is implemented. A watershed project often has dozens of these sites. (See Figure 1 and the Friends of Deckers Creek overview on page 25.)

While wanting to improve the entire Mississippi River is a noble goal, it wouldn't be a practical pursuit for a volunteer watershed group. Better to start small. As the *User's Guide to Watershed Planning in Maryland* notes, "Watersheds and subwatersheds are the most practical units for preparing local plans. Each watershed is composed of many individual subwatersheds that can have their own unique water resources objectives."

This isn't to say that smaller projects shouldn't lose sight of larger objectives. "A watershed plan is a comprehensive framework for applying management tools within each subwatershed in a manner that also achieves the water resource goals for the watershed as a whole," the *User's Guide* states.

Photo by Brian Prechtel, www.ars.usda.gov

Photo by Peggy Greb, www.ars.usda.gov

DATA SOURCES

When assessing the water quality in a watershed, gathering information from existing sources is a good way to begin. A good place to start is with the state agency that has oversight for surface water quality. Specific data sources include:

- source water assessment plans,
- the 303(d) list, a biennial list of streams that do not meet water quality standards,
- the 305(b) report, showing the quality of a state's streams,
- Total Maximum Daily Load (TMDL) plans, and
- National Pollutant Discharge Elimination System (NPDES) reports submitted to the states.

At the national level, agencies such as the U.S. Geologic Survey (*www.usgs.gov*), the Natural Resources Conservation Service (*www.nrcs.usda.gov*), and the U.S. Environmental Protection Agency (*www.epa.gov*) are sources of water quality data. See the special watershed section on the National Environmental Services Center Web site (*www.nesc.wvu.edu*) for a listing of useful Internet resources.

Using Existing Information

Once you've identified a watershed or subwatershed with a manageable scale, it's time to start collecting data. Fortunately, a wealth of information is usually available to get started, often through local, state, and federal government sources. Watershed experts sometimes call the process of finding and compiling this information a desktop assessment.

"Desktop assessments fall into the 'don't-reinvent-the-wheel category,'" observes Craig Mains, a training specialist at the National Environmental Services Center and a leader in several watershed assessment efforts. "Watershed groups will want to piece together enough data to get a good picture of the overall health of their stream. It only makes sense to gather as much data as possible from all sources. It may take some research on the part of the watershed group to find not just what data exists, but also who knows about different sources of data, and where the data can be found."

There are many potential sources of information but not all will be applicable to the situation at hand, so watershed groups will have to be flexible in their searches. A good place to start is with the state agency that has oversight for surface water quality in your state.

As part of complying with the federal Clean Water Act, state water quality agencies have to file a biennial list of streams that do not meet water quality standards (impaired waters) with EPA. The list is known as the 303(d) list. These agencies also have to file a biennial report on the quality of the state's streams known as the 305(b) report. In the past, these reports were typically published separately, but they are increasingly being integrated into one report. These reports don't typically include much raw data, but those data should be readily available from the state agency that compiled the report.

Other possible sources of information at the state level include source water assessment plans, total maximum daily load plans, national pollutant discharge elimination system reports, and special reports generated for specific watersheds. At the local level, land use plans, flood management plans, and water and sewer facility plans usually have applicable information.

"Water quality data have both a spatial and a temporal dimension," Mains adds. "Existing data are especially valuable because they can provide historical information that might allow the watershed group to determine if there are trends in the quality of the stream over time."

Dirty Hands, Wet Feet

Most watershed groups, after reviewing the information available to them, discover that they need more specific data to help address the unique problems they are trying to solve. "While mining existing data is a good place to start, there is no substitute for developing an on-the-ground, in-the-stream knowledge of your watershed," says Mains. "Usually some additional assessments will be needed to get a clear picture of what is going on in the watershed.

"Some information will likely be available," he continues, "but it is unlikely that this data will provide all the information that a watershed group might want.

Photo by Scott Bauer, www.ars.usda.gov

FIELD TESTING FOR WATER QUALITY

Methods for assessing water quality are typically grouped into three categories:

1. Chemical—measures the pH of the water and pollutants and other chemicals found in it.
2. Biological—gauges the extent of microbial plant, insect, and animal life in water.
3. Physical—examines the characteristics of the watershed, including streambed materials and banks.

Testing will vary depending on the problems inherent in the watershed and the goals of the restoration effort, as well as the resources available to the watershed group.

State agencies, for example, will have a body of data, but because they have such a wide geographic area to cover, their data on a particular watershed is likely to have some gaps either in terms of the number of sampling locations, the frequency of sampling, or the parameters measured. Assessments by the watershed group can fill in any gaps."

Field tests can be divided into three general categories:

1. **Chemical**, which includes measurements such as pH, conductivity, dissolved oxygen, biochemical oxygen demand, and nutrients such as phosphorous and nitrogen.
2. **Biological**, which measures some aspect of aquatic life, including tests for bacteria, benthic macroinvertebrates (e.g., insects, snails, crustaceans, worms), algae, rooted aquatic plants, and fish.
3. **Physical**, which includes measurements of some characteristic of the structure of the stream bed and banks such as the relative composition of stream bed materials according to particle size (silt, sand, pebbles, cobbles, boulders, etc), the extent that larger particles are embedded by fine sediment, the extent to which the stream bed and banks have been altered by human activity, and the overall condition of stream banks, including measuring the extent of eroded or unstable banks. Measurement of stream flow is also a physical indicator and involves measuring stream width and depth to develop a cross sectional profile and measuring stream current velocity. Other physical indicators include water clarity, water color, and temperature. Stream temperature is critical because it affects the metabolic rate of aquatic organisms and also limits the saturation concentration of oxygen in water.

Information gathered about a specific watershed or subwatershed can have utility beyond just measuring water quality. Mains says that

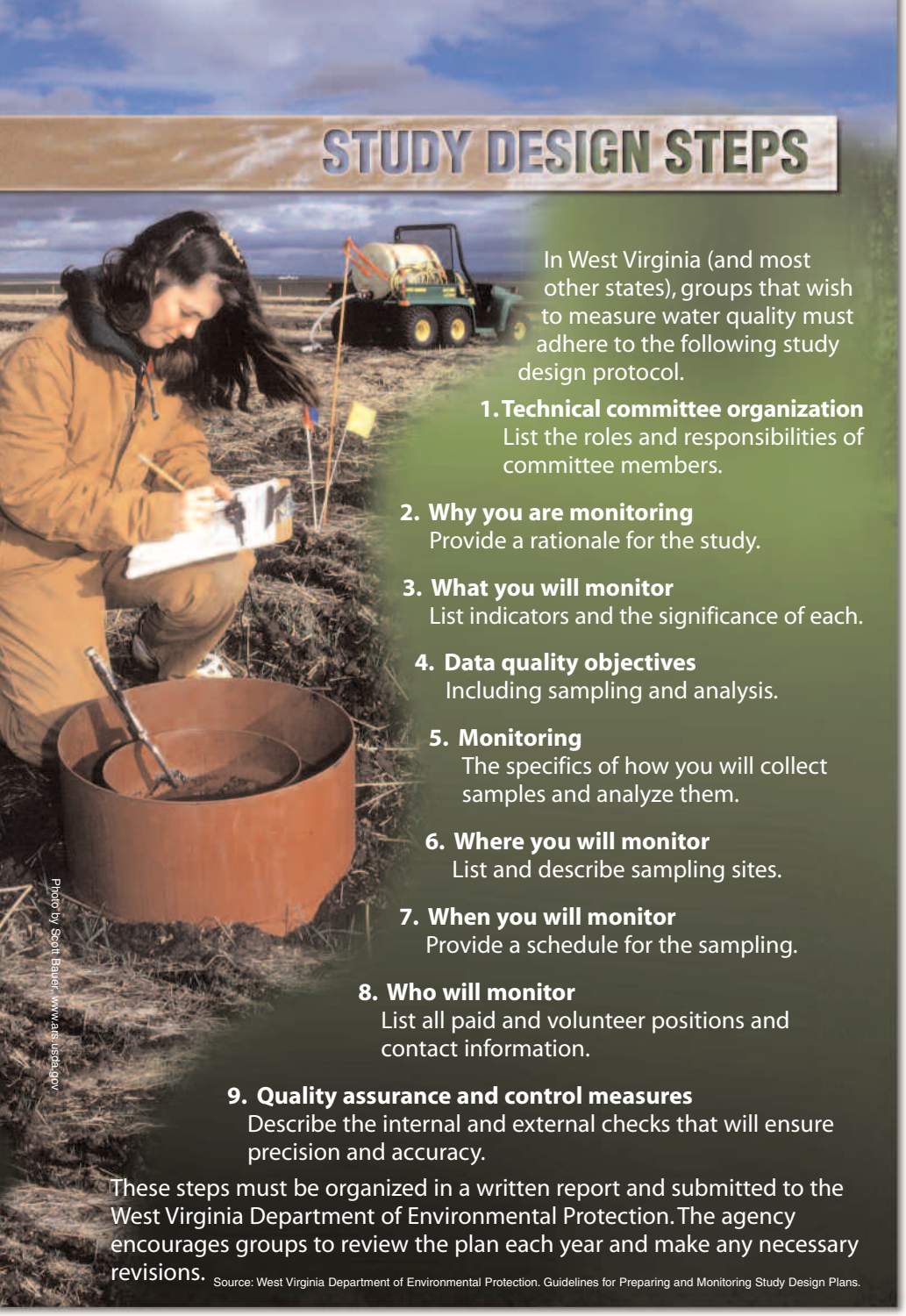


Photo by Scott Bauer, www.ars.usda.gov

STUDY DESIGN STEPS

In West Virginia (and most other states), groups that wish to measure water quality must adhere to the following study design protocol.

1. **Technical committee organization**
   List the roles and responsibilities of committee members.
2. **Why you are monitoring**
   Provide a rationale for the study.
3. **What you will monitor**
   List indicators and the significance of each.
4. **Data quality objectives**
   Including sampling and analysis.
5. **Monitoring**
   The specifics of how you will collect samples and analyze them.
6. **Where you will monitor**
   List and describe sampling sites.
7. **When you will monitor**
   Provide a schedule for the sampling.
8. **Who will monitor**
   List all paid and volunteer positions and contact information.
9. **Quality assurance and control measures**
   Describe the internal and external checks that will ensure precision and accuracy.

These steps must be organized in a written report and submitted to the West Virginia Department of Environmental Protection. The agency encourages groups to review the plan each year and make any necessary revisions. Source: West Virginia Department of Environmental Protection. Guidelines for Preparing and Monitoring Study Design Plans.

this information is also useful in public awareness efforts.

"Well-designed assessments can provide an antidote to misconceptions that might exist about a particular stream," he says. "Local residents sometimes feel they know everything about a stream, which is not always the case. They may believe that the entire stream is impaired, when the impairment may be localized. Or, they may believe that a historically high quality stream is in pristine condition, while some gradual degradation may have actually occurred without much notice. Actual stream data can end such misconceptions."

Ongoing Assessment Efforts

Assessing water quality is not a one-time activity. Watershed groups should develop a multi-year strategy to gather information about watershed conditions. "What tests or measures a group decides to conduct would depend on the mission or goals of the group, how much money they have to spend on equipment and/or lab analyses, and the capability of the group," Mains says.

"Ideally," EPA notes in their *Watershed Approach Framework*, a strategy "should recognize that responsibilities can be shared by many stakeholders and that monitoring must be done to fulfill distinct purposes: characterizing the watershed, identifying and locating specific problems, and determining if actions are effective and goals are met. A strong monitoring program should include:

- an inventory of key existing information on resources, including priority groundwater, sources of drinking water, habitat, wetlands and riparian acreage, function and/or restoration sites;
- a monitoring design that confirms or updates existing information or fills gaps and can report trends;
- reference conditions for biological monitoring programs to provide baseline data for water quality assessments and development of biological and nutrient criteria;
- data collected using comparable methods to allow aggregation of data at various scales and stored so as to be readily accessible to others (e.g., in EPA's database STORET);
- geographic references so that monitored waters can be mapped using a geographical information system (GIS), allowing information to be aggregated on a watershed basis;
- key information on condition of waters (e.g., impaired, in need of special protection, endangered species present, threatened sources of drinking water) and causes of impairment are reported in the national water quality inventory (305(b) report); and
- collaborative efforts on existing and planned monitoring activities with other public and private institutions to share information when goals are similar."

Invariably, watershed groups augment written plans with various maps showing water quality data. In recent years, this means using GIS. The hardware and software needed is expensive but often available at local engineering firms or colleges and universities. The ability to update geographic information and to examine different scenarios makes this technology very appealing.

Watershed Health Is Holistic

Water quality is, of course, hugely important for watershed planning and restoration. But, it represents only part of the picture. In reality, numerous activities impact the watershed, some obvious and some not so obvious.

"Formerly, when most people thought about surface water quality, they focused on the network of river and streams and the discharges of contaminants into those waterbodies," Mains says. "The watershed approach recognizes that what happens on the land surface can, directly or indirectly, affect water quality. Focusing on the stream network has been compared to analyzing the veins on a leaf, while focusing on the watershed would involve analysis of the entire leaf. Stream quality is a reflection of everything that is happening on the watershed."

For More Information

The National Environmental Services Center has a section of its Web site devoted to watershed issues. Go to *www.nesc.wvu.edu/ndwc/ndwc_watershed.htm* for a listing of watershed resources and articles. NESC Training Specialist Craig Mains may be reached at (800) 624-8301 ext. 5583 to discuss watershed planning and restoration efforts.

The U.S. Environmental Protection Agency's (EPA) publication *Volunteer Stream Monitoring: A Methods Manual* provides more information about chemical, biological, and physical assessments. Download the manual from the EPA Web site at *www.epa.gov/volunteer/stream/stream.pdf*. EPA's Watershed Web site (*www.epa.gov/owow/watershed*) has a great deal of

GLOSSARY

Benthic Macroinvertebrates
Organisms with no backbones that live on the stream, river, or lake bottom, and are large enough to be seen without magnification. They can be sampled to assess stream quality based on their numbers, diversity, and sensitivity/tolerance to pollution.

Biochemical Oxygen Demand (BOD)
The amount of oxygen consumed during the microbial decomposition of organic matter and the chemical oxidation of some inorganic compounds. It is measured under laboratory conditions by incubating a water sample under prescribed conditions and measuring the dissolved oxygen concentration before and after incubation.

Conductivity
The ability of water to carry an electrical charge. The conductivity of surface waters is largely determined by geology, so an abrupt change in conductivity may indicate a source of pollution.

Dissolved Oxygen (DO)
A measurement of the concentration of gaseous oxygen (O2) in water. Adequate dissolved oxygen is crucial for the maintenance of aquatic life. Oxygen is dissolved into water through diffusion from the atmosphere, by aeration, and as a product of photosynthesis. Oxygen is removed from water through the respiration of organisms and the decomposition of organic materials. As oxygen levels decrease, the types of aquatic organisms the stream can support may shift to less desirable species.

National Pollutant Discharge Elimination System (NPDES)
A program created as part of the Clean Water Act that works to control water pollution by regulating the discharge of point-source pollutants into U.S. surface waters. Facilities that discharge effluents directly into surface water must obtain an NPDES permit, which specifies what types and concentrations of waste may be discharged.

Nutrients
Typically refer to certain forms of phosphorus and nitrogen, which are essential nutrients for aquatic plants and animals. Under certain conditions, nutrients can stimulate plant and algal growth, which can potentially affect dissolved oxygen levels in the water and change the composition of aquatic life. Sources of nutrients may be from wastewater treatment plants, runoff from agricultural operations, runoff from urban and suburban areas, and failing septic systems.

pH
A measure of the intensity of the acid or base content of a water. pH is expressed as the negative logarithm of the concentration of hydrogen ions and is measured on a scale of 0 to 14. A pH of 7 is neutral, with lower numbers representing increasingly more acidic solutions and higher numbers more alkaline. Most aquatic life prefers pHs in the range of 6 to 9, with long-term deviations outside that range resulting in stress on aquatic life that may affect survival.

Total Maximum Daily Load (TMDL)
Calculates the maximum amount of the pollutant a water body can receive and still meet water quality standards. It identifies and quantifies the sources of the pollutant, both point and non-point source, and, using computer modeling, determines how the inputs must be reduced from the various sources in order for the water body to meet water quality standards. A water body may have multiple TMDL studies for different pollutants.

information about watersheds. The manual *EPA Requirements for Quality Assurance Project Plans* may be downloaded at *www.epa.gov/Region3/esc/QA/docs_qapp.htm* and the manual *The Volunteer Monitors Guide to Quality Assurance Project Plans* is available at *www.epa.gov/owow/monitoring/volunteer/qappcovr.htm.*

The Maryland Department of Natural Resources developed *A User's Guide to Watershed Planning in Maryland*, which may be downloaded from *http://dnr.maryland.gov/watersheds/pubs/planninguserguide/UserGuideCover-Ack.pdf* Although tailored to watershed efforts in Maryland, the guide is useful to groups in other parts of the country. A section of the site features tools and worksheets that can help document assessment efforts.

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On Tap Editor **Mark Kemp-Rye** lives in the Deckers Creek watershed, part of the Monongahela River sub-basin, in turn, part of the Ohio River basin.

NEXT INSTALLMENT

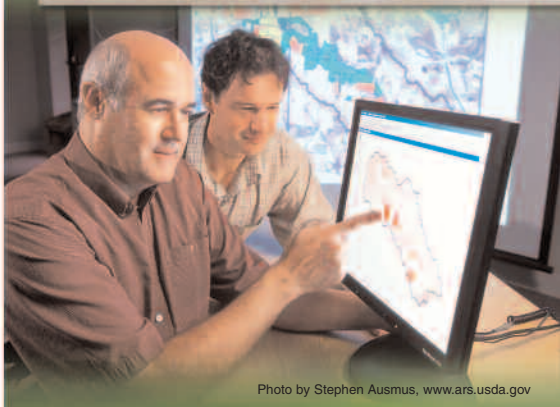

Photo by Stephen Ausmus, www.ars.usda.gov

The third article in our watershed series—coming in the Summer 2007 *On Tap*—deals with the specifics involved when crafting a watershed plan.

WATERSHED PLANNING WP

A Modest Beginning

Friends of Deckers Creek Measures Water Quality

Editor's Note: *In each segment of the four-part series about watershed groups, we'll show how the Friends of Deckers Creek, a successful watershed organization in West Virginia, has implemented the ideas presented in this article in their restoration efforts.*

Founded in 1995, the Friends of Deckers Creek (FODC) watershed group has worked diligently to restore an impaired waterway in northern West Virginia.

The Deckers Creek watershed, although relatively small, has several factors that influence water quality. Primarily, there is a legacy of acid mine drainage from abandoned coal mines that adds acidic water and iron to the stream resulting in stretches with very sparse aquatic life. However, a sizeable limestone quarry and runoff from the stockpiles of crushed rock has a neutralizing effect on the acid water. (See the map at right.)

To get an initial idea of what was going on in the water, the group conducted a benthic macroinvertebrate survey of the watershed. "We chose this type of survey because we wanted an overall assessment of the health of the watershed," recalls Craig Mains, a training specialist with the National Environmental Services Center and a founder of the FODC. "Because the benthic organisms have extended life spans in the aquatic environment they are exposed to the entire range of water quality conditions and because different organisms range from pollution tolerant to pollution sensitive they are excellent indicators of stream health. Also, because they don't require much investment in terms of collection equipment, this type of study made sense for a group that had more time than money."

Mains and other volunteers collected samples at 40 sites in the watershed, once in the spring and once in early fall. They also measured pH, conductivity, and temperature, but the focus was on the benthic macroinvertebrates. After analyzing the samples for diversity, pollution tolerance/sensitivity, and overall numbers, the group assigned a stream quality rating for individual stream segments and created a color-coded stream map that graphically showed stream quality for the watershed in a way that the general public could understand.

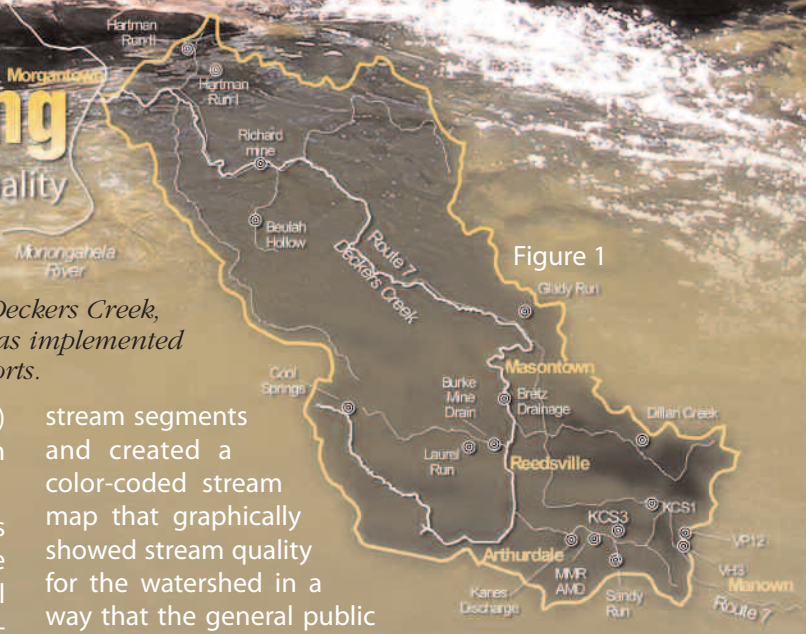

Figure 1

"The general public impression of the creek was that, while some of the tributaries were in fairly good shape, the main stem of the stream was polluted from beginning to end to the extent that it supported almost no life," Mains says. "We knew that the upper section of the main stem was acidic and that there was some recovery in pH levels below the limestone quarry, but that the pH readings dropped once again further downstream below where additional acid mine drainage entered. The benthic survey, however, showed that, far from being lifeless, aquatic life had recovered considerably downstream of the quarry. This led us to believe that if the primary source of acid mine drainage in the lower watershed was treated the lower section would become fishable."

Since 2002, FODC has conducted quarterly chemical monitoring and semi-annual biological monitoring for benthic macroinvertebrates and fish at fixed sites across the watershed. By publishing these data in annual *State of the Creek* reports, the group has educated the local community and agencies about the true conditions of the creek. FODC data has also been valuable in securing funding to mitigate several acid mine drainage sites in the watershed.

To learn more about the Friends of Deckers Creek, visit their Web site at **www.deckerscreek.org**.

FRIENDS OF DECKERS CREEK

All You Need to Know, From Idea to Funding RUS Water and Wastewater Loans and Grants Program

By Mark Kemp-Rye, *On Tap* Editor

Between 1940 and 2006, the U.S. Department of Agriculture's Rural Utilities Service (RUS, formerly the Farmers Home Administration) has funded water and wastewater projects valued at more than $35 billion. Many small and rural community water systems would never have been completed without these loans and grants.

Along with the drinking water state revolving loan fund, the RUS water/waste disposal (WWD) loan program is the major source of funding for small and rural communities seeking to build, improve, or expand their water or wastewater facilities. During the last (2006) fiscal year, RUS distributed $1.5 billion in program funding—$1 billion in the form of low-interest loans and $500 million in grants—through its network of rural development (RD) offices. If your community hasn't benefited from this program, chances are the folks down the road have.

Who is eligible?

How do you know if your town can participate in the WWD program? To be eligible for an RUS loan, a system must:

- be a local government, a cooperative, not-for-profit corporation, or an Indian tribe;
- provide service to a rural area or town of fewer than 10,000 people;
- be unable to self-finance the project or secure other financing at a reasonable rate;
- have the authority to construct, operate, and maintain the facility; and,
- be legally able to secure and repay the loan.

If your system meets all of these requirements, you may qualify for RUS funds.

Funding Has Many Uses

RUS program financing can be used for most costs related to the building or expansion of a water or wastewater project. These costs can include construction, legal expenses, engineering, and initial operating costs. RUS funds can account for most of the project financing and, in some cases, all of it. In many cases, other government programs (local, state, and federal) make up what RUS can't provide.

In fact, RUS encourages borrowers to seek joint funding whenever possible. Usually, an approved applicant receives a combination of a loan and a small grant. Because they don't have to be repaid, grants are more desirable. RUS determines whether an applicant is eligible for a grant based on the median household income of the area being served. If the community meets certain income requirements, the size of the grant is based on the user rates a system will have to charge to its customers to fund the project.

Grants help reduce project costs so the water or wastewater service can be provided at "reasonable" rates. Reasonable user rates are determined by similar system costs: what other communities are paying for the same type of service. The system receiving RUS funds is compared to neighboring communities that have similar population, income, and water or wastewater systems.

The rates from the other communities are used as a basis for determining what would be a reasonable average user cost in the community requesting RUS funds. RUS can provide up to 100 percent of a project's funding, but a maximum of 75 percent of that funding can be in the form of grants.

"One needs to look no further than the projects funded to see the impact we have had on removing public health hazards, creating growth opportunities and improving the quality of life for people living in rural America," says Gary Morgan, Assistant Administrator, RUS Water and Environmental Programs.

How does the process work?

A preliminary eligibility determination starts the process. A community planning to apply for RUS funding should do so as early as possible by submitting a standard application form, available at any state or local RD office. The application generally determines if the community meets the population, median income, and other eligibility requirements.

The application is then reviewed by RUS officials at the state RD office. If the document meets all criteria, RUS officials prepare for an application conference with community officials. At this point, RUS officials can look at the history of similar projects in the region and offer general advice as to what type of system should be installed, as well as some idea of the proposed project's per-household cost.

RUS officials feel one important matter discussed at the application conference is the selection of a consulting engineer. Community officials should stress to the engineer the importance of designing a system modest in scope and design and according to RD regulations. Communities should also check an engineer's references and consult with other communities the engineer may have worked with before hiring the engineer.

After all of these concerns are addressed, the RUS process may be postponed so that state government officials can submit relevant comments or give any needed project approval, such as from the state environmental office. State RUS representatives must then determine if the project is:

- Technically feasible—the preliminary engineering report is used to study community needs and ensure than an appropriate system design is being proposed.
- Environmentally feasible—this step addresses such concerns as, "Is the system being constructed in a floodplain?" And, "Will any wetlands be disturbed?"
- Legally feasible—Engineering and legal contracts are reviewed as well as any water purchase agreements and project-related property purchases.
- Financially feasible—this analysis determines whether adequate revenue will be generated to cover the system's operating costs, debt service, and other expenses.

Once all the feasibility issues are dealt with and any state input is received, the final step to loan approval is a letter of conditions. This letter explains the list of requirements the applicant will have to accomplish in order to close the loan and receive the funds. If the applicant agrees to the terms in the letter of conditions, the approval is signed by the state RD director.

It Ain't Over Yet

The time involved in the total RUS loan application process is difficult to estimate. The feasibility study alone can require anywhere from a minimum of three months to upwards of a year. After RUS approves a loan and/or grant, there is still a lot of work to be done. The engineer has to finish the design work, and the state engineer has to approve the design once it is complete. That entire process can take a year or so on a big project.

To make sure that higher priority projects are funded first, a rating system is used. Each approved application is given a score based on various criteria, the main factors being population (smaller communities receive priority), income (low-income residents receive priority), and public health (pressing health and sanitation problems receive priority). Each state office begins funding the projects with the highest priority first and works down the list until the money is gone or all prepared applications are funded.

Each state knows in advance how much money it will have for projects in a given fiscal year. State offices try to have enough projects lined up to account for about 150 percent of its allocations. This allows each state office to use its allocation even if a few applications are withdrawn or delayed.

Lower Rates, Longer Terms

A community's RUS loan is set at one of three rates—poverty, intermediate, and market rate—based on the community's median income. Current loans are in the 4.125 to 4.5 percent range, which is much lower than rates offered by commercial banks. RUS may also extend loans for up to 40 years, making the debt service payment more reasonable and affordable for the community.

"I believe we offer a unique service to rural America," says Morgan. "The combination of technical assistance, affordable financing, and partnerships helps create viable communities where people can live and prosper."

What information do I need?

Whether you are seeking an RUS loan or money from another source, most funding agencies need background information to determine whether or not a community is eligible.

Here are some items funding agencies typically request:

- an overview of the proposed project;
- rough cost estimates of the project;
- health or environmental problems the current systemfaces;
- current and projected user rates;
- number of residential and commercial users;
- total amounts of water used in a given time period (e.g., daily, weekly, monthly)
- median household income of the service area; and
- population of the service area.

These various pieces of information are easily obtained. Once eligibility is determined, applicants are then encouraged to file a formal application for their project.

RUS Application Process

The application process for RUS loans and grants has four components:

1. Initial Contact

RUS used to require a pre-application for communities seeking a loan or grant. Now, applicants can usually find out if they're eligible from their state rural development (RD) office. To locate your state office, check the blue pages in your phonebook or call the National Drinking Water Clearinghouse at (800) 624-8301. Information is also available on the RUS Web site at *www.usda.gov/rus/water*.

2. Application Conference

If the preliminary eligibility determination is favorable, an RUS representative meets with the applicant to discuss how to complete the final application and how to select a project engineer. The application is available at any state or local RD office.

3. Feasibility

After the formal application is submitted, RUS officials determine if the project is technically, environmentally, legally, and financially feasible. More detailed documentation is usually required at this step.

4. Approval

Projects are approved and prioritized at the state level. The number of projects funded depends on the amount of federal appropriations available in that fiscal year. Approved applicants may receive both a loan and small grant, depending on the availability of grant funds.

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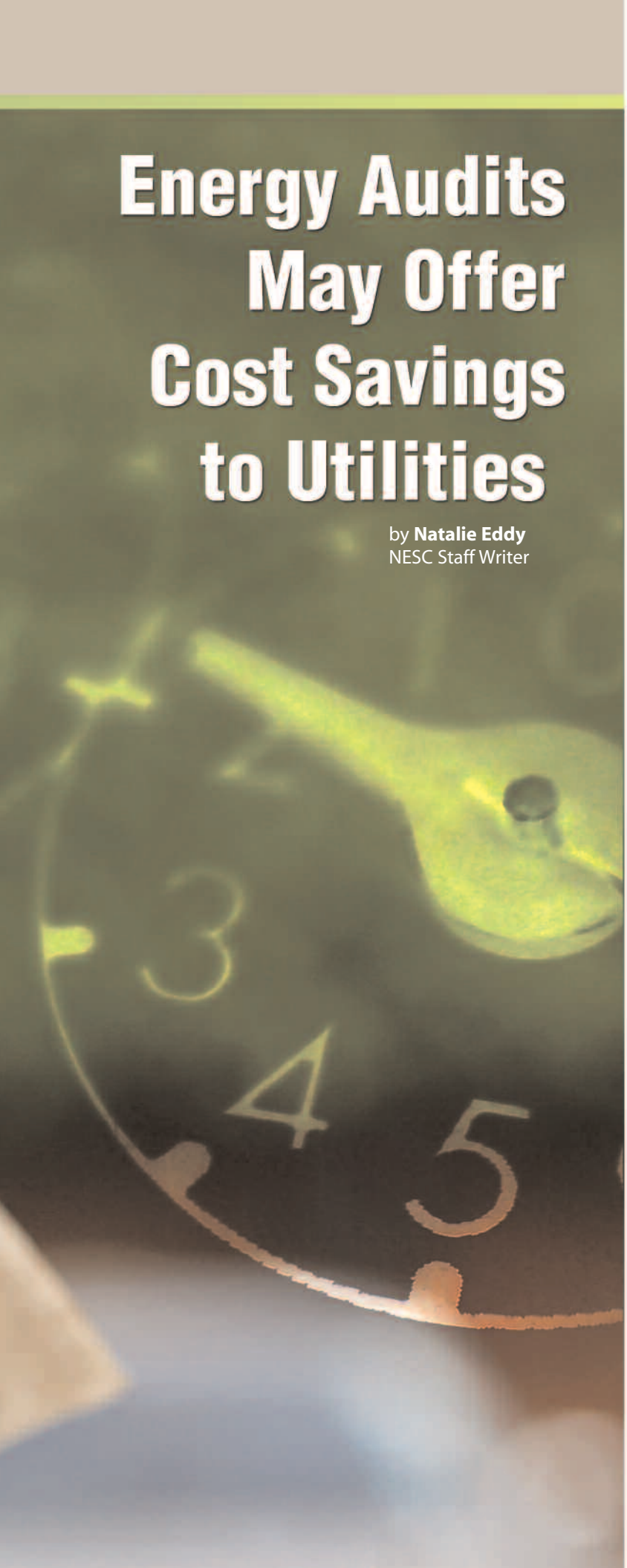


Energy Audits May Offer Cost Savings to Utilities

by **Natalie Eddy**
NESC Staff Writer

Large water and wastewater treatment plants can save 10 to 20 percent of their total energy costs through a conservation study. Although the cost of a professional energy audit may be prohibitive to smaller facilities, experts say smaller plants don't have to be left out in the cold.

One option may be to enlist technical assistance from your electric company. Some electric utilities offer technical assistance to water and wastewater plant operators and will hire a professional energy auditor or share in the cost of an audit. Also, some energy auditing firms offer group rates to smaller facilities.

Failing that, however, there are steps operators can take on their own, according to Ray Ehrhard, deputy director of the Electric Power Research Institute's (EPRI) municipal water and wastewater program, a research arm of electric utilities. "Generally, for smaller facilities, the best bang for the buck is making management controls without spending money. Things like making sure you're on the right electric rate schedule, shifting loads to off peak periods, looking for unnecessary equipment that's running, a variety of things like that." Ehrhard added that he has seen plants save as much as 50 percent by instituting these changes.

Pumps Are Paramount

Peter Barrer, PE, and Sharon Jones, project manager, both of Demand Management Institute (DMI) in Newton, Massachusetts, said one of the most important things a small facility can do to save money is to confirm that their pumps are in adjustment and working at their design efficiency level.

"If there's a single thing any facility should do it is to confirm their pumps are in adjustment," said Barrer. "It is often necessary to adjust the pump to obtain the original efficiency level. We often recommend that pumps get adjusted. It's easy for them to get out of adjustment over time, through wearing of the rings."

He suggested comparing the pump's performance to its original expectation by using a flow meter, pressure gauges, and a power measurement.

Jones suggested that pumps be tested annually to see if they are working at their targeted efficiency level. "It can be a tremendous opportunity for cost savings," she said. "Every pump has a manufacturer's performance curve that says at this pressure you should get this much flow, but be sure to use calibrated pressure gauges to get accurate readings."

"We had a case recently working with a plant where their motors were 200 to 300 horsepower. We checked the performance and just with an adjustment, which a maintenance guy was able to do in one day, we saved them $20,000 per year. That plant had been running like that for 10 years. It made it easy for them to pay our bill," she added.

Most smaller utilities will have only one pump. Barrer said if there is more than one pump, it is important to choose a pump that best matches the flow at any given time of day.

Jones noted that in many cases, pumps are oversized for a facility. "Many times when plants are built, they look at expectant population growth," she said. "Very often we will find a pumping station with two to five pumps that only runs one pump."

She added that sometimes it is worthwhile for facilities to buy a smaller pump just to handle night flows. "Sometimes after a system is built and you see what levels you're running at you can put in a smaller pump to match the flow more efficiently," she said.

Timing Matters

Jones noted that DMI has done a large amount of work with water and wastewater plants. "For one water supply utility we saw that they were normally running their pumps 24 hours per day, making as few flow changes as possible," she recounted. "Their electric company charged almost twice as much for electricity used during the day as for that used at night. We showed them that it would be to their advantage to fill their storage tanks at night and allow their water levels to fall to the lowest comfortable level during the day."

Barrer said some plants are installing variable speed drives in hopes of saving energy. He cautioned, however, that while they may be convenient, in many cases, will not save energy. "They are being sold for energy efficiency, particularly on water supply plants," he said. "They're very nice for operation. They don't bang the pumps starting and stopping, but we often find that they don't save energy."

However, Jones said if you already have a speed drive, it is usually to your advantage to use it to match the flow to the demand. "You will seldom recover the cost of putting the drive in compared to running on/off; but if you already have one, you can match your flow to the demand to keep a lower level in your storage tank," she explained.

"The power that you have to put into your pump is a function of flow and pressure. That pressure is set by the level of water in your storage tank so if you can lower that level, that's less power to put into that pump. There's always an advantage in maintaining the lowest level you're comfortable with."

Other Tips To Consider

Jones said another cost-saving tip is to analyze relative efficiency of water sources. "The cost of providing water can be very different," she said. "We had a case where a water supply plant had two sources—one source was the river supply, the other was a mountain stream. You have to look at how much power has to be put into each.

"There's a huge benefit to using the water that is from the mountain stream. The river water had to be pumped and treated. The mountain water was already at a high elevation so it required very little energy. They saved a tremendous amount of money by making a simple change."

Jones said some utilities base their yearly rates on the highest demand period charges, called ratchet charges. She suggested that in water supply systems it might be cost efficient to turn off one supply pump when operating a backwash pump so you can lower the demand peak and avoid these charges.

To help operators remember what time of day pumps should be running, she said it is helpful to make a clock face. "You should read the rate schedule and associated charges to find out when electricity costs more in your area," she said. "Then, make up a clock face with 24 hours on it. Put peak demand periods in red to remind operators. It's a simple thing, but it works."

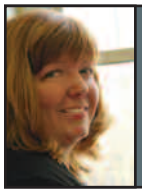
Barrer added that another cost-saving tip for smaller utilities is to use premium efficient motors when replacing a motor. "This can make a difference of two to three percent of a utility's total energy cost," he said, adding that it is only cost efficient if the motor already needs to be replaced.

Ehrhard suggested that operators "look at their equipment. Can they have more efficient equipment or operate it differently?" He added, "The best thing to do is to appoint an energy champion in the plant. Usually things are overlooked unless someone takes that role. We have seen some real results with this method. It can be a maintenance guy, plant operator, or anybody."

"It helps to have information on energy usage that's readily available and easy to track.

Many times the electric utility can help with that by putting a meter on the plant to track what their usage is. The energy champ might say, 'I'm noticing at these two hours during the day, we're at peak rate, we need to do these things to eliminate it.' Then, he can make the necessary changes."

To learn more about the Electric Power Research Institute, visit their Web site at www.epri.com. *Information about the Demand Management Institute may be found at* www.dmiinc.com.



Natalie Eddy, who now teaches in the journalism program at West Virginia University, was previously a writer for the National Environmental Services Center.

Photo courtesy of mn.water.usgs.gov

This article originally appeared in the Winter 1999 issue of *Water Sense*. Published by the National Drinking Water Clearinghouse between 1995 and 2000, *Water Sense* covered financial and management topics for small community water systems. Copies of the newsletter may be found on the National Environmental Services Center Web site at *www.nesc.wvu.edu/ndwc/ndwc_watersense.htm*.

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A New Measure of Success

Federal Programs Use Program Assessment Rating Tool

by **Caigan M. McKenzie**, NESC Staff Writer

Charles Robinette, special projects coordinator with the West Virginia Bureau of Health, was puzzled by the U.S. Environmental Protection Agency's (EPA) request. "We oversee the Safe Drinking Water Act for the state of West Virginia, and EPA funds the program," he says. "When we report the program's progress to EPA, we give general comments to the questions they ask. In many cases, the answer is 'ongoing' when we are asked about progress in specific phases of the program. This year, though, the type of information that EPA wanted had drastically changed."

Robinette is referring to the Program Assessment Rating Tool (PART). Administered through the Office of Management and Budget (OMB) in conjunction with federal agencies, PART was established in 2002 as a tool to evaluate the performance and management of the approximately 1,000 federal programs that are funded each year.

The Parts of PART

PART is a questionnaire composed of 25 questions that are common to all programs. In addition, PART includes customized questions about programs in each of the following program categories: direct federal, competitive grant, block/formula grant, regulatory, capital assets and service acquisition, credit, and research and development.

Questions are divided into four sections and are weighted:

- 20 percent of a program's overall score is determined by answers about a program's purpose and design;
- 10 percent by strategic planning;
- 20 percent by management; and
- 50 percent by results and accountability.

Answers must be supported by verifiable data.

Performance Measurements

More than half of federal programs have not demonstrated results, according to the OMB's first performance assessment process, because measurements were based solely on outputs. To reflect more realistic results, OMB has required that all federal programs measure progress through outcomes, outputs, and efficiency.

"There is a lot of confusion with these terms, particularly between outcomes and outputs," says Craig Mains, a training specialist with the National Environmental Services Center. "Outputs are the internal activities of a program (the products and services delivered). It answers the question: 'What does the program do to achieve its goal or purpose?'" For instance, a goal of a watershed training program could be to teach stakeholders how to protect their watersheds. The output measure could be the number of participants in the training program.

"Outcomes are the events or conditions external to the program and of direct importance to the public/beneficiary," Mains continues. "It answers the question, 'What is the program's purpose or goal?' For instance, do water tests taken after a watershed training program show a decrease in pollution?"

Efficiency measures looks at the ratio of inputs to outputs and outcomes. It tries to determine whether or not resources such as time, effort, and money are being used in the best possible manner.

Performance Ratings

Based on the answers given in the PART, the OMB will score each section (purpose and design, strategic planning, management, and results) from zero to 100. These scores are translated into ratings of program performance:

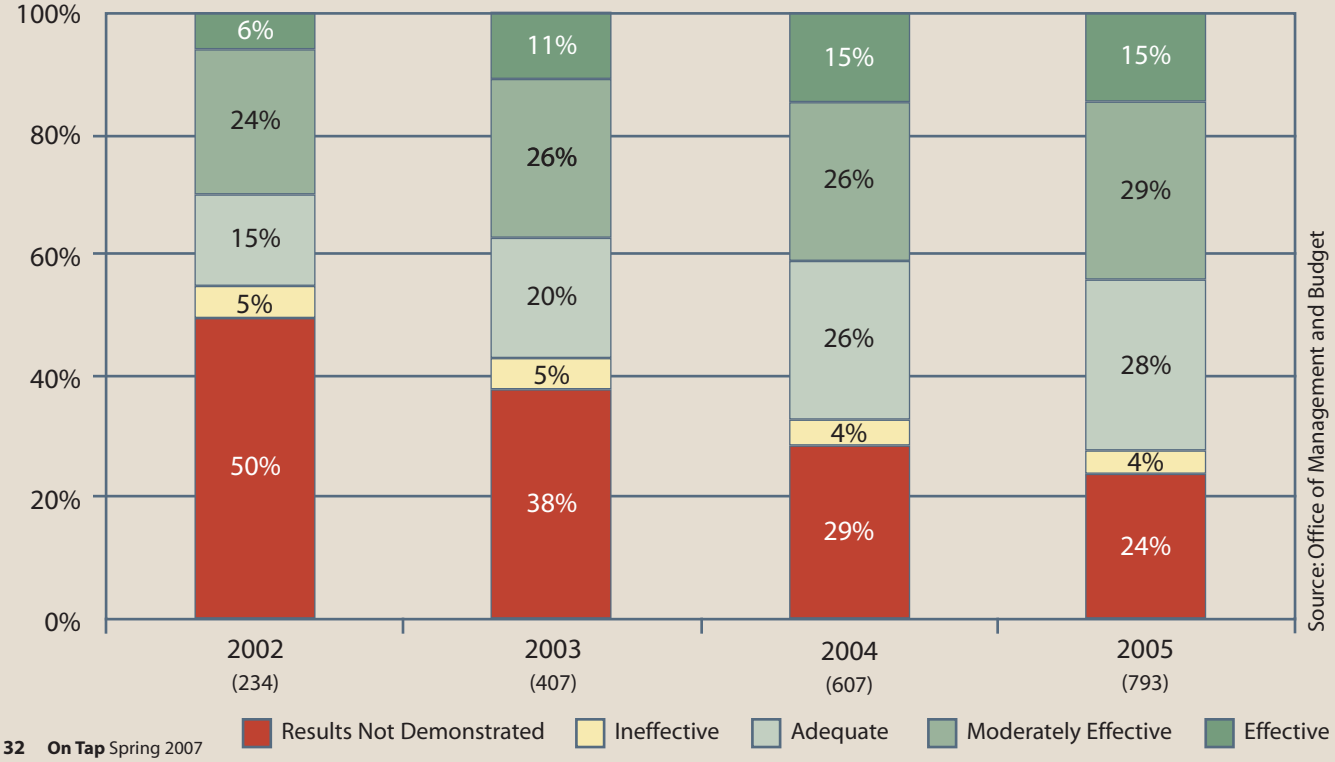
Effective	85 - 100
Moderately Effective	70 - 84
Adequate	50 - 69
Ineffective	0 - 49

Regardless of its overall score, a rating of "results not demonstrated" is given to a program when it does not have acceptable performance measures or performance data. Federal agencies can appeal the OMB evaluations to the President's Management Council, a five-person panel comprised of deputy secretaries who have management responsibilities at their respective agencies.

Relationship Between Ratings and Funding

Mains points out that a high score does not necessarily translate into increased funding, nor does a low score translate into decreased funding or termination of a program. A program that is rated effective, for instance, may be terminated or have its funding reduced because it has completed its mission, is duplicative of other programs, or if the program is ranked below programs with a higher priority. Conversely, a program that is rated ineffective may receive additional funding to help it overcome its deficiencies.

Figure 1: Distribution of Cumulative Ratings per Year



Program Follow-up Actions

One of PART's primary goals is to help programs, which it does by developing an action plan to improve a program's performance. Here are some actions for improving a water resources research program that was rated moderately effective:

- Work with other federal agencies on a multi-year plan to coordinate water research.
- Develop shared water research performance measures across agencies.
- Plan regular, independent reviews of the entire water resources research program.

When a program shows significant improvement, it can be reassessed to increase its rating. Even programs that receive the highest ratings have follow-up action plans.

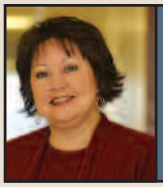
Under PART, federal agencies have become more aggressive in taking the steps necessary to improve program performance and accountability (see Figure 1.)

Because of PART's success in increasing government accountability, it was one of six winners of the 2005 Innovations in American Government Award, a program of the Ash Institute for Democratic Governance and Innovation at Harvard University's Kennedy School of Government.

For More Information

For more information about PART, visit the Office of Management and Budget's Web site at www.omb.gov/part. *After a program has been PARTed, draft summaries are automatically generated for public review at* www.ExpectMore.gov.

The National Environmental Services Center offers a training course covering PART and its components. To learn more, contact Craig Mains, NESC training specialist, at (800) 624-8301 ext. 5583 or by e-mail at cmains@mail.wvu.edu.



A member of NESC for more than eight years, **Caigan McKenzie**, has had a number of her water and wastewater articles reprinted in a variety of publications.

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Examples of Outputs and Outcomes

Outputs	Outcomes
Number of people served by water/ sewer projects.	Increased percent of people with access to clean drinking water.
Number of acres of agricultural lands with conservation plans.	Percentage of improvement in soil quality; dollars saved in flood mitigation.
Number of businesses assisted through loans and training.	Percentage of businesses that remain viable three years after assistance.

Source: Office of Management and Budget

How does PART affect my town?

Because PART evaluations are a recent development, it is difficult to predict their long-term impact, especially at the community level. It is likely, however, that some efforts will continue to be made to measure the effectiveness of government programs, including those that are intended to improve small community environmental services.

OMB implements PART review in conjunction with federal agencies that administer government programs. Federal agencies that administer those programs will increasingly be looking to state agencies and non-governmental organizations that in turn receive federal agency funding to provide documentation of their effectiveness. In the past, documentation was typically in the form of outputs—the number of communities assisted, for example. Because PART emphasizes outcome documentation as well as outputs, it is likely that small community assistance organizations and state agencies will feel increasing pressure from federal agencies to better document their outcomes at the local level. The end result may be that small community personnel will receive more requests for information related to the impact of assistance or compliance work.

The "trickle-down" flow of federal funding to small communities may increasingly rely on a "trickle-up" flow of information. Small community personnel such as plant operators and town managers can help by providing documentation of improvements in community conditions to the organizations and agencies that assisted in those improvements.

Map courtesy of docs.unh.edu

During the 1990s, the town of Batavia, New York (shown at right) faced the challenge of continuing to provide clean, safe drinking water. Rather than replace their aging treatment plant, local officials crafted an arrangement with neighboring Erie and Monroe counties, both of whom had more capacity than they were using. By the end of the project, 31 other communities became involved in the $35 million project.

Photos courtesy of www.downtownbataviany.com

Batavia, NY

Population 16,256*

*2000 U.S. Census

Continued from page 17.

and other regulatory mandates. These include, for example, EPA's copper, lead, arsenic, microbe, disinfection by-product, and radionuclide rules, which are driving new investments in treatment technologies. Because these investments are expensive, many small water utilities can most economically meet these new demands by spreading their water filtration and treatment costs over a larger customer base, rather than continually raising their water rates. This creates an incentive for institutional change, especially through water system expansion or consolidation.

The need to purchase advanced treatment technologies, in turn, raises many of the issues that private water systems faced in meeting new demand at the turn of the last century, when cities were rapidly growing and privately owned utilities' access to capital was constrained. These capital needs are likely to grow simply because of the need to replace old pipes, expand service to meet new demand, and comply with post-9/11 security needs. Most analysts consider water service bonds to be a safe investment, but bond returns are still influenced by the size and scale of the water utility. It's often easier and cheaper for larger water utilities to borrow money than smaller ones because of their larger revenue streams. State revolving loan funds can theoretically offer smaller water systems capital at lower rates than could private bond markets, but because the demand for these funds outstrips supply, access to that capital can involve a long wait on a state priority list.

More stringent public oversight (by state environmental agencies and public utility commissions) of water systems can influence institutional change. Public utility commissions have resolved most of the historic problems of corruption, but regulatory red tape can also impede needed improvements, especially if it limits a small utility's ability to raise its water rates to pay for its growing treatment and operational

costs, or denies its requests for expansion of its service area. Larger water systems with their larger staffs simply have greater administrative capacity to handle the reporting and the paperwork generated in meeting state public utility regulations as well as SDWA mandates. So, in the same way that some scholars believe that contractual conflicts on the state and municipal level drove urban water system changes in ownership in the 19th and 20th centuries, state and federal conflicts may still create incentives for water systems to change their scale or operations in the 21st century.

Finally, reducing the transaction costs of acquisition could be a useful strategy to encourage mergers between water systems so that they can realize better economies of scale and thus achieve higher rates of regulatory compliance. Lee's statistical analyses of water system mergers in the Midwest reinforce current beliefs that merger can be an effective way for smaller water systems with SDWA violations to achieve regulatory compliance. The fact that smaller water systems and water systems with SDWA violations are both more likely to be acquired gives some credence to those beliefs.

However, this same analysis shows that small water systems in rural counties with lower incomes and low or declining growth rates are apparently not using merger as a compliance strategy, despite their higher rates of SDWA violations. If regulators and policy makers want to encourage mergers as one way to shift more capital and resources to troubled small rural water systems, adopting policies to reduce the transaction costs of a merger make a lot of sense. Because water systems that purchase water often are acquired by the system that they purchase water from, adopting state and federal policies that encourage the transfer or sale of water between adjacent rural systems is likely to be the most helpful approach to reducing some of these costs.

Other strategies can also be considered. Either offsetting high transaction costs with direct grants or loans, or deregulating the merger process (especially if water systems are treated like public utilities) will certainly encourage more mergers. Reducing some of the political burdens on transfers of publicly owned systems (by removing requirements for public referenda, for instance) might also reduce some of these costs, making mergers a more effective strategy for dealing with SDWA violations by small water systems.

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By **Martin Jaffe**, Director and Associate Professor, Urban Planning & Policy Program, University of Illinois at Chicago.

John Braden, Professor, Department of Agricultural & Consumer Economics, University of Illinois at Urbana-Champaign.

Min-Yang Lee, Graduate Research Assistant, Department of Agricultural & Consumer Economics, University of Illinois at Urbana-Champaign.

LETTER TO THE EDITOR

To the Editor,

I read the article on chlorine safety (Fall 2006 *On Tap*) and wondered about the wisdom of storing and using this chemical in a populated area. The City of Syracuse, New York, gets its water directly from Skaneateles Lake—unfiltered. The chlorination is done in a small building located in downtown Skaneateles, right next to a hotel and just upwind of the center of the small village.

I think it would be a good idea to move this chlorination to a point one or two miles downstream from the present downtown site. This would place the threat more away from a population center and the injection point could stay the same if they ran a pipe from the present site down the inside of the line to the new out-of-town site. It would also be an improvement—coupled with other security measures such as alarms, cameras, and regular police patrol—with respect to the issues of environmental terrorism.

Bill Hecht

Syracuse, New York

Editor's Response

Zane Satterfield, NESC engineering scientist and author of the chlorine safety article, responds:

Dealing with chlorine gas in a populated area is always a safety risk. The best arrangement is to store the chlorine downwind and on the outskirts of town. Any water system that deals with chlorine gas in any amount should have any emergency response plan and procedures in place involving the local police, fire, and rescue services. Security must also be addressed, as well as educating local residents about potential hazards.

fun time

WORD PUZZLE*

watershed
planning
management
conservation
consolidation
merger
distribution
lines
pigging
trading
well
maintenance
quality
assessment
involvement
success

a	t	d	u	h	p	l	e	v	g	i	d	o	p	r	y	h	m	c	o	t	a
g	t	n	e	m	e	v	l	o	v	n	i	p	g	a	m	t	n	e	a	q	j
b	n	d	n	a	w	r	p	s	s	c	i	f	s	e	t	u	i	y	w	d	i
f	i	i	g	e	d	w	r	z	k	h	t	n	a	n	j	w	e	l	l	e	w
e	l	z	d	p	f	r	e	w	n	w	h	i	n	e	g	n	c	i	a	s	h
t	s	g	s	a	h	v	c	o	n	s	e	r	v	a	t	i	o	n	p	u	z
n	u	w	n	e	r	b	o	l	h	r	t	w	t	o	l	h	k	e	g	r	q
e	c	n	a	n	e	t	n	i	a	m	a	e	z	s	v	p	d	s	n	e	s
m	c	e	r	n	g	e	s	t	g	a	e	u	s	d	d	i	o	p	s	h	d
s	e	a	s	z	e	n	o	d	b	n	a	r	i	v	o	g	r	w	e	i	e
s	s	o	p	m	p	z	l	i	h	a	q	t	g	t	n	g	w	a	c	n	m
e	s	t	g	c	k	o	i	r	f	g	g	j	t	e	h	i	g	t	t	y	u
s	q	e	v	e	g	e	d	s	n	e	d	n	g	s	r	n	i	e	i	i	l
s	w	t	a	h	r	z	a	e	r	m	d	b	i	u	p	g	z	r	w	p	v
a	w	g	d	s	l	g	t	q	d	e	p	y	l	n	w	t	f	s	a	l	r
i	p	c	t	y	s	n	i	g	z	n	u	w	h	d	t	n	a	h	l	b	e
i	n	g	j	u	h	n	o	a	y	t	s	h	o	k	r	z	p	e	t	q	i
a	t	m	r	p	s	d	n	o	i	t	u	b	i	r	t	s	i	d	m	t	a

*Solution on page 39

Wordsearch by Sheila Anderson

QUOTES

A lake is the landscape's most beautiful and expressive feature. It is earth's eye; looking into which the beholder measures the depth of his own nature.

—Henry David Thoreau (1817–1862)

It is a fascinating and provocative thought that a body of water deserves to be considered as an organism in its own right.

—Lyall Watson (born 1939)

Don't empty the water jar until the rain falls.

—Philippine Proverb

Man—despite his artistic pretensions, his sophistication, and his many accomplishments—owes his existence to a six-inch layer of topsoil and the fact that it rains.

—Author Unknown

If you're not part of the solution, you're part of the precipitate.

—Steven Wright (1955–)

WATER TRIVIA

According to energy conservation experts, homeowners can save energy by using cooler water when washing clothes. Using hot water for both washing and rinsing uses how much more energy than using warm wash and cold rinse options?

a) slightly more
b) twice as much
c) 3.5 times as much
d) five times as much

According to the Alabama Office of Water Resources, using hot water for both washing and rinsing requires more than three-and-a-half times the energy than the warm wash/cold rinse combination.

Hmmmm

In a 100-year period, a water molecule spends 98 years in the ocean, 20 months as ice, approximately two weeks in lakes and rivers, and less than one week in the atmosphere.

Source: LennTech, Rotterdam, The Netherlands

World's Water Resources Face Mounting [PRESSURE]

By **Elizabeth Mygatt**
Staff Researcher, Earth Policy Institute

Global freshwater use tripled during the second half of the 20th century as population more than doubled and as technological advances let farmers and other water users pump groundwater from greater depths and harness river water with more and larger dams. As global demand soars, pressures on the world's water resources are straining aquatic systems worldwide. Rivers are running dry, lakes are disappearing, and water tables are dropping.

Much of the growth in water use over the past half-century is from a vast increase in irrigation, which is used to produce 60 percent of the world's grain. Globally, irrigated area nearly tripled between 1950 and 2003, growing from 94 million to 277 million hectares. This growth, however, is tapering off as the water needed to expand irrigation becomes increasingly scarce. Forty years ago, irrigated area was expanding at an annual rate of 2.1 percent, but the last five years of data reflect slower growth of only 0.4 percent.

Meanwhile, the extent of irrigated area per person reached a high of 47 hectares per thousand people in 1978 and has been shrinking steadily since 1992. In 2003, per capita irrigated area dropped below 44 hectares per thousand people, the lowest level of the past four decades. With population growth outpacing growth in irrigated area, this figure is unlikely to rebound substantially.

As demand for water continues to grow to satisfy rising agricultural, industrial, and residential needs, aquatic ecosystems struggle to respond. Countless communities depend heavily on rivers, both for direct water use and as a source of energy. But as upstream populations increase their demands, downstream communities have less water available to them. In some cases, rivers become so overexploited that they cease to exist altogether.

The Colorado River in the southwestern U.S. is among the world's rivers that run dry for at least part of the year, depleted by southwestern farmers and thirsty cities alike, with more than one-fourth of these withdrawals—3.8 trillion liters—going to California alone. Other rivers, including the Ganges, the Indus, and the Nile, are sometimes little more than a trickle by the time they reach the sea.

As rivers run dry, the lakes that rely on them suffer as well. Lake shorelines are receding and water levels are dropping due to dramatic reductions in inflow from rivers and streams, declining recharge from overstressed aquifers, and increasing water withdrawals from lakes. For example, Mono Lake in California has fallen by 11 meters since 1941, the year Los Angeles first began to draw water from its tributaries.

Falling water tables are less obvious indicators of global water shortages than disappearing lakes and dry riverbeds. Yet groundwater reserves are becoming increasingly depleted, due in large part to the rise in irrigated area and the growing use of water for industrial purposes. Aquifers that supply irrigation water to some of the world's major grain producers are of particular concern because they cannot be replenished.

While groundwater is integral to today's agriculture, it is also a valuable resource in urban environments. Some of the world's largest cities, including Mexico City, Calcutta, and Shanghai, rely heavily on local groundwater. Worldwide, it is esti-

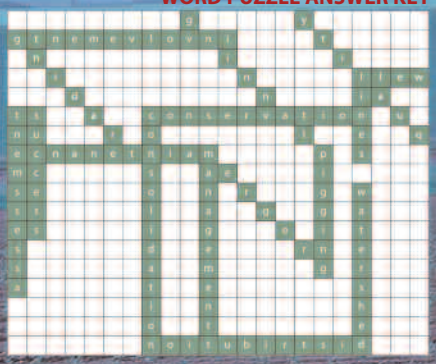
mated that roughly two billion people—in both rural and urban environments—rely on groundwater for daily water consumption.

With the projected addition of 2.6 billion people to the global population by 2050, most of them in countries where water tables are already falling and wells are going dry, water shortages will likely become more commonplace and more severe. Absent a global effort to quickly slow population growth and to use water more efficiently, water shortages may translate into food shortages in more and more countries.

Water resources are one of 12 indicators that the Earth Policy Institute monitors in the development of what they call an eco-economy. Learn more about EPI's work by visiting their Web site at www.earth-policy.org.

A graduate of Williams College, **Elizabeth Mygatt** is the staff researcher at the Earth Policy Institute. In this position, she conducts research and writes and edits *EPI's Eco-Economy Indicators* and *Eco-Economy Updates*.

WORD PUZZLE ANSWER KEY



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For many years, the National Drinking Water Clearinghouse has provided products at no charge. Now, we've implemented a fee structure for some of our products.

Of course this seems like bad news, but in some ways it isn't. Here's why:

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3. We'll be able to expand our product offerings because we can now provide items that would've been rejected due to their cost.

View the complete products list on the NDWC Web site at *www.ndwc.wvu.edu*.

If you don't have Internet access or you'd like to discuss your particular situation, please call us toll free at (800) 624-8301 and select option "3" to talk with one of our technical assistance specialists.

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