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Reader Suggestion

Conservation: It's the Future of Water

by Harriet Emerson
On Tap Editor
Mohamed Lahlou, Ph.D.
NDWC Technical Assistance Specialist

The history of humankind is the story of water—a tale of communities blooming along the banks of rivers and edges of oceans. No civilization flourishes without water and human survival depends on good drinking water.

All the water that ever has been or will ever be on Earth is here now, and with only 1 percent of all that water available for drinking, water conservation makes sense. According to former U.S. Senator Paul Simon's *Tapped Out*, the world's population of 5.9 billion will double in the next 40 to 90 years.

"At least 300 million people live in regions of severe water shortages. By the year 2025, it will be three billion. Compounding these grim realities," says Simon, "is the fact that per capita world water consumption is rising twice as fast as the world's population."

According to David Prasifka's *Water Supply Planning*, two billion people worldwide don't have an adequate water supply and three billion are without adequate sanitation. Exact figures are difficult to come by, however, the numbers are staggering.

What is water conservation?

We are in the midst of a national shift away from the traditional water supply management concept that perpetuated an endless thirst for new water sources, toward water demand management and a holistic view of ecosystems.

The August 1998 Environmental Protection Agency (EPA) *Water Conservation Plan*

Guidelines state that "water conservation consists of any beneficial reduction in water losses, waste, or use." For water systems serving populations of 10,000 or fewer, the *Guidelines* recommend universal metering, water accounting and loss control, costing and pricing, and information and education. (For a review of EPA's *Guidelines* see page 6. See also the *Water Conservation Measures Fact Sheet* in the center pages.)

The American Water Works Association

(AWWA), which has long urged utilities to adopt efficient water use policies, uses the term "total water management," which it says "recognizes the paradigm shift from considering water available in unlimited quantities to understanding water supply as a limited resource."

AWWA sees this view of water management as an "attempt by the water supply industry to assure that water resources are managed for the

greatest good of the people and the environment and that all segments of society have a voice in the process." It is a concept that considers integration of the complete water cycle and holds that "land and water resource management must be integrated at the local level."

In "Conservation in the Arabian Gulf Countries," a *Journal of American Water Works Association* article, Adnan Akkad suggests that a better term for water conservation is "effective water use," because the term "conservation" may carry the stigma of inconvenience and discomfort. *Continued on page 18*



Picture by Harriet Emerson

A storm rumbles over the Atlantic at Virginia Beach, Virginia.

In This Issue

**Special
Water
Conservation
Issue**

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Conservation Is the Future of Water

We devote this issue of *On Tap* to water conservation, beginning with an overview of the subject by *On Tap* Editor Harriet Emerson and Technical Assistance Specialist Mohamed Lahlou, Ph.D., who wrote his doctoral dissertation on water demand management. (See page 1.)

Kathy Jespersion, National Drinking Water Clearinghouse (NDWC) staff writer looks at technical assistance in California, our most populous state and one that may very well face future water problems. Many of the state's 31 million people are totally dependent upon water transported from somewhere else. (See page 4.)

In August, the U.S. Environmental Protection Agency (EPA) published its *Water Conservation Plan Guidelines* as mandated in the reauthorized Safe Drinking Water Act of 1996. The Guidelines recommend that small drinking water systems implement four conservation measures—metering, leak detection, pricing policy, and public education. (See page 6 for a review.) Lahlou gives us a “Conservation Measures Fact Sheet” in lieu of his usual water treatment Tech Brief. (See center pages.)

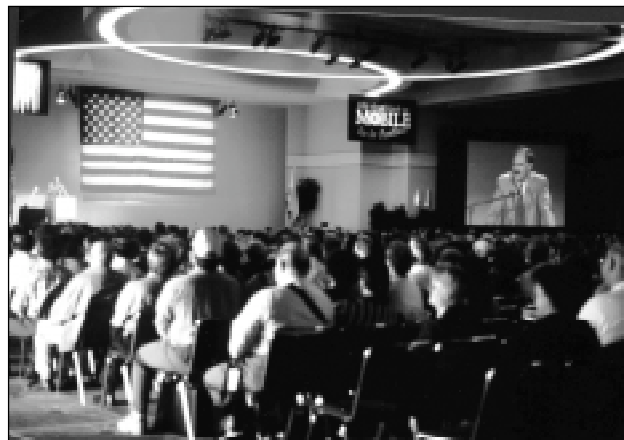
Thanks to John Flowers, an environmental engineer with EPA, who reviewed our conservation issue. Flowers serves as Director of Water Alliances for Voluntary Efficiency (WAVE). (For information about this program, see page 24.)

Currently, Consumer Confidence Reports (CCR) are a hot topic. Jamie Knotts, NDWC promotions editor, provides an overview of the CCR (see page 10). We plan to take a closer look at the CCR and its impact on small systems. If your community has had experiences with the CCR that you'd like to share with our readers, contact us at *On Tap*.

We bid a fond farewell to Technical Assistance Specialist Salam Murtada, who has moved south to work as an environmental engineer with North Carolina's Department of Environment and Natural Resources. Murtada is now employed in the Underground Storage Tanks (UST) Section of the state's Waste Management Division. We thank him for contributing the article on USTs. (See page 12.)

Michelle Moore, contributing writer, investigates an increasingly popular method of water-saving landscaping—xeriscaping. Moore, who writes a gardening column for the *Pittsburgh Post Gazette*, is particularly well suited to handle the topic as she has 13 years experience in the field and is pursuing a degree in horticulture. (See page 13.)

A number of readers have requested information about desalination. Due to the expense, desalination is not a method widely used by small systems; however, in the future, the technology should improve and the use of desalination is bound to increase as population increases and



Rural Utilities Service (RUS) Deputy Administrator John Romano addressed National Rural Water Association Conference attendees in Mobile, Alabama, at the end of October. He noted that for the second time, the White House announced Water 2000 funding affording rural drinking water issues higher national visibility. (For more about Water 2000, see page 3.)

water quality decreases. Technical Assistant Specialist Babu Srinivas Madabhushi answers desalination questions. (See page 22.)

We provide a large conservation resource section in this issue, including a list of organizations and Web sites for adults (see page 24) and conservation education for children. (See page 26.)

The NDWC employs several graduate students who perform research and help field technical assistance calls. Vipin Bhardwaj has worked with the NDWC since the beginning of the year and Ganesh Kumar Subramanian began to work with us in August. Both have a background in chemical engineering. Bhardwaj is pursuing a masters degree in environmental engineering and Subramanian in chemical engineering.

We've added a new icon to *On Tap* pages to indicate that a reader suggested an article or subject. Look for this: Reader Suggestion

Contact On Tap Online

Do you have suggestions for On Tap? Call, write to the address in the credit box at the left, or e-mail.

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Water 2000 Help Is On the Way to 87 Rural Communities RUS Awards \$155.8 Million in Assistance

This summer Vice President Al Gore and U.S. Department of Agriculture (USDA) Secretary Dan Glickman announced \$155.8 million in grants for rural communities through Water 2000, stating that 2.5 million people in more than 1,300 rural communities nationwide have been helped already through this initiative. However, the release says, at least 2.2 million rural Americans still contend with critical quality and accessibility problems with their drinking water, including an estimated 730,000 people who have no running water in their homes.

"Safe, reliable drinking water is more than a matter of convenience," Gore said when announcing the combination of grants and loans that will be distributed under the Water 2000 initiative. "It's critical to public health and economic development. Through Water 2000, we are helping to build and upgrade the basic infrastructure needed to sustain rural communities."

The Centers for Disease Control and Prevention estimate that nearly one million Americans become sick each year from drinking contaminated water. These illnesses, which are primarily intestinal, are both dangerous and expensive, especially to infants and people with suppressed immune systems.

Nearly five million more rural residents are affected by less critical, but still significant, water problems, as defined by the Safe Drinking Water Act (SDWA). Among these problems are under-sized or poorly protected water sources, a lack of adequate storage facilities, and antiquated distribution systems. Leaks can cause problems in older, existing systems. Leakage decreases water pressure throughout the system, which may increase the likelihood of contamination.

Who benefits from Water 2000 funding?

All Water 2000 funding goes toward building new systems or improving and expanding existing systems. The intention of the program is to resolve the problems of rural Americans who have no drinking water in their homes, who are drawing water from unclean or unsafe sources, or whose water supply is so inadequate that they only have sporadic water service, according to Bart Handford, assistant to the administrator for the USDA Rural Utilities Services (RUS).

RUS selects Water 2000 water and waste disposal projects and funds them through appropriations made by Congress. RUS also considers assistance provided to the neediest communities as falling in the Water 2000 category. Those projects qualify for the lowest of its three interest

rates, because the median household income of the area served is lower than the poverty rate or less than 80 percent of the state median household income.

Rural Areas Are Already Receiving Help

Several projects have already received funds from Water 2000. The village of Kongiganak in Bethel, Alaska, has treated surface water available at a washeteria. Some residents catch rain in the summer and melt ice in the winter to meet water needs. Homes are not plumbed, and honey buckets, receptacles in which waste is collected, are hauled by the villages to a pretreatment site at a sewage lagoon. The residents will benefit from an upgrade of the washeteria and treatment for wastewater and honey bucket waste. The project will also locate and develop a potable water supply for this remote, rural Alaskan village. This \$800,000 project will be funded with a USDA Rural Development Rural Alaska Villages Grant of \$300,000 and a grant from the State of Alaska of \$500,000.

The Old Leupp Water Line Extension project in Navajo County, Arizona, is to be funded with a \$126,000 loan and grant from RUS. The sole water main serving this area is not adequate to meet the needs of residents. Low water pressure and frequent breaks in the pipeline create reliability and health problems for customers. The situation is so bad that some families have had to resort to hauling water and using pit privies. A new water line will be constructed that will serve homes on the existing system and four additional homes that, due to system problems, were previously unable to connect to the system.

The town of Tilton in Belknap County, New Hampshire, relies on individual subsurface septic systems for waste disposal. Soil surveys have shown that natural soils in the area are not suitable for leach fields to properly treat wastewater from the septic systems. These inadequate systems pose a threat to the nearby Lake Winnisquam and to wells supplying domestic water to residents. The proposed project will replace the malfunctioning and deficient septic systems with eight-inch pipe, a six-inch force main, and two pump stations. This plant is also part of an effort to reduce, and eventually eliminate, pollution in nearby lakes.

Most of us can take for granted the availability of clean, safe drinking water. But these examples

Continued on page 5



RUS Interest Rates

The interest rates for the first quarter of fiscal year 1999 apply to all Rural Utilities Services (RUS) water and wastewater loans issued from October 1 through December 31, 1998. The rates are:

- poverty line, 4.5 percent;
- intermediate, 4.75 percent; and,
- market, 5.0 percent.

For the phone number of your state Rural Development office, contact the National Drinking Water Clearinghouse at (800) 624-8301 or (304) 293-4191.



In California: Technical Assistance Aids Water Conservation

by Kathy Jespersen
NDWC Staff Writer

Water conservation in California is no simple task. Yet, neither is providing technical assistance designed to conserve the state's limited water supplies. Agriculture, the environment, and urban communities each place distinct demands on these strained resources. And, since California is growing so rapidly, so is the demand for water.

According to the California Water Plan (CWP), if the state does not take tangible steps toward water conservation now, it will face a serious statewide water shortage by the year 2020.

"Water is California's modern-day gold, and it is crucial that we ensure there will always be enough," said Doug Wheeler, secretary of resources, California Resources Agency, in a January 1998 press release. "The state has a variety of options, such as conservation, recycling, groundwater storage, and off-stream storage that will make the most of our water supply."

Technical Assistance Is Provided

California provides technical assistance for small systems through its Local Assistance Program via five offices, including its headquarters, and four districts—Northern, Central, San Joaquin, and Southern. Its technical assistance program includes regular communication with local water systems, technical advice on management concerns, regular training options, and publications that help answer technical assistance questions.

Since 1991, the state also has had a comprehensive water conservation program in place. Through the program, California provides technical assistance and incentives to

encourage conservation measures. The program helps local systems by:

- conducting water resources investigations;
- supporting local surface and groundwater projects that restore or enhance environmental resources;



Photo by Harriet Emerson

Dry cliffs rise along the classic California coastline at San Gregorio Beach, an hour south of San Francisco.

- encouraging water conservation programs;
- promoting water reclamation and use of recycled water;
- promoting conjunctive use of surface and groundwater;
- facilitating voluntary water transfers that do not harm fish or wildlife resources, cause overdraft, or degrade water supplies;

- operating a state drought center and water bank; and
- encouraging effective land management practices in drainage problem areas.

Low-interest Loans Help Conservation

California provides low-interest loans as one of its water conservation incentives. "We've given loans to communities for projects such as installing meters, lining distribution lines to prevent water loss, replacing leaking distribution system controls, and installing low-flow flush toilets," said David Rolph, environmental specialist, California Department of Water Resources. "If the purpose is to minimize water loss, we can usually find a way to fund the project, as long as it meets the engineering/hydrologic feasibility and cost effectiveness eligibility criteria established for the program."

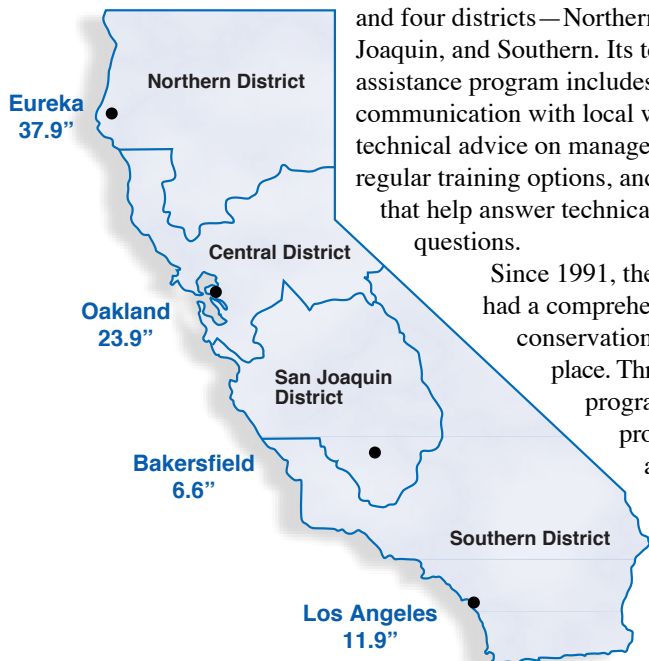
"We have three programs that provide financing to local agencies—Water Conservation loans, Groundwater Recharge loans, and Local Projects water supply construction loans and feasibility study grants," he continued. "A big incentive for many communities is that the loans offer a discounted interest rate for water conservation projects."

Best Management Practices Save Water

Another big part of California's water conservation program is what it calls Best Management Practices. *Continued on next page*

Precipitation varies widely in California—amounts for selected cities are indicated below. Rain falls most frequently October–April in the North and November–March in the South.

Source: WorldClimate.com



Continued from previous page

Management Practices (BMPs). BMPs are policies, programs, practices, rules, regulations, or ordinances as well as the use of devices, equipment, or facilities that result in conservation and more efficient use of water. A voluntary BMP program is implemented by the California Urban Water Conservation Council. BMPs include:

- residential plumbing retrofit programs;
- system water audits, leak detection, and repair;
- metering;
- landscape conservation programs;
- high-efficiency washing machine rebate programs; and
- public education programs.

“Because water tends to be inexpensive, there isn’t much effort put toward conserving it,” said Keith Watkins, chief of water use efficiency, California Department of Water Resources.

According to Watkins, that’s why metering and pricing are important to a water conservation program. “Requiring meters and billing customers for how much water they actually use could result in a 20 percent reduction in water demand statewide,” he said.

California Conserves Water for Agriculture

In California, water conservation also means controlling agricultural water use. According to the state’s Web site, “With irrigation, California’s valleys became the greatest food producing area on earth. By the end of the 19th Century, the state produced an amazing volume of wheat, more cotton than any state but Texas, two-thirds of the nation’s oranges, more than 80 percent of the nation’s wine, and 90 percent of the lemons. The agricultural products quickly exceeded in value all the gold the state ever produced.”

With the rest of the nation depending on California for much of its produce, the state has to ensure that there’s plenty of water for irrigation purposes. “There’s been an effort to use recycled water for irrigation,” said Watkins. “Also, irrigation districts must develop water plans, which are administered by the Agricultural Water Management Council. The plans should evaluate current water management practices and design ways for increasing efficiency.”


Population Affects Conservation

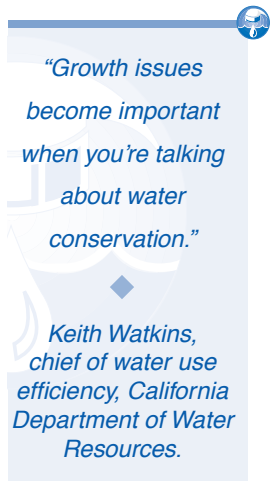
For a growing state, California must also consider its increasing population. By 2020, the population is expected to jump from 31 million inhabitants to 47.5 million, according to the CWP.

“Growth issues become important when you’re talking about water conservation. Attempts to limit growth sometimes work and sometimes don’t. There really aren’t any simple answers,” said Watkins. “There’s been much growth in the desert, and large chunks of prime agricultural land have been converted for urban development.”

Urban water use is expected to increase from 11 percent of California’s total water use to 15 percent by 2020. According to the CWP, “Reliable water supplies for the state’s industry and population are vital to retain environmental quality and the productivity of California’s economy, the seventh largest in the world.”

For more information about California’s technical assistance or water conservation programs, tour the state’s Web site at <http://www.dwr.water.ca.gov/> or call Keith Watkins at (916) 327-1808.

For more information about California’s loan programs, call David Rolph at (916) 445-8259. 




RUS Awards \$155.8 Million in Assistance

Continued from page 3

show the primitive conditions under which many people are still living here in the U.S. Through Water 2000, rural Americans will be able to enjoy convenient, clean drinking water, too.

More information about Water 2000 may be found on USDA’s Web site at <http://www.usda.gov/rus/watr2000/index.htm> or by contacting Bart Handford at (202) 720-1261. You may also e-mail him at bhandfor@rus.usda.gov or write to 1400 Independence Ave., SW Stop 1538, Washington, DC 20250-1538.

The National Drinking Water Clearinghouse (NDWC) offers a compilation of On Tap and Water Sense articles titled the Water 2000 Information Package. To obtain a copy, call the NDWC at (800) 624-8301 or (304) 293-4191 and request item #DWBLGN35. The cost is \$1.90 plus postage. Orders may also be placed via e-mail at ndwc_orders@ndwc.wvu.edu. 



EPA Publishes Conservation Guidelines

Editor's Note: The U.S. Environmental Protection Agency (EPA) Conservation Guidelines include more than 200 pages of suggestions for systems of all sizes. This On Tap review concentrates on the Basic Guidelines, which are recommended for public drinking water systems serving 10,000 or fewer people. We suggest that system managers order the guidelines, which include dozens of helpful worksheets.

In August, the U.S. Environmental Protection Agency (EPA) published voluntary guidelines for utilities to use when preparing a conservation plan as required by the Safe Drinking Water Act (SDWA) Amendments of 1996. The law required EPA's guidelines to take into account system size, water availability, and climate.

Use of these guidelines is not required by federal laws or regulations; however, beginning in August 1999, states may require public water systems to prepare conservation plans as a condition of qualifying for a loan under the drinking water state revolving loan fund (DWSRF), a financial program authorized as part of the 1996 SDWA Amendments.

These Guidelines are written for water system managers; however, managers must comply with their own state, regional, or local regulatory requirements.

Ultimately, which guidelines are appropriate and how great the need is for conservation planning depends upon factors and conditions affecting individual water systems. For example, smaller systems with constrained water supplies may want to go beyond Basic Guideline suggestions and institute EPA's Intermediate Guidelines. (See table on page 9.)

What is the purpose of the guidelines?

The EPA states that while the Guidelines are not a federal requirement, they may "help bring conservation into the mainstream of water utility capital facility planning. The infrastructure needs of the nation's water systems are great. Strategic use of water conservation can help extend the value and life of infrastructure . . ." for both water and wastewater supply facilities. The Guidelines state that conservation can extend water supplies, reduce utility operating costs, and reduce energy use for customers and utilities. This in turn reduces greenhouse gas emissions, improves water systems, maintains ecosystems, and protects water resources.

"One of the chief purposes of conservation" the Guidelines state, "is that it can help systems avoid, downsize, or postpone, water and wastewater projects."

How are the guidelines organized?

The guidelines are organized into six parts, beginning with an introduction and an overview of the organization. The next three sections constitute a three-leveled structure for water conservation measures—basic, intermediate, and advanced. The final section includes six alphabetical appendices that provide very helpful supporting information, including detailed descriptions of conservation measures, conservation benchmarks, acronyms and a glossary, information resources, funding sources, and state contacts.

What measures does EPA recommend?

The EPA recommends that all water systems, including those serving 10,000 or fewer people consider implementing the following Basic Guidelines:

- universal metering,
- water accounting and loss control,
- costing and pricing, and
- information and education.

The EPA suggests water systems serving between 10,000 and 100,000 people consider instituting Basic and Intermediate Guidelines:

- water-use audits,
- retrofits,
- pressure management, and
- landscape efficiency.

The EPA recommends water systems serving more than 100,000 people consider instituting Basic, Intermediate, and Advanced Guidelines:

- replacements and promotions,
- reuse and recycling,
- water-use regulation, and
- integrated resource management.

What can very small systems do?

The guidelines encourage all systems to consider the fullest range of planning methods and conservation measures that is practical. The first section includes recommendations for water systems serving 3,300 or fewer people (approximately 1,000 connections). While these very small systems may follow the Basic Guidelines, there is also a capacity development approach that integrates water conservation assistance with the state's general capacity development program.

States may determine which conservation planning approach to use for small water systems on a statewide or case-by-case basis. States are encouraged to use a capacity development approach to help small systems develop and implement basic conservation measures. States may use funds from the 10 percent DWSRF

Continued on next page

Contents of a Comprehensive Water Conservation Plan

1. Specify Conservation Planning Goals

- List of conservation planning goals and their relationship to supply-side planning
- Description of community involvement in the goals-development process

2. Develop a Water System Profile

- Inventory of existing facilities, production characteristics, and water use
- Overview of conditions that might affect the water system and conservation planning

3. Prepare a Demand Forecast

- Forecast of anticipated water demand for future time periods
- Adjustments to demand based on known and measurable factors
- Discussion of uncertainties and “what if” (sensitivity) analysis

4. Describe Planned Facilities

- Improvements planned for the water system over a reasonable planning horizon
- Estimates of the total, annualized, and unit cost (per gallon) of planned supply-side improvements and additions
- Preliminary forecast of total installed water capacity over the planning period based on anticipated improvements and additions

5. Identify Water Conservation Measures

- Review of conservation measures that have been implemented or that are planned for implementation
- Discussion of legal or other barriers to implementing recommended measures

- Identification of measures for further analysis

6. Analyze Benefits and Costs

- Estimate of total implementation costs and anticipated water savings
- Cost effectiveness assessment for recommended conservation measures
- Comparison of implementation costs to avoided supply-side costs

7. Select Conservation Measures

- Selection criteria for choosing conservation measures
- Identification of selected measures
- Explanation for why recommended measures will not be implemented
- Strategy and timetable for implementing conservation measures

8. Integrate Resources and Modify Forecasts

- Modification of water demand and supply capacity forecasts to reflect anticipated effects of conservation
- Discussion of the effects of conservation on planned water purchases, improvements, and additions
- Discussion of the effects of planned conservation measures on water utility revenues

9. Present Implementation and Evaluation Strategy

- Approaches for implementing and evaluating the conservation plan
- Certification of the conservation plan by the system’s governing body

Source: EPA Water Conservation Plan Guidelines, 1998.

Continued from previous page
capacity development set-aside to provide systems with water conservation assistance if the state has identified the systems in its capacity development strategy.

Under the SDWA, in order to avoid having DWSRF funds withheld, by August 2000 each state must develop and implement a strategy to assist public water systems in acquiring and maintaining technical, managerial, and financial capacity.

Several basic conservation practices can be directly linked to the three basic capacity elements. Under the capacity development approach, states encourage and assist small water systems in making a variety of conservation-oriented

improvements. According to the Guidelines, “States should provide technical assistance to water systems to help them implement at least the basic elements of a conservation program.” If a very small system is not capacity-limited or wants to implement more conservation measures, it may use the planning approach in the Basic Guidelines.

Systems Should Set Conservation Goals

In beginning water conservation planning, each water system needs to state its goals in terms of expected benefits for the water system and its customers. Planning goals might include eliminating, downsizing, or postponing the need for capital projects; extending the life of existing

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EPA Publishes Conservation Guidelines

Continued from previous page

facilities; avoiding new source water development costs; improving drought or emergency preparedness; educating customers about the value of water; or protecting and preserving environmental resources.

The process of developing goals should involve community representation. Involving the community in goal development and implementation also serves an important public education function and can greatly enhance the success of the program.

Modern resource planning emphasizes an open process that gives all affected groups—stakeholders—an opportunity to express interests and concerns.

Develop a Water System Profile

Each water system can begin to develop a profile by taking an inventory of existing resources and conditions. Summarize the service and operating characteristics of the water system, including an overview of conditions and a description of climate, water availability, and other factors that might affect water conservation planning.

The guidelines include a worksheet separated into service characteristics, annual water supply, service connections, water demand, average and peak demand, and pricing. It helps assist managers in summarizing system conditions via questions, such as, is the system in a designated critical water supply area? Does the system have substantial unaccounted-for and lost water? Is the system planning substantial improvements?

Prepare a Demand Forecast

The guidelines recommend that each water system prepare a forecast of anticipated water demand, taking into account variations in demand based on types of water use, such as per capita water use or per-connection or per-household basis. For forecasting purposes, per-connection water use is multiplied by the number of current and projected connections. They suggest preparing forecasts for five-year and ten-year time points. The longer the planning horizon, the greater the uncertainty.

Identify, Evaluate Conservation Measures

Water systems have access to a wide selection of conservation measures, including supply-side and demand-side management techniques for saving water. Each system needs to identify conservation measures and look at whether or not a specific measure is cost effective and whether or not it complies with applicable laws and

regulations already, including state and local plumbing codes. Each conservation plan should indicate which measures will be implemented now or in the future and why. If a conservation measure won't be implemented, managers should note the primary reason why not.

All water systems regardless of size should consider universal metering, water accounting and loss control, costing and pricing, and information and education.

Criteria that can be used to select conservation measures may include:


- program costs,
- cost-effectiveness,
- ease of implementation,
- budgetary considerations,
- staff resources and capability,
- environmental impacts,
- rate payer impacts,
- environmental and social justice,
- water rights and permits,
- legal issues or constraints,
- regulatory approvals,
- public acceptance,
- timeliness of savings, and
- consistency with other programs.

For each selection criterion, managers should identify whether, how, and why the factor affects the feasibility of implementing one or more conservation measures. Some factors might be more important than others. Also, since conservation measures can reduce water sales and utility revenues, each plan should briefly address how planned conservation measures will affect water utility revenues.

Present Implementation Strategy

Each water system needs to prepare a strategy and timetable for implementing and assessing conservation measures that includes a plan for monitoring and evaluation. This may include regular communications meetings with community groups. Many systems update plans every five years.

For a discussion of conservation measures recommended for small systems, see the Water Conservation Measures Fact Sheet in the center pages.

To order a copy of EPA's Water Conservation Plan Guidelines, call (800) 490-9198 and request EPA-832-D-98-001. There is no charge for this publication. 



On average, 50-70 percent of household water is used outdoors for watering lawns and gardens. Plant low-water-use grasses and shrubs to cut your lawn watering by 20-50 percent.

Blue Thumb Project

Guidelines and Associated Conservation Measures

Measures	Advanced Guidelines		
	Intermediate Guidelines		
	Basic Guidelines		
LEVEL 1 MEASURES			
Universal metering [B]	<ul style="list-style-type: none"> Source-water metering Service-connection metering and reading Meter public-use water 	<ul style="list-style-type: none"> Fixed-interval meter reading Meter-accuracy analysis 	<ul style="list-style-type: none"> Test, calibrate, repair, and replace meters
Water accounting and loss control [A]	<ul style="list-style-type: none"> Account for water Repair known leaks 	<ul style="list-style-type: none"> Analyze nonaccount water Water system audit Leak detection and repair strategy Automated sensors/telemetry 	<ul style="list-style-type: none"> Loss-prevention program
Costing and pricing [B]	<ul style="list-style-type: none"> Cost-of-service accounting User charges Metered rates 	<ul style="list-style-type: none"> Cost analysis Nonpromotional rates 	<ul style="list-style-type: none"> Advanced pricing methods
Information and education [B]	<ul style="list-style-type: none"> Understandable water bill Information available 	<ul style="list-style-type: none"> Informative water bill Water-bill inserts School program Public-education program 	<ul style="list-style-type: none"> Workshops Advisory committee
LEVEL 2 MEASURES			
Water-use audits [B]		<ul style="list-style-type: none"> Audits of large-volume users Large-landscape audits 	<ul style="list-style-type: none"> Selective end-use audits
Retrofits [A]		<ul style="list-style-type: none"> Retrofit kits available 	<ul style="list-style-type: none"> Distribution of retrofit kits Targeted programs
Pressure management [A]		<ul style="list-style-type: none"> Systemwide pressure management 	<ul style="list-style-type: none"> Selective use of pressure-reducing valves
Landscape efficiency [P]		<ul style="list-style-type: none"> Promotion of landscape efficiency Selective irrigation submetering 	<ul style="list-style-type: none"> Landscape planning and renovation Irrigation management
LEVEL 3 MEASURES			
Replacements and promotions [B]			<ul style="list-style-type: none"> Rebates and incentives (nonresidential) Rebates and incentives (residential) Promotion of new technologies
Reuse and recycling [B]			<ul style="list-style-type: none"> Industrial applications Large-volume irrigation applications Selective residential applications
Water-use regulation [B]			<ul style="list-style-type: none"> Water-use standards and regulations Requirements for new developments
Integrated resource management [B]			<ul style="list-style-type: none"> Supply-side technologies Demand-side technologies

[A] measure affects average-day demand
 [P] measure affects maximum-day (peak) demand
 [B] measure affects both average and peak demand

Source: U.S. EPA Water Conservation Plan Guidelines, 1998



Customer Confidence Reports Systems Must Report Water Quality

by Jamie Knotts
NDWC Promotions Editor

By October 1999, drinking water systems must provide their customers with their first yearly Consumer Confidence Report (CCR) that outlines the water quality delivered to customers. Required by the 1996 Safe Drinking Water Act (SDWA) Amendments, these reports give customers information about their water quality.

Because of unfamiliarity with the new requirement, the American Water Works Association (AWWA) and the National Rural Water Association (NRWA) have developed templates that systems can use to complete their CCR. These computer-based report-writing aids offer examples and help systems present their data.

Know What Is Required

All community drinking water systems, regardless of size, must provide CCR information to their customers. The only difference between small and large systems is the means of delivery.

Systems serving more than 10,000 customers are required to mail the CCR. Systems having between 500 and 10,000 customers—if waived by a state's governor or tribal leader—can publish the reports in a newspaper and notify customers that it will not be mailed. These systems must make the reports available upon request. Systems serving fewer than 500 may post the report in a public place as long as they notify customers that it is available and how they may access it.

A few key pieces of information that must appear in reports include:

- a list of the type and location of the source (groundwater, surface water, combination of the two, or purchased from another system);
- a brief summary of how susceptible the drinking water source is to contamination;
- results of water quality tests if contaminants are found;
- data presented in a whole number format rather than in decimal calculations;
- definitions for phrases such as Maximum Contaminant Level Goal, Variances, and others;
- results if *Cryptosporidium* or radon has been tested for and detected;
- an explanation of any violation that occurred; and
- a description of any variance or exemption given to the utility.

What help is AWWA providing?

AWWA's CCR writing tool or *CCRbuilder* is an Internet-based computer program that guides users through the process. *CCRbuilder* may be accessed from a standard Web browser, allowing utilities to input data into the program. They may choose to write the report in one sitting or input data as it becomes available and complete the report at another time.

Users may choose to use the simple \$75 version, which includes everything necessary to complete a CCR, or purchase value-added features. Prices for the value-added services were not available at press time.

Lab reports typically display figures using decimals, but the CCR requires whole numbers be used so consumers may understand them better. The software will complete all the necessary data transformations from decimal numbers to whole numbers.

Access *CCRbuilder* at <http://www.CCRbuilder.com> or at <http://www.AWWA.org>.


NRWA Offers CCR Assistance

John Trax, senior environmental engineer with NRWA, says staff jointly wrote a draft CCR template and tested it in three states using before and after phone surveys to gauge consumers' reactions. The purpose was to write a template for systems to use that resulted in an easy-to-understand CCR.

"Basically it boils down to one simple thing—residents only really want to know if their water is safe to drink," Trax says. "All the technical mumbo-jumbo in the report really isn't understood. They told us they want the report, but they want to know in simple terms if the water is safe."

He says that with lessons learned from the study, NRWA's computer-based template will help systems write a good report for consumers. Utilities can obtain the template on a disk from their state rural water association. Users will proceed through 17 sections with step-by-step instructions.

NRWA will provide training for small systems in the coming year through their state member associations. "We're encouraging systems to get the training early so they can complete their CCR's on time," Trax says.

For your state's rural water association, call the National Drinking Water Clearinghouse at (800) 624-8301 and ask to speak with a technical assistant. 



For a copy of the Consumer Confidence Report Final Rule, call the Safe Drinking Water Hotline at (800) 426-4791 and request EPA 816-Z-98-005.

SDWA Advocates Water Conservation

by Kathy Jespersen
NDWC Staff Writer

Water conservation would be a serious matter even if the U.S. Environmental Protection Agency weren't required to publish guidelines under the reauthorized Safe Drinking Water Act (SDWA). "We feel that water conservation is pretty important," says Tom Franklin, chief of the small systems alternatives evaluation section, Pennsylvania Department of Environmental Protection.

Pennsylvania made a commitment to conserve water through a contract with the Pennsylvania Rural Water Association (PRWA). The state will use funds provided by the reauthorized SDWA for technical assistance to small public water systems to implement its water conservation program.

According to Franklin, the PRWA will perform water audits on community water systems and provide water conservation materials for educating system customers. They will also conduct hands-on training in using equipment that locates and detects leaks.

The state's water conservation program will have a two-fold mission: to help the supplier eliminate water loss and to educate the consumer. "A good conservation program will cut down on loss and the resources that the system has to put into treating water," Franklin explains. "Per capita water use is extremely high in some areas. We don't always know if that's from actual usage or from leaks. Some systems have a water loss much higher than 20 percent, and most loss comes from leaks. Our conservation program will help systems find out where their losses are coming from.

"We hope to have the contract in place by the end of the year," says Franklin. "If PRWA can show us the benefits of a water conservation program, we hope to have this as a continuing program."

Oklahomans Use Water Wisely

In Oklahoma, water conservation is a way of life. "If you've lived in Oklahoma any length of time, you know how to use water," says Mike Harrell, environmental engineer supervisor for public water supply, Oklahoma Department of Environmental Quality.

Harrell says that although the state has no formal water conservation program, Oklahomans have an adage: Use all the water you want—as long as you use it wisely. "We went 93 days with less than a quarter inch of rain this year. Luckily, at the end of spring, most of the state's streams and lakes were at 98 to 99 percent capacity.

"We didn't have any systems that were totally out of water," he continues. "We limited outdoor water use—that usually means lawn watering. Most systems went with a voluntary odd/even outdoor water use plan, where certain areas watered on odd days and others on even days. There were only a handful of systems that had to move to a mandatory plan of no outdoor water use at all. There were 70 systems with some kind of restriction, and out of 1,200, that's really not too bad."

Oklahoma's water conservation efforts include public education fact sheets and a drought task force. "We get a lot of help from the media as well," says Harrell. "Newspapers print articles or information from the fact sheets so the public will know how to conserve water.


"The drought task force includes the state's Department of Agriculture and the Oklahoma Water Resources Board," he explains. "They perform weekly water evaluations, soil moisture tests, and monitor stream levels. We've also worked with the Oklahoma Rural Water Association to develop a draft by-law to implement rationing. And the Oklahoma Municipal League drafted an ordinance that municipalities can use. So all in all, we're pretty familiar with water conservation."

Water, Water Everywhere

"We have an abundance of water in Idaho," says Steve Tanner, program supervisor with Idaho Department of Environmental Quality. "We aren't ignoring water conservation, but water is so plentiful here there's not a lot of talk about it."

Tanner says that there is an effort to get systems to meter; however, many of the customers object to it. "There are more than 1,000 systems that don't charge a meter rate," he says. "They are coming around, but it's been a slow process."

Don Munkers, executive director, Idaho Rural Water Association, agrees, adding, "But we do have concerns over water. The Snake River Aquifer was once seen as an endless supply of water, but it has been drawn down and the recharge doesn't bring it back 100 percent. Also, we have seen an increase in population, and there is a push toward conservation.

"We'd like to see systems develop rate structures that are fair, which take usage into consideration," he says. "Then we could get a better account of our water." 



"A good conservation program will cut down on loss and the resources that the system has to put into treating water."

*Tom Franklin,
chief of the small
systems alternatives
evaluation section,
Pennsylvania
Department of
Environmental
Protection.*



1998 UST Deadline Approaches Groundwater Protection Is a Step Closer

by Salam Murtada
Environmental Engineer
UST Section

North Carolina Department of Environmental
Health and Natural Resources

By December 22, 1998, all regulated underground storage tanks (USTs) must provide proper corrosion protection, spill, and overflow control in order to comply with federal and state regulations.

According to the Federal Register (40 CFR 280.12), this rule applies to tanks that contain regulated substances and are at least 10 percent beneath the surface of the ground. Regulated substances include motor fuel, such as gasoline, kerosene, diesel, and hazardous substances. The rule, however, does not cover septic or wastewater collection systems, or flow-through process tanks.

And interestingly enough, federal regulations exempt domestic heating oil tanks from being regulated, despite the fact that they constitute almost twice as many regulated USTs.

UST upgrade requirements are specified at 40 CFR 280.20–280.34, which may be adopted more stringently by individual states. The codes outline several options UST owners may take to meet required design and performance standards.

Leaking USTs are a major threat to source water nationwide. In fact, a 1996 U.S. Environ-

mental Protection Agency (EPA) census estimated that 1.1 million federally regulated USTs buried in 400,000 sites accounted for 317,000 reported releases.

Federal requirements were originally introduced in 1988, because of the extent of groundwater contamination leaking USTs cause. All those responsible for USTs should have been implementing a leak detection monitoring protocol since 1993 to ensure that a system is tight, according to federal and state guidelines. Furthermore, UST owners and operators are required to verify that such measures are met through standardized reporting and record-keeping.

What if USTs don't meet regulations?


The number of releases is expected to increase substantially after the 1998 deadline as many

USTs will be forced to close down, be removed, or be replaced.

If regulated UST systems do not comply with upgrade requirements by the December deadline, they may face closure, either temporarily—for not more than 12 months during which the owner can upgrade—or permanently, following complete removal of the UST and implementation of limited site assessment. Should the soil samples taken around the UST system indicate contamination levels above acceptable limits, the owner will need to implement a more comprehensive site assessment, which may be followed by costly soil and/or groundwater remediation.

Many states initiated trust fund programs that pay cleanup costs, provided that the owner maintains compliance throughout tank operation. However, due to cash flow problems and potential insolvency experienced by many, states are resorting to alternative funding mechanisms, such as allowing private insurance companies to reimburse owners for cleanup costs. These insurance companies will have to assess eligibility criteria based on owner compliance as well as financial responsibility.

Unfortunately, many small independently owned service stations may not be financially capable of meeting the upgrade requirements or trust fund eligibility, particularly by states administering private insurance programs as their only cleanup cost recovery. However, federal and state assistance programs, such as the Bureau of Indian Affairs, Administration for Native Americans, Rural Development Administration, and others, do exist to help small and disadvantaged UST owners.

You may download information on various UST topics from EPA's Web site at <http://www.epa.gov/swrust1/pubs/index.htm>. 

References

- North Carolina Department of Environment, Health, and Natural Resources. Division of Water Quality, Groundwater Section. "An Underground Storage Tank: Compliance Inspection."
- U.S. Environmental Protection Agency. September 1988. "Underground Storage Tanks, Technical Requirements, and State Program Approval." Final Rule. Federal Register: 40 CFR Parts 280 and 281.
- U.S. Environmental Protection Agency. January 1997. *State Funds in Transition: Models for Underground Storage Tank Assurance Funds*. EPA 510-B-97-002.
- U.S. Environmental Protection Agency. September 1995. *Financing Underground Storage Tank Work: Federal and State Assistance Programs* EPA 510-B-95-010.



The North Carolina Department of Natural Resources issues this sticker to facilities that meet upgrade requirements.



Xeriscaping™ Conserves Water

by Michelle Moore
NDWC Contributing Writer

It's probably no surprise that a big jump in household water use occurs in summer because folks are outdoors gardening and watering their lawns. Traditional commercial landscapes also consume plenty of water. These lush floral displays and broad expanses of turf dress up a neighborhood, but many popular landscape plants are real water guzzlers.

A relatively new concept in landscaping has cropped up that was created to conserve water. "Xeriscaping," a term coined (and trademarked) in Denver, Colorado, uses planting and design features that are more suitable to a particular region, whether in the arid West or the more variable climate of the Northeast.

Water treatment facilities, large and small, are being called upon to encourage consumers to consider using xeriscaping principles to decrease the huge volume of water devoted to landscape irrigation. Education through example is one simple way a small facility can achieve water savings—and make the treatment plant more attractive in the process.

Creating a Sustainable Landscape

Some people mistakenly think that xeriscaping means "xero-scaping" with nothing but a few cacti and rocks featured in a design. That's not the case. Xeriscaping includes a much broader range of choices, and using xeriscaping principles can reduce outdoor water use by one-third.

"Xeriscape is an attractive, sustainable landscape that conserves water," Diane Radeke of the Colorado Springs Utilities Water Resources Xeriscape Demonstration Garden says. "In urban areas, 50 to 70 percent of all water used [in arid states] is for the irrigation of landscapes. If this usage can be reduced, it will help conserve an important resource and save money both in maintenance and water costs."

Colorado Springs, Colorado, only receives about 16 inches of precipitation annually, but people attempt to grow garden ornamentals there that require at least an inch of water per week to flourish. In

other words, garden designs in the arid West and Southwest are better suited to desert marigold and globemallow than they are to delphinium and fox-glove, traditional garden plants in moister climates.

What exactly is xeriscaping?

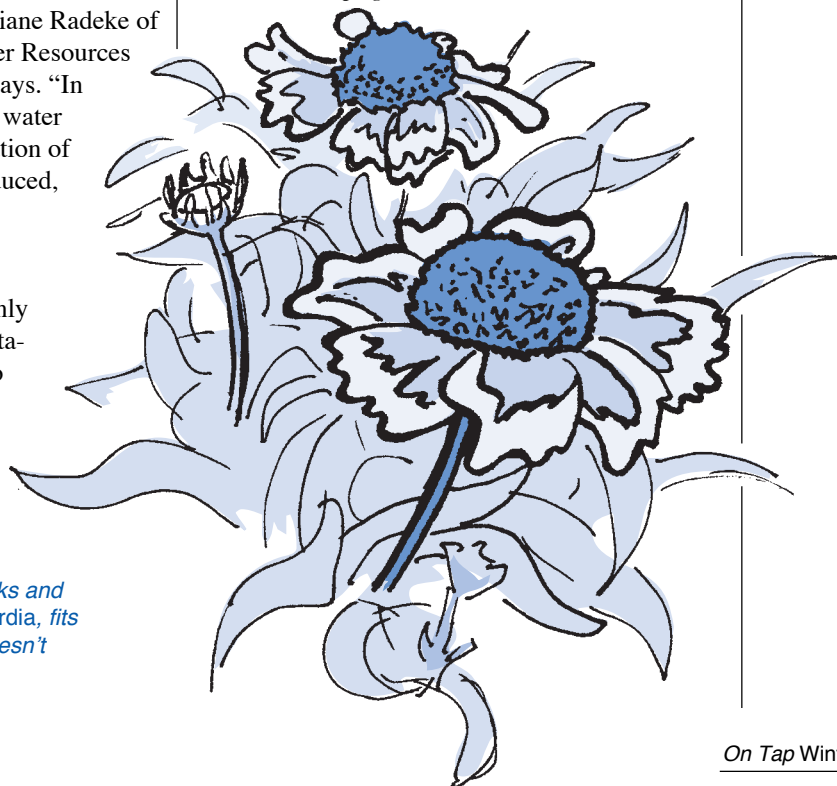
Seven principles define the basic ideals behind this landscaping practice:

- Planning and design,
- Soil analysis,
- Proper plant selection,
- Practical turf areas,
- Efficient irrigation,
- Use of mulches, and
- Appropriate maintenance.

The first step in any landscaping project is the creation of a workable and attractive design. Designing a Xeriscape is no different. Areas for traffic, recreation, reflection, and gardening pleasure are incorporated. Considerations, such as amount of sunlight, views, and time devoted to maintenance need to be included in the plans.

"All gardens should begin on paper," Radeke says. "It is so much easier to erase a plant than to move it after it is planted in the wrong place. Also, plants perform better when they are grouped by their water needs. Planting a low water requiring plant next to a high demand plant results in over-watering one and under-watering the other."

Besides water needs, the soil's nutrient availability must be determined. Adding organic material to the soil is usually necessary, and compost or well-rotted manures also contribute
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Xeriscaping is far from using just rocks and cactus. Any plant, such as this Gaillardia, fits into a xeriscape plan as long as it doesn't require a lot of supplemental water.

Xeriscaping™ Conserves Water

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much to a soil's texture and general good health. Keep in mind, though, that many plants native to some areas of the West and Southwest are better suited to less fertile soil. Soil amendment applications (lime, fertilizer, etc.) need to be adjusted according to the results of a soil test, available through a state's cooperative extension service.

Reduce Turf Areas

Changing turf areas may be one of the more difficult decisions in retrofitting to Xeriscape. People frequently believe turf requires less maintenance, but that's not necessarily true. To keep a lawn green in the heat of summer is a lot of work, and takes a lot of water. Reducing the area of high water-requiring turf to a more reasonable size is necessary.

Many turf grasses will naturally wither and brown in the heat of a dry summer, going dormant until fall and winter rains rejuvenate them. This is a natural process, and watering only weakens their systems and causes problems. Grasses, such as Kentucky bluegrass, just do not do well in an arid climate like Phoenix, Arizona, or Albuquerque, New Mexico. With an average rainfall of less than nine inches of rain per year, does it make sense to plant grass that requires 40 or more inches of water to remain green and healthy? A compromise can be achieved by reducing areas of turf grass to play yards and walkways around larger mulched beds of flowers, shrubs, and water-saving groundcovers.

"Water-wise" Plants Have an Advantage

Water-wise plants start out with an advantage. They are adapted to lower natural rainfall, so they require much less applied water than do non-natives and more demanding ornamentals. Cities encouraging xeriscaping usually have plant lists available for residents to refer to. Colorado Springs has lists of trees, shrubs, flowers, groundcovers, and grasses that are tailored for specific microclimates within the city's borders. The list includes a plant's water requirements, height and width, and other information.

"Plant lists were developed for each of the eight communities that include local and other western natives and non-native plants that would be compatible in that community," Radeke said. "For commercial sites, the designer is required to use a specific percentage [60 percent] of these identified plants in their design, grouping plants by their water needs.

This concept of grouping plants, called "zoning," places drier-growing plants separately from those with higher water requirements. So,

when water does need to be applied, the right amount can be added to the appropriate zone.

Water Early To Lessen Evaporation

The best time to irrigate is early in the morning to reduce the evaporation versus absorption rate. Deep, infrequent waterings encourage roots to penetrate deeper into the soil, reaching down for moisture. Frequent, shallow watering causes root growth closer to the soil surface, making roots more vulnerable to drying out.

Turf is best irrigated with a sprinkler system, while trees, shrubs, and garden beds are best watered by low-volume drip hoses, which emit water at ground level where less evaporation can take place. The type of irrigation system chosen should be well thought out and designed to work for the particular landscape features it will service.

To reduce the frequency of irrigating, mulches should be applied to garden beds. Mulch is a barrier (bark chips, shredded compost, or other organic material) over the garden's surface. In addition to reducing direct evaporation from the soil, mulches also help cool plant roots. Keeping a deep layer of mulch on landscaped beds provides organic material that can be incorporated into the bed after it decomposes.

The last of the seven xeriscaping principles is a basic tenet of all good gardening—diligent maintenance. Mowing, pruning, weeding, pest control, and fertilizing keep any landscape strong and healthy. Maintenance of irrigation systems is imperative to their functioning properly.

Towns Provide Incentives and Education

Cities and towns across the South and West have adopted various incentives and ordinances to encourage xeriscaping to help protect their diminishing groundwater supplies. For instance, Albuquerque has a Xeriscape retrofit incentive program that provides assistance for replacing high water-use landscaping with a more water-efficient plan. Eligible applicants can receive a water bill credit of \$0.15 for every square foot of qualifying landscape up to 1,667 square feet (\$250), with a minimum of 500 square feet needed to participate.

In El Paso, Texas, the Texas Agricultural Extension Service conducts public workshops, and the Master Gardeners have prepared programs on water saving landscaping. "Sunscapers" is a nine-session course taught at the Centennial Museum at the University of Texas at El Paso that includes "water-smart landscaping within the larger context of conserving natural resources and living in the desert."

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"Xeriscape principles are really just good horticultural practices that can be applied in all phases of gardening."



Diane Radeke,
Colorado Springs
Utilities Water
Resources Xeriscape
Demonstration
Garden

Continued from previous page

In Amarillo, Texas, an existing recycling center adjacent to a solid waste transfer area had been “a bit of an eyesore,” Duane Strawn, a landscape architect with the parks department, said. Three city departments cooperated to build and maintain a xeriscaping demonstration garden. Now, this public garden of drought-tolerant plants surrounds the recycling operation.

The Idea Is Spreading

The concepts of xeriscaping have become more the norm than the exception in dry regions of the U.S. In other parts of the country, such as Florida and the Northeast, utilities have had to devise strategies for conserving groundwater in the face of growing populations and pollution.

Radeke said that in 1990, when the Xeriscape Demonstration Garden was started, most people had never heard of xeriscaping.

“In the early years we tracked the number of people who visited the garden,” she said. “It was a good week when we had 20 people visit us. Now our open houses bring hundreds of people, and we often have more than 20 people visit on a weekday. Local schools, community organizations, and other groups frequently arrange tours of the garden and the adjacent water operations building.”

In Corpus Christi, Texas, a partnership between city departments and local nonprofit organizations called the Xeriscape Coalition, is teaching residents water-saving habits through an interactive outreach program. Their Xeriscape Learning Center and Design Garden is a three-quarter-acre public garden at the Corpus Christi Museum of Science and History that, in addition to the garden itself, features two exhibits housed in separate gazebos. The Water Story Gazebo introduces visitors to the hydrologic cycle, water treatment, and conservation. The story of the city’s water

storage and delivery from the Nueces River Basin and a history and future look at water in South Texas are included in the displays. The Children’s Gazebo has a number of activities intended to make learning about water fun for kids.

Home gardening ideas are presented at the Xeriscape Learning Center and Design Garden, as well as displays comparing various mulches and demonstrations of composting techniques and soil preparation. One-page flyers explain the seven principles of xeriscaping, plus a more detailed “Xeriscape-to-Go” idea packet helps residents get started with their own water-saving gardening plans.

Inspiring people to work together to decrease water consumption can be challenging, especially in a small community with a tight budget. These common sense ideas using xeriscaping principles show a manageable way to achieve substantial water savings, while still providing the little bit of paradise we seek in a garden.

For more information about xeriscaping check these Web sites based in different parts of the U.S.:

Groton, Connecticut:

<http://www.grotonutilities.com/conserv.htm#xeris>

Southwest Florida:

<http://www.dep.state.fl.us/swfwmd/xeris/swfxeris.html>

Denver, Colorado:


<http://www.water.denver.co.gov>

Colorado Springs Utilities:

<http://www.csu.org/xeri/>

Albuquerque, New Mexico:

<http://www.cabq.gov/resources/index.html>

Xeriscape Landscaping, a U.S. Environmental Protection Agency booklet, may be ordered from the National Small Flows Clearinghouse at (800) 624-8301 or (304) 293-4191. Request item #GNBLPE01. The item is free. Postal charges are added to orders. 

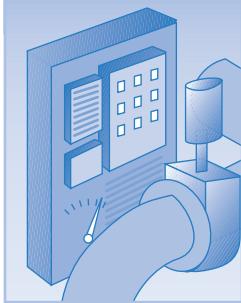
Are we Tapped Out?

Former U.S. Senator Paul Simon takes a look at global water use in his new book *Tapped Out: The Coming World Crisis in Water and What We Can Do About It*. Simon, who heads the Public Policy Institute at Southern Illinois University, devotes the first half of his book to interesting information and statistics about population growth and water use in this country and around the world.

Simon’s suggestions for solving the water problem are conservation, desalination, pollution

and over-population control. Much of the second half of his book is a call to put funding and research into desalination.

A hard cover edition of Tapped Out is available for \$22.95 from Welcome Rain Publishers. You may order through Karen Strauss/Strauss Consultants, 48 West 25th Street, 11th Floor, New York, New York 10010 or call (212) 367-8270. The book may also be ordered online at <http://www.amazon.com>.



Retrofit Programs Save Water

by Mohamed Lahlou, Ph.D.
 NDWC Technical Assistance Specialist
 Harriet Emerson
 On Tap, Editor

Retrofitting or updating older plumbing devices to decrease water use is an efficient, effective, and immediate way to conserve water. Replacing toilets, taps, and shower fixtures with more efficient ones is a logical step for communities that want to reduce domestic water use.

Primarily due to the financial cost to systems and individuals, retrofitting is listed as a Level 2 Measure in the U.S. Environmental Protection Agency (EPA) *Water Conservation Plan Guidelines*. Water use audits, pressure management, and landscape efficiency are also listed as Level 2 Measures, which are recommended for systems serving between 10,000 and 100,000 individuals. The EPA Guidelines suggest communities look into these measures after they have met the Basic Guidelines—deemed to make the most impact for the least cost:

- universal metering,
- water accounting and loss control,
- costing and pricing, and
- information and education.

(See the Conservation Measures Fact Sheet in the center pages for more information.)

Can a community encourage retrofitting?

Retrofitting can be worth the time and money. For example, a family of three, using simple conservation devices installed on showers and toilets, can save more than 16,000 gallons of water a year.

A side benefit of a retrofitting program is that it increases public awareness of the need for

conservation. A community can achieve a more rapid replacement of plumbing fixtures either through incentives and free assistance, or through regulatory penalties and requirements, or a combination of both. The following are actions a community can take to accomplish a more rapid retrofit of plumbing fixtures:

- Provide retrofit kits, consisting of water-saving devices for toilets and showers, plus toilet leak detectors and informational literature free to households.
- Offer a rebate program. Many cities in the U.S. offer cash rebates or credits on water bills to those who replace plumbing fixtures.
- Provide assistance. Direct assistance with retrofitting can be achieved by sending a person from the utility to an individual residence or by contracting with trained plumbers.
- Reinforce building and hook-up requirements. A community can make certain that builders do not hook up homes to city service unless they use water-saving devices.

Installation Requires Skilled Plumbers

A major issue in retrofitting is making certain well-trained plumbers are available to do the job. Many states and communities require that plumbers be certified. Repairing leaking domestic water fixtures and retrofitting represent a large economic potential for the plumbing trades sector (as well as the consumers). Making sure plumbers are skilled will ensure that a large percentage of leaks will be fixed, and that repairs will last as long as possible if not through the life of durable fixtures.

Replacement costs can be substantial. Making sure the new parts used are more reliable and save
Continued on next page

Table 1: Benchmarks for Savings from Retrofitting

Category	Measure	Reduction in end use	Life span (years)
Retrofits	Toilet tank displacement devices (for toilets using > 3.5 gallons/flush)	2 to 3 gpcd	1.5
	Toilet retrofit	8 to 14 gpcd	1.5
	Showerhead retrofit (aerator)	4 gpcd	1 to 3
	Faucet retrofit (aerator)	5 gpcd	1 to 3
	Fixture leak repair	0.5 gpcd	1
	Governmental buildings (indoors)	5 percent	na

na = not available gpcd = gallons per capita per day

Source: U.S. EPA *Water Conservation Plan Guidelines*, 1998
 Compiled from various sources. Actual water savings can vary substantially according to a number of factors. These data are provided for illustrative purposes only and may not be current or applicable. To the extent practical, planners should use regionally appropriate or system-specific assumptions and estimates.

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more water than the current ones is essential to the success of this task.

Water industry stakeholders, including plumbing manufacturers, the water utility, water customers, and trade workers would do well to come together to establish a cooperative program that sets quality standards for fixtures and promotes plumbing maintenance and skills development among trades people. Stakeholders can identify and promote water efficient products and educate water customers about the economic value of these products.

How can a system estimate savings?

The savings from individual fixtures quickly add up, providing many systems with a new “source” of water, thus reducing the need for capacity expansion. Table 1, on the facing page, reports savings associated with retrofitting. Table 2, below, gives potential water savings from efficient fixtures.

Did you ever wonder what the savings are for upgrading the water-using fixtures in your home? Key your information into the **Indoor Water Efficiency Spreadsheet** and find out. By selecting certain variables, you may custom design the spreadsheet and know in advance what savings you’ll get after installing water-saving appliances and fixtures. View the spreadsheet at <http://solstice.crest.org/environment/gotwh/general/indoor-water/index.html>.


Water Efficiency: Shopping for a Good Toilet or Showerhead? is a site that, located at <http://home.earthlink.net/~wliebold/>, provides a good overview of low-flow toilets and water-saving shower heads. In addition to explaining the benefits of these products, the site discusses consumer surveys that rate satisfaction with various toilets and showerheads and include customers’ views on efficiency and performance. 

Table 2: Potential Water Savings From Efficient Fixtures

Fixture [a]	Fixture capacity [b]	Water use (gpd)		Water savings (gpd)	
		Per capita	2.7-person household	Per capita	2.7-person household
Toilets [c]					
Efficient	1.5 gallons/flush	6.0	16.2	na	na
Low-flow	3.5 gallons/flush	14.0	37.8	8.0	21.6
Conventional	5.5 gallons/flush	22.0	59.4	16.0	43.2
Conventional	7.0 gallons/flush	28.0	75.6	22.0	59.4
Showerheads [d]					
Efficient	2.5 [1.7] gal/min	8.2	22.1	na	na
Low-flow	3.0 to 5.0 [2.6] gal/min	12.5	33.8	4.3	11.7
Conventional	5.0 to 8.0 [3.4] gal/min	16.3	44.0	8.1	22.0
Faucets [e]					
Efficient	2.5 [1.7] gal/min	6.8	18.4	na	na
Low-flow	3.0 [2.0] gal/min	8.0	21.6	1.2	3.2
Conventional	3.0 to 7.0 [3.3] gal/min	13.2	36.6	6.4	17.2
Toilets, Showerheads, and Faucets Combined					
Efficient	Not applicable	21.0	56.7	na	na
Low-flow	Not applicable	34.5	93.2	13.4	36.4
Conventional	Not applicable	54.5	147.2	33.5	90.4

na = not applicable gpd = gallons per day

[a] Efficient = post-1994

Low-flow = post-1980

Conventional = pre-1980

[b] For showerheads and faucets: maximum rated fixture capacity (measured fixture capacity). Measured fixture capacity equals about two-thirds the maximum.

[c] Assumes four flushes per person per day; does not include losses through leakage.

[d] Assumes 4.8 shower-use-minutes per person per day.

[e] Assumes 4.0 faucet-use-minutes per person per day.

Source: Amy Vickers, “Water Use Efficiency Standards for Plumbing Fixtures: Benefits of National Legislation,” American Water Works Association Journal. Vol. 82 (May 1990): 53; and U.S. EPA Water Conservation Plan Guidelines, 1998.

Conservation: It's the Future of Water

Continued from page 1

conditions that occur with the more stringent forms of water use restrictions.

So Many People, So Little Water

The 1997 Public Broadcasting Service (PBS) video series *Cadillac Desert*, based on Mark Reisner's book by the same name, states that 80 percent of the illnesses in developing countries can be traced to poor drinking water and lack of sanitation. According to a United Nations report, 9,500 children die each day either because of lack of water or, more frequently, because of diseases caused by polluted water.

In a PBS interview with Mike Malone, Sandra Postel, director of the Global Water Policy Project and author of *The Last Oasis*, comments, "In most of the countries in Africa and the Middle East, populations are going to double within about 30 years. We see enormous water scarcity, even at today's levels of population, and in Africa, extraordinary poverty."

The British publication *People and the Planet* predicts that by the year 2025 at least 65 nations will experience severe water shortages. There's even talk of water wars. Where? In terms of the potential for conflict "the three major river basins in the Middle East: the Jordan, the Nile, and the Tigris-Euphrates," says Postel.

In *Tapped Out*, Simon concurs. "Middle Eastern leaders who are usually reluctant to agree on anything are unanimous in saying that severe water shortages lie ahead for that region, and unless this difficulty is solved, armed confrontation is almost inevitable."

What about water scarcity in this country?

"While our problems are not as severe in the U.S. as in most nations," says Simon, "three of the fastest growing large states—California, Texas, and Florida—also feel the squeeze on water supplies and will soon face major difficulties."

In a July 1998 article in *The Atlantic Monthly* "Travels Into America's Future," Robert Kaplan comments, "Any place with less than 20 inches of rainfall a year—a category that includes almost all of the American West—will sustain human population only with difficulty . . . Nature itself ordained government help and supervision because the lands west of the 100th meridian [which runs through the Dakotas, Nebraska, Kansas, Oklahoma, and Texas] receive, for the most part, less than 20 inches of rain annually—the minimum required not only to sustain a human population, but also for agriculture without irrigation.

"And the discovery, mapping, and exploitation of aquifers in the first half of the twentieth century

has further postponed the day of reckoning for humankind and nature in the West," Kaplan adds. "But that day is coming."

The history of the American West is a story of dry earth and extraordinary engineering feats in the effort to obtain water. "Even in the Pacific Northwest, where they have a lot of it, the story of the West is the story of water," says Reisner, in a PBS interview with Malone. "We're always trying to manipulate it, move it, send it from where it is to where it isn't."

California Is a Good Example

Those who have lived through a drought or water rationing understand the need to conserve. Anyone who has traveled the southern California coast with its parched golden earth splintered in fissures, or seen a noon sun evaporate spray over irrigated green patches of the Central Valley understands the need for conservation.

Southern California, notes Simon, averages less than 10 inches of rain per year. (Other sources put the amount at 11 inches.) And Los Angeles, with a population of approximately 14 million, he says, is drier than Beirut, Lebanon. Reisner notes that even with all those people, Los Angeles only uses 8–10 percent of the water in that state.

Where does all the water go? According to the Water Resource Institute, approximately two-thirds of global water withdraws are used for agriculture and a quarter for industry.

In a November/December 1996 *Mother Jones* article, "How Paradise Lost," Gray Brechin discusses California's Central Valley, a 500-mile-long basin enclosed by the Sierra Nevada Mountains to the east and the Coast Ranges to the west. The northern third is known as the Sacramento Valley and the southern two-thirds, the San Joaquin Valley. "Human ingenuity and capital turned California into the greatest food and fiber factory ever known," he says.

Brechin says that by the turn of the century, most of the valley's artesian wells had gone dry from continual overdraft and drought. "Pumps took over, dropping water tables and stanching the flow of springs upon which wildlife depended.

"By 1902, Congress had passed the Reclamation Act, committing the federal government in perpetuity to building dams and canals to irrigate the arid lands of the West."

Reisner says that almost 1,400 dams were built in California, although not all of these are huge dams.

"We've totally re-engineered these systems to the point that there's virtually no natural ecosystem functioning anymore," says Postel.

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"While our problems are not as severe in the U.S. as in most nations, three of the fastest growing large states—California, Texas, and Florida—also feel the squeeze on water supplies and will soon face major difficulties."



Paul Simon,
Tapped Out

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Damming alters the environment by harnessing wild rivers and often destroys wildlife habitats. Irrigation can leave huge deposits of salt. Brechin notes that three million tons of salt are carried annually into the San Joaquin Valley via federal and state aqueducts. Much of it is picked up by pumps and reapplied to the fields. A large part of it, however, flows into Southern California to become drinking water.

The financial cost is extraordinary. According to Brechin, "In 1988, a government economist calculated that taxpayers had invested \$6.8 billion in the federally run Central Valley Project in the 50 years since its inception in 1937."

But why should the rest of us conserve?

Those in the East—its hills lush with broad-leaved green trees—or people in states, such as Idaho with small populations and abundant water supplies, may question the need for conservation.

Conserving water increases total amounts available and often eliminates the need to find new sources. The 1998 EPA Guidelines state "the infrastructure needs of the nation's water systems are great. Strategic use of water conservation can help extend the value and life of infrastructure assets used in both water supply and wastewater treatment."

How great are the system needs in this country? EPA's 1997 *Drinking Water Infrastructure Needs Survey* estimates that over the next 20 years we will need to spend \$138.4 billion on infrastructure—small systems need \$37.2 billion of that amount.

EPA's 1996 *Clean Water Needs Survey*, whose statistics are primarily based upon a database containing information about 16,000 publicly owned wastewater treatment facilities, estimates that \$139.5 billion will be needed for the country's wastewater systems over the next 20 years. Of that amount, water quality program needs for communities with fewer than 10,000 people are estimated at \$13.8 billion.

What about small systems?

Conservation may look like income down the drain to a small drinking water system in the business of selling water. To consumers it may simply sound like higher prices and restriction of habits.

Loss of income is a very real consideration. In his book *Water Conservation*, William Maddaus warns that one of the major concerns when increasing water-use efficiency is the possibility of an immediate reduction in utility revenues. Therefore, he says, skillful advance

planning is required to take into account conservation-related reductions as they affect increases in demand and revenue anticipated from projected growth.

A 1994 AWWA white paper "Total Water Management" states, "Water is a renewable but finite natural resource. Water conservation considerations should be a part of any utility's water resources planning. Conservation, encompassing supply and demand management, is appropriate to some degree for all utilities and not just those in water-short areas."

To convince the local population that water conservation makes good water and economic policy, however, local water utilities will need to educate consumers about the benefits of regionally appropriate conservation measures and resources planning. Although, the paper adds, "this may be a daunting task for those utilities in areas where water resources are plentiful."

In a 1993 *Journal of the AWWA* article, Amy Vickers, one of the experts in the field, notes that there are benefits to conserving. "A key assumption underlying the potential incentive strategies for conservation is that increased water efficiency is a substitute for water supply capacity and has equivalent value in the market place."

According to a 1992 EPA Office of Water, *Statement of Principles on Efficient Water Use*, "Efficient water use can have major environmental, public health, and economic benefits by helping to improve water quality, maintain aquatic ecosystems, and protect drinking water resources. As we face increasing risk to ecosystems and their biological integrity, the inextricable link between water quality and water quantity becomes more important.

"Water efficiency is one way of addressing water quality and quantity goals. The efficient use of water can also prevent pollution by reducing wastewater flows, recycling industrial process water, reclaiming wastewater, and using less energy."

A few years ago, several members of the National Drinking Water Clearinghouse toured a community water plant and were told the system uses a block rate system in which cost decreases as water use increases. Good for business, they said. "What about wastewater?" our engineer asked. "Not my problem," was the operator's wry response. It is becoming increasingly clear that water use or misuse is *our* problem.

Will states and communities conserve?

According to an October press release by the U.S. Geological Survey (USGS), the answer is *Continued on page 20*



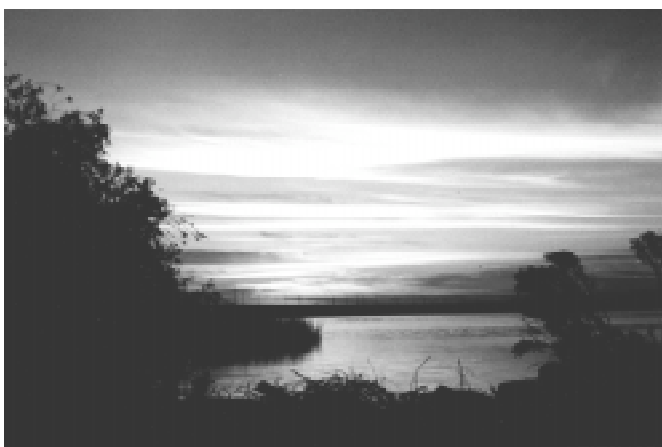
Conservation: It's the Future of Water

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“yes.” USGS statistics show that the nation is using less water—2 percent less than we used in 1990 and nearly 10 percent less than in 1980, despite a continuous increase in population over that same time period.

After continual increases in the nation's reported total use of surface water and groundwater from 1950 to 1980, water use declined and has remained fairly constant since the mid-1980s, according to the USGS report.

In *Urban Water Demand Management and Planning*, Duane Baumann states that in a survey of 1,383 households in both humid and semiarid regions in the U.S., 86 percent perceived the need to conserve as moderately important to very



Sunset reflects on Mobile Bay in Alabama.

Photo by Harriet Emerson

important. And conservation is impossible without the support of the public.

“The nation is clearly using surface- and groundwater resources more efficiently,” says Robert Hirsch, USGS chief hydrologist. “Enhanced citizen awareness of the value of water and conservation programs in many communities across the country have helped to cut water use in spite of continued population growth. Improved irrigation techniques and more efficient use of water by industry have contributed to reduced water use as well.”

According to EPA's Guidelines, as of late 1997, 18 jurisdictions (primarily states) had instituted water conservation planning guidelines for water utilities. All of these planning guidelines—the EPA surveyed 12 of the 18—require that utilities address leak detection, metering, pricing, and public education. The measures most frequently mentioned in statutes and guidelines are: metering and meter repair, leak detection and repair, rate design and conservation pricing, plumbing retrofits and promotion of water-saving fixtures, public information and education, and landscaping.

Is conservation required by law? The answer is, that depends where you live. No, it's not required by federal law. Your community water system won't violate any EPA regulations for refusing to implement water conservation measures. However, at their discretion, states may require drinking water systems to prepare a plan consistent with federal or state guidelines as a condition of qualifying for a loan under the Drinking Water State Revolving Loan Fund (DWSRF). EPA's Guidelines contain a section that lists the primacy agency, DWSRF agency, and water resource agency for each state.

What can we do to conserve?

According to Darilek, one issue upon which water managers agree is that water conservation needs to link water quantity and quality together in a direct manner. Incorporating water conservation into water policy means that for a water conservation program to be highly effective, both quantity and quality considerations and activities must be included in the program.

The EPA's Office of Water strongly encourages all sectors, including municipal, industrial, and agricultural, to achieve efficient water use. And, the planning approach suggested by EPA's 1998 *Water Conservation Plan Guidelines* is designed to be accessible and relatively inexpensive.

Think Creatively, Take Small Steps

In 1982, the EPA vetoed the proposed Two Forks Dam in Colorado following protests by environmentalists determined to save wild rivers and the habitat of the sand hill crane. Denver then developed xeriscaping, which encourages landscaping with plants that are either indigenous to an area (growing wild within 50 miles) or that require very little supplemental irrigation. (For more about xeriscaping see page 13.)

A September 1998 flyer from the Eastern Municipal Water District in Perris, California, encourages customers to turn down their watering clocks in October. “Nearly 50 percent of the domestic water used in Southern California goes toward watering lawns and landscaping around single-family homes. Reducing this type of usage by just 6 percent would be sufficient to provide water for 300,000 people.”

Wellesley, Massachusetts, created a very successful conservation program through a comprehensive strategy that ties peak demand rates, full cost pricing, and public education. The

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program helped the community reduce its peak water demand by 90 percent.

Under a set of 1989 state laws that were to be phased in by 1991, Connecticut mandated residential retrofit programs for utilities serving more than 1,000 customers; uniform plumbing efficiency standards for toilets, showerheads, urinals, and faucet aerators; and water conservation planning as a prerequisite for state regulatory permit actions, including rate increases. (See “Conservation Doesn’t Have To Hurt,” in the Fall 1996 *On Tap*.)

Whenever possible, educate the public. (See page 24.) If you can’t get through to adults, consider the kids. More and more schools are including water conservation as an element of education, and whatever children learn they take home to their parents. (See page 26.)

Use Water More than Once

An “AWWA Statement of Policy on Water Supply Matters,” revised in 1995, says that first and foremost AWWA believes that sources of water with best available quality should be used for potable purposes and encourages responsible use of reclaimed water in lieu of potable water for nonpotable uses.

Many areas of the country reclaim graywater or wastewater. The USGS report estimates that the amount of wastewater reclaimed in 1995 is more than double the amount used in the 1970s and 1980s. The release can be returned either to the natural environment or reclaimed for beneficial uses, such as irrigation of golf courses and parks. Illinois and Ohio reported the largest release of treated wastewater. Florida, California, and Arizona also reported large uses of reclaimed wastewater.

The 1993 *National Geographic* “Water: The Power, Promise, and Turmoil of North America’s Fresh Water,” includes an aerial view of an upscale community in Glendale, Arizona, laced with artificial lakes filled with treated wastewater.

Reisner says that California has done a fairly serious job stretching its water supply through conservation, especially in the agricultural sector, and that Los Angeles reclaims water by using tertiary or reverse osmosis and uses much of it to water outdoor landscaping.

“The fact of the matter is we can’t afford to build these big projects anymore,” he adds. “They’re simply too expensive. The environmental effects of them are just so great, so profound, that politically, I don’t think you can get them through.”

According to the *Cadillac Desert* video, Israel currently recycles two thirds of its wastewater and reuses it to drip irrigate crops. Drip irrigation,

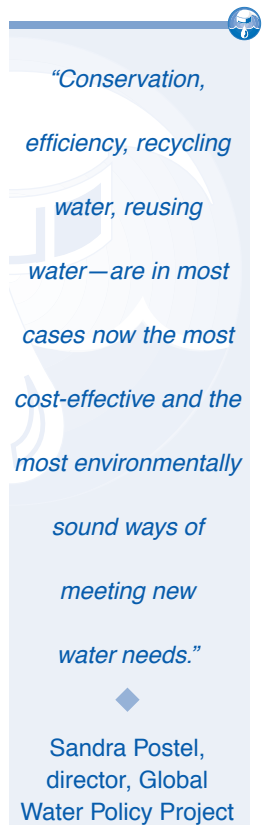
the video says, can save one third of what is used in spray irrigation.

In the PBS interview, Postel says that “conservation, efficiency, recycling water, reusing water—are in most cases now the most cost-effective and the most environmentally sound ways of meeting new water needs. By far, they’re more cost-effective and more environmentally sound than all the supply-side solutions we’ve been using in the past.

“And,” she says, “they’ve barely been tapped. We’ve been still focused very much on building dams and river diversions, and not looking at these conservation alternatives. And they’re out there; they’re waiting in the wings; the technology is there. The problem is we haven’t put in place the incentives through pricing, marketing, and other market mechanisms and regulations to get them out there, to get them used.”

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What is desalination?

by Babu Srinivas Madabhushi
NDWC Technical Assistance Specialist

Desalination is a process that removes dissolved minerals including salts from saline water and produces potable water. Desalination is a natural and continuous process and a part of the natural water cycle. Sea water evaporates and returns to earth as desalinated rainwater.

Why desalinate?

Desalination has become increasingly important in the last four decades due to the tendency, in recent years, for the world's swelling population to dwell in areas where supplies of high quality fresh water sources are less than adequate. Moreover, as there are a considerable number of saline sources available, desalination is becoming an attractive possibility. More than three quarters of the earth's surface and more than 95 percent of the world's water is either salty or brackish, and therefore not potable. Desalination increases the range of water resources available for use by communities.

According to Ron Linsky of the National Water Research Institute in California, "the country needs to improve the reliability of its supply. Water could be on the commodities market in the next century. We may ultimately face rationing or importing."

Can I drink desalinated water?

Yes, desalinated water can be used for drinking purposes, groundwater recharge, and also for irrigation. During the Persian Gulf War, the U.S. Army used mobile units that could produce 3,000 gallons of potable water per hour from brackish water sources. If the desalinated water is to be used for domestic use, post treatment should be done to ensure that treated water meets the health and anti-corrosive standards.

How do I desalinate?

A number of technologies, such as the membrane process, distillation, and vacuum freezing, have been developed to perform desalination. Distillation and the membrane process are the techniques used the most.

Nearly 60 percent of the world's desalination systems use distillation, heating the salty water to produce water vapor that is then condensed to form fresh water.

What are the distillation techniques?

The most commonly used distillation methods are multistage flash distillation (MSF), multiple effect distillation (MED), and vapor compression (VC). In MSF, the raw water is heated and pressure is lowered, so that the water flashes into steam. This process is carried out in a number of stages, in which the pressure is gradually reduced. In the MED process, the raw water passes through a number of evaporators connected in a series. Interestingly, the vapor in the earlier stage is used to evaporate the water in the later stages. In the VC process, the raw water is evaporated, the vapor produced is compressed, and the compressed vapor is used again for heating the additional raw water. VC is generally used for small and medium scale desalination units.

Can I use reverse osmosis to desalinate?

Yes, there are several membrane processes, such as reverse osmosis (RO) and electrodialysis, which can be used for efficient desalination. In RO, the water is pumped through semipermeable membranes to separate and remove the minerals from the saline water. Before being pumped through the membranes, the water is pretreated to remove any particles that might clog membrane pores. Suspended solids in the raw water can be removed by using coagulation and filtration.

What is the desalinated water quality?

Distillation plants produce water with total dissolved solids (TDS) concentrations ranging from 1 to 50 milligrams per liter (mg/l) and RO plants produce water with TDS concentrations ranging from 10 to 500 mg/l.

The quality of the treated water depends on the concentration of salts in the raw water, and, in the case of RO, the membranes selected and the pressure applied. In distillation, the quality depends upon the heating system, the pressures applied, etc. Quality of treated water can be improved by repumping the water through the membranes.

Why is pretreatment required?

Pretreatment is required to avoid substances that could interfere with the process and reduce desalination efficiency. Bacteria can grow in RO and distillation plants, hence disinfection may be required. Metals should be removed from the raw water as they may contribute to corrosion problems in distillation plants.

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Cadillac Desert Is Water History at its Best

The Public Broadcasting System (PBS) has produced a fascinating four-videocassette documentary *Cadillac Desert* that tells the story of the “epic struggle for water in the modern American civilization in the desert—the abundance it has brought, and the great risks it has created.”

The series, winner of the DuPont-Columbia Journalism Award, begins with the tale of how visionary William Mulholland delivered a river of water across the Mohave Desert to Los Angeles in 1913, then traces the 100-year effort to tame the Colorado River and transform California’s Central Valley into history’s most productive agricultural region. Learn how America’s mighty dams inspired similar projects overseas.

Chinatown, Roman Polanski’s fictionalized tale of greed and intrigue based on the Mulholland project, is included in the package. The movie stars Jack Nicholson and Faye Dunaway.


The series is based on Marc Reisner’s 1986 book *Cadillac Desert: The American West and Its*

Disappearing Water, which Reisner spent 10 years researching.

One video in the series—*The Last Oasis: Facing Water Scarcity*—is based on a book of the same name by Sandra Postel, director of the Global Water Policy Project.

PBS offers the 6 hour and 20 minute series for \$99.95. You may order online at <http://www.pbs.org/> or call PBS at (800) 645-4PBS and request item number A2729-WWV8.

A revised 1993 paperback version of Reisner’s *Cadillac Desert: The American West and Its Disappearing Water*, a Penguin Book, is available in book stores or you may visit the publisher’s Web site at <http://www.penguin.com>.

An updated 1997 version of Postel’s *The Last Oasis: Facing Water Scarcity*, published by W.W. Norton and Company and edited by Linda Starke, is available in paperback at bookstores. All the above items may also be purchased through <http://www.amazon.com>. 

What is desalination?

Continued from previous page

Comparison of Distillation and RO

According to some sources, the distillation process produces better quality water more economically than does RO. There is no break in operation for cleaning and replacement. Pretreatment requirements are fewer for distillation, as coagulation and filtration have to be carried out to prevent clogging of membrane pores in RO. Moreover, distillation plants do not produce secondary wastes from backwash of filters used for pretreatment.

But, in the case of RO, no heating is required, and hence, less energy is required. No corrosion problem is faced. Simultaneously, RO can remove other contaminants and requires less space for installation of the equipment.

Is any secondary waste produced?

Desalination plants produce liquid wastes with high concentrations of salts, metals, etc. Liquid wastes may be discharged in the ocean after making sure that they satisfy the discharge requirements. Otherwise, they have to be treated and disposed.

What is the energy requirement?


The desalination process uses mainly electricity and heat. The energy required depends on the raw water quality, temperature and the treated water quality, and on the process used.

How much does desalination cost?

For brackish water, the treatment costs may range from approximately \$1 to \$2.40 per 1,000 gallons. The cost for sea water desalting is estimated at \$4 to \$16 per 1,000 gallons. These estimates are only provided to give an idea of the range of costs, but these costs vary with site-specific conditions.

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If you have questions, comments, or want further information about desalination, contact Madabhushi at (800) 624-8301 or (304) 293-4191. You may also e-mail him at bmadabhu@wvu.edu. 



Reader Suggestion

Conservation Information Available Web Sites, Organizations Provide Resources

by Jamie Knotts
NDWC Promotions Editor

Utilities looking for educational resources, conservation organizations, or ways to encourage water conservation in their systems, should consider contacting the following for information.

WaterWiser, the Water Efficiency Clearinghouse, should be the first stop on the Web for those interested in learning about conservation. The site offers an abundance of information including book reviews, an efficiency-related company directory, a calendar of events for conservation activities, an online discussion group, and numerous links to other sites.

The site may be viewed at <http://waterwiser.org/> or contact them at WaterWiser, 6666 West Quincy Avenue, Denver, CO 80235. Their phone number is (800) 559-9855.

Another comprehensive water conservation site on the Internet is maintained by the U.S. Department of the Interior's Bureau of Reclamation. The **Virtual Water Conservation Center**, at <http://209.21.0.235/>, offers a wide range of information services, from regional issues in the Great Plains and western states to educational lesson plans to water-management documents that may be downloaded. More than 35 links to general education, agriculture, nature, urban, government, educational resources, and kid's sites are included.

A quick reading list of water saving tips may be found at <http://www.americanwater.com/49ways.htm>. **American Water and Energy Savers, Inc.** provides 49 ways to save water indoors and outdoors. The list can easily be used to educate customers about ways they can conserve water in their homes.

Utilities wanting to start a water conservation program should check out **Drop by Drop, A How-To Guide: Starting a Water Conservation Program**, at <http://www.jeonet.com/city/water.htm>. This simple one-page Web site gives the basics that may help convince customers to conserve.

The U.S. Environmental Protection Agency (EPA) offers a water saver management software package through its **Water Alliances for Voluntary Efficiency (WAVE)** program. WAVE is a non-regulatory water efficiency partnership that encourages commercial businesses and institutions to reduce water consumption. Members receive the easy-to-use PC-based WAVE-Saver software that can identify water and cost saving opportunities. WAVE-Saver was developed in

conjunction with leading water-use experts, and sponsored by the EPA and Metropolitan Water District of Southern California.

For software or more information about WAVE, contact John Flowers, director, EPA, 401 M St. SW, Mail Stop 4204, Washington, DC 20460. You may also call him at (202) 260-7288 or e-mail wave@epamail.epa.gov.

The EPA's publication **Cleaner Water Through Conservation** may be viewed online at <http://www.epa.gov/OW/you/intro.html>. The document explains the relationship between water quantity and quality, and discusses how developing water-use efficiency programs can help states and local communities achieve cleaner water by conserving.

The U.S. Geological Survey's **National Water-Use Information Program** offers a wide range of water-use information on its site located at <http://water.usgs.gov/public/watuse/>. The program compiles data about the nation's water use in cooperation with local, state, and federal environmental agencies. The site includes documents that may be downloaded, such as water-use maps and tables, publications, and reports.

Xeriscaping has become a popular method for conserving water in landscaped areas. To learn more, log on to the **Xeriscape™ Colorado!, Inc.** site at <http://www.xeriscape.org/>. This nonprofit membership group promotes water saving landscapes and offers a history, an overview of xeriscaping fundamentals, and creative approaches others can use. (For more information about xeriscaping, see page 13.)

The **Texas Water Resources Institute** (TWRI), located at Texas A&M University in College Station, is at the center of water research, training, and technology transfer in Texas. Part of a national network of institutes created by the Water Resources Research Act of 1964, TWRI's work involves researching water quality and conservation issues, educating future scientists, and providing water resource information to the public and water professionals.

TWRI's Web site at <http://twri.tamu.edu/> offers an extensive list of water-related technical report abstracts. Online versions of the reports are not available; however, you may request free copies through an online form. TWRI's four water-resources-related newsletters—including *Texas Water Savers: News of Water Conservation and Reuse in Texas*—are also available online.

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Organizations Offer Information, Funding

The following agencies and organizations offer water conservation assistance and information:

American Water Works Association (AWWA)

6666 West Quincy Avenue, Denver, CO 80235
<http://www.awwa.org>
 Contact the AWWA bookstore at (800) 926-7337
 or (303) 794-7711.

AWWA offers various books and news articles about conservation. Searches of available reference materials may be made on their Web site.

Bureau of Reclamation, U.S. Department of the Interior

Water Conservation Field Services Program/
 Efficiency Incentives Program
 1849 C Street NW, Washington DC 20240-0001
<http://www.watershare.usdr.gov>
 Contact Cindy Dyballa at (202) 208-7589
 Grants are available for a range of water conservation projects, such as planning, education, demonstrating innovative technologies, and conservation-implementation activities.

Rural Utilities Service, U.S. Department of Agriculture (USDA)

Water and Wastewater Loan/Grant Program
 USDA, Rural Utilities Service
 1400 Independence Avenue, SW, Washington, DC 20250
<http://www.rurdev.usda.gov/RUS>
 Contact Richard Mansfield at (202) 690-2670
 Grants and loans are offered for drinking water and wastewater infrastructure construction for communities serving fewer than 10,000. Conservation measures are eligible.

Office of Wastewater Management, U.S. Environmental Protection Agency (EPA)

401 M Street SW, Mail Code 4201, Washington, DC 20460
<http://www.epa.gov/owm/>

You may download the agency's *Water Conservation Plan Guidelines* as well as learn about water efficiency programs that encourage conservation. Go to the Web site above and click on "water efficiency."

Economic Development Administration, U.S. Department of Commerce


Public Works and Development Facilities
 Grants Program
 14th & Constitution Avenue, NW, Washington, DC 20230
<http://www.doc.gov/eda>
 Contact David McIlwain at (202) 482-5265
 Grants are provided to fund public works infrastructure and development facilities including improvements to drinking water systems. Conservation measures are eligible under the grants.

U.S. Department of Housing and Urban Development

Community Development Block Grants
 451 7th Street, SW, Washington, DC 20410
<http://www.hud.gov>
 Contact Yvette Aidara at (202) 708-1322 ext. 4378
 Grants are available for low to moderate income communities to assist in various planning and management efforts if part of a community economic development project.

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The **WaterReuse Association of California** Web site at <http://www.webcom.com/h2o/> is a good source of information about water reclamation and recycling, as a supplemental source of water. By increasing water reclamation and recycling, the association hopes to augment California's limited water resources. An extensive Frequently Asked Questions (FAQ) section explains everything you want to know about recycling and reusing water. A regulations section offers updates on pending legislation. A links sections offers other water-related sites. (For more information about California, see pages 1 and 18.)

Waterfront, The City of Winnipeg's Web site at <http://www.mbnet.mb.ca/wpgwater/> was Canada's first online information resource for municipal water conservation. A study revealed that residential consumption increases by 2 percent per year and that conservation measures would be needed to slow that growth. The result was an active campaign to increase water conservation—the Waterfront Web site was part of this effort. Other cities or towns looking for ideas to spur consumer conservation awareness can learn from the many conservation education examples listed here. 



Reader Suggestion

Activities for Youth:

Water Conservation Can Be Fun

by Margaret Caigan McKenzie
NDWC Staff Writer

Editor's Note: In the last On Tap survey, more than a dozen readers requested information about environmental education programs for children, including public education, simple water experiments for children, and successful education programs for kids.

Water is one of our most precious resources. But because it flows so freely from our faucets, many of us do not view it as the valuable commodity it is.

While it is true that most Americans have access to plenty of fresh water, it is also true that in parts of the country, water is occasionally in short supply. As the population continues to grow, shortages of fresh water will occur more often. This is one reason why it is so important to increase public understanding of water issues.

Children are an audience that responds well to water conservation education. Their natural curiosity and open-mindedness have earned many youth well-deserved recognition.

Kids Are Making a Difference

The **President's Environmental Youth Award** (PEYA) is one nationwide program that annually recognizes youth on both a regional and national level. Sponsored by the U.S. Environmental Protection Agency (EPA) and the White House Office of Education, this program is open to any student in grades K–12.

Students may compete in PEYA individually or as a group. Applications may be submitted throughout the year but must be postmarked on or before July 31 of the award year to be eligible for that year's competition. Call your regional EPA office for entry forms and further information.

For the number of your regional EPA office, call the EPA at (202) 260-2090 or log onto their Web site at <http://www.epa.gov/>. You may also call the National Drinking Water Clearinghouse (NDWC) at (800) 624-8301 or (304) 293-4191.

Kids! Renew America is a national publication that recognizes youth environmental programs. This publication is sponsored by **Renew America**, a nonprofit organization that identifies and honors successful environmental programs that protect, restore, and enhance the environment.

Renew America offers information about numerous youth environmental programs, valuable tips for starting your own projects, and names and addresses of helpful organizations.

Contact **Renew America** at (202) 721-1545 or e-mail renewamerica@counterpart.org. You may also access their Web site at http://solstice.crest.org/renew_america.

Log onto the Internet

For hours of amusing and educational fun, log onto the Internet. The U.S. Geological Survey's (USGS) **Water Science for Schools** site is a good place to begin. It includes pictures, data, maps, and an interactive section. You can hone your math skills by figuring out just how many showers you can get from a rainfall or you can become a city planner in charge of water works for an imaginary city. You may find this site at <http://www.wga.usgs.gov/educ/>.

EPA's Office of Water has a **Kid's Stuff** site that employs word games to increase your water conservation vocabulary, provides step-by-step instructions for building an aquifer, and invites you to laugh at the cartoon representations of embarrassing moments in a water drinker's life. This site may be found at <http://www.epa.gov/OW/kids.html>.

The American Water Works Association (AWWA) provides many of the materials in its **Blue Thumb Kit** online at <http://www.awwa.org/bluethum.htm>. There are cartoon posters about water issues, bookmarks, water facts, water experiments, and water word games. Each May, AWWA produces a new Blue Thumb Kit in recognition of Drinking Water Week. National Drinking Water Clearinghouse (NDWC) is a member organization of the Blue Thumb Alliance.

A limited number of 1998 kits are available free from the NDWC at (800) 624-8301 or (304) 293-4191. You will be charged shipping costs. Ask for item #DWPKE17. Otherwise, you may order a copy of the 1998 kit from AWWA at (800) 926-7337 at a cost of \$7.95 plus shipping. AWWA's 1999 kits will be available in February.

Are you looking for holiday gifts?

The Groundwater Foundation offers a number of products that might make fun holiday gifts.

- **Dripial Pursuit** is a card game that asks questions related to water, natural resources, and geography. Play it in the classroom or at home with family and friends. Play in teams or individually. Order item 2-2; the cost is \$6.
- **Groundwater Bookmarks** are laminated bookmarks that list The Top Ten Ways to

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Protect and Conserve Groundwater. Priced at 50 cents for the first nine, these book-marks are discounted when purchased in volume.

- “Excuse Me, Sir, That’s My Aquifer!” is a cassette tape by nationally known folk singer and writer Ann Bailey-Rowland who uses humorous verse and song to express environmental concerns. The cassette contains nine songs and comes with its own booklet featuring sing-along lyrics, background notes and several student activities. Item 2-4 costs \$13.50.
- *Puddle Pictures* is much like the popular Pictionary game. It is a team card game—challenging for both children and adults—that uses water-related words. Request item 2-6. The cost is \$6.

You may order the above products from The Groundwater Foundation at (800) 858-4844 or print the order form from their Web site at <http://www.groundwater.org/> and mail it with your check or money order.

Water Festivals Are Fun

If you are a 4th, 5th, or 6th grader who lives in Nebraska, you may get to spend a fun-filled day learning about groundwater at the annual groundwater festival held in March at Grand Island, Nebraska. Because of this festival’s success, it has become an international model for developing water festivals. Currently, water festivals are held in nearly 40 states.

For more information about this festival or to find guidance in developing your own water festival, contact The Groundwater Foundation at the number above.

TV Time Can Be Educational

The often maligned TV offers water conservation education in a relaxed setting. Look for environmental programs on the Public Broadcasting System, Arts and Entertainment, and the Discovery channels.

If you don’t want to wait for TV to air an environmental program, you can contact the World Resources Institute. They have an extensive listing of environmental videos and may be reached at (202) 638-6300 or e-mail mary@wri.org.

How can adults help?

The Education Resource Information Center (ERIC) in Columbus, Ohio, offers a video titled *Planning for Fun and Success* that explores eight

youth water education programs. It includes a program leader workshop guide that explains how to design a community-based youth water program.

You may order the video for \$10.95 plus shipping charges by calling (800) 276-0462.

What about educational grants?

If you want to bring water conservation education into schools, grants are available for just that purpose. For example, in 1997, Hygiene Elementary School in Hygiene, Colorado, was awarded \$4,900 to teach students about water-related topics, and this year the Center for Environmental Research and Service in Troy, Alabama, received a \$4,800 grant to develop a water conservation education program.

A grant that started out supporting a project in Atlanta, Georgia, now benefits numerous schools throughout Georgia and 33 other states, as well as in Canada. Funds were granted to develop a partnership among water utilities, private sector enterprises, county cooperative extension services, and local public and private school systems.

The partnership used the grant to develop the *Water Sourcebook Series*—four hands-on water activity books based on the theme “use what you need, and don’t pollute.” The activities in the books—designed to support the disciplines of mathematics, science, language arts, social studies, and related arts—are applicable to all geographic areas, and have been tested by teachers.

Because of the varied ages of its target audience, separate books were designed for grades K–2 (\$21.95); grades 3–5 (\$24.95); grades 6–8 (not yet available); and grades 9–12 (\$29.95). The grade 6–8 Sourcebook will be available in April. Quantity discounts are available and shipping charges are added. To order, call Fox McCarthy at (770) 426-8936 or write to Georgia Water Wise Council, Inc. at 1033 Franklin Road, Suite 9-187, Marietta, Georgia 30067-8004.

Need help writing grants?

Many teachers are not experienced grant writers and tend to shy away from writing grant proposals. EPA has developed software—the “EPA Grant-Writing Tutorial”—that will walk you through the grant writing process.

You may use this software online at <http://www.epa.gov/teachers/grants.htm> or download it to your computer. 🌐

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NDWC Suggests Conservation Products

Note: The free items listed below are limited to one of each per order. Call (800) 624-8301 or (304) 293-4191 to order products. Please allow three to four weeks for delivery. Actual shipping charges are added to each order. National Drinking Water Clearinghouse (NDWC) products also may be ordered via e-mail at ndwc_orders@ndwc.wvu.edu. Products are subject to availability. Please verify price when ordering.

■ Computer Search—Water Conservation Item # DWBLCM11

This 1998 computer search contains abstracts of articles related to water conservation and reuse, including water-saving appliances and devices that can be used in homes, water saving devices, and the uses of recycled water.

Cost: \$10.20

■ 21 Water Conservation Measures for Everybody Item # DWFSPE60

This fact sheet, published by the U.S. Environmental Protection Agency in 1992, presents the importance of water conservation, as well as statistics of water consumption and the waste. It also gives a list of measures that can be taken for efficient water conservation.

Cost: \$0.00

■ Introduction to Water Loss and Leak Detection Item # DWBL0M04

Aimed at operators of small water systems, this 1989 guide discusses the types of water loss and the steps to isolate and pinpoint leaks

Cost: \$3.00

■ Yes, You Can: Two Small Towns Show How To Save Money and Water Item # DWFSPE60

The communities of Lorena, Texas, and Bern, Kansas, outline how they saved money and water through public education and conservation in this 1991 brochure.

Cost: \$0.00

■ RESULTS 3.0

Item # DWSWGN31 (Mac version)

Item # DWSWGN25 (DOS version)

The newly updated RESULTS Database includes information about alternative treatment technologies in use by more than 1,000 small drinking water systems around the country. The computer disk offers system and manufacturer contacts, as well as treatment specifics. An online version is available free of charge and may be accessed at the National Drinking Water Clearinghouse (NDWC) Web site located at <http://www.ndwc.wvu.edu>.

Cost: \$10.00 (Mac version)

\$5.00 (DOS version)

On Tap Offers Conservation Articles

For a look at what Connecticut is doing about conservation, see "Conservation Doesn't Have to Hurt," page 1, Fall 1996 *On Tap*, Volume 5, Issue 3. The article is a case study of how the small town of Portland, Connecticut, (2,000 service connections) implemented state-mandated retrofitting.

Another helpful article from a back issue is "50 percent loss? How to Detect Small Utility Water Leaks," page 4, Winter 1993 *On Tap*, Volume 2, Issue 1. This issue is out of print; however, the three-page article is available for a small copying fee plus postage.

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