Municipal Water Restriction Ordinances: Best Practices and Current Trends

Phase 1 Summary Document of Findings

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CHAMPAIGN COUNTY rpc REGIONAL PLANNING COMMISSION

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INTRODUCTION

The Champaign County Regional Planning Commission (CCRPC) is in the process of developing a model ordinance for municipal water use restrictions. Once developed, the model ordinance will be available to local municipalities for potential use as a regulatory tool, in addition to simply encouraging less water consumption.

This report is part of Phase 1 of model ordinance development by CCRPC, and is a summary of findings regarding the current best practices and trends associated with the development and use of a municipal water use restriction ordinance. The report additionally summarizes: federal and state standards and policies relevant to water conservation in Illinois and current status of regional water supply planning; water use restriction issues; and selected water use restriction ordinances.

GOVERNMENT STANDARDS AND PROGRAMS

Federal agencies such as the Environmental Protection Agency (EPA); the Department of Energy (DOE) and the Department of Interior (DOI) are responsible to oversee administration of various distinct water resource policies and standards. Depending on the specific standard, administrative oversight at the state level is delegated to the Illinois Environmental Protection Agency (IEPA), the Illinois Department of Natural Resources, Office of Water Resources (IDNR/OWR), the Illinois Department of Commerce and Economic Opportunity (DCEO), or other state office. Appendix A contains a brief description of these federal and state agencies, selected water resource-related standards (i.e., *Safe Water Drinking Act; Clean Water Act; Energy Policy Act; and SECURE Water Act)* and recent EPA advisory principles associated with the efficient use of water.

There are two federal programs related to water use: WaterSMART and WaterSense®.

WaterSMART

The DOI established the WaterSMART program in 2010 to implement the *SECURE Water Act* and to better position itself to meet water supply challenges. WaterSMART is an online resource which provides states, tribes, local governments, other organizations and the public access to information, leadership, and assistance from all DOI bureaus regarding the efficient use of water and regarding integrating water and energy policies to support the sustainable use of all natural resources. (1) Appendix B contains "Frequently Asked Questions" about the DOI's WaterSMART online information clearinghouse. (2)

WaterSense®

WaterSense® is a voluntary partnership program sponsored by the EPA with the goal of protecting the future of the U.S. water supply. EPA develops specifications for water-efficient products through a public process. If a manufacturer makes a product that meets those specifications, the product is eligible for third-party testing to ensure the stated efficiency and performance criteria are met. If the product passes the test, the manufacturer is rewarded with the right to put the WaterSense® label on that product. WaterSense® partners with manufacturers, retailers and distributors, and utilities to bring WaterSense® labeled products to the marketplace and make it easy to purchase high-performing, water-efficient products. WaterSense® also partners with irrigation professionals and irrigation certification programs to promote water-efficient landscape irrigation practices. Presently, the majority of WaterSense® 'promotional partners' in Illinois appear to be communities, state and local government entities situated in the northern portion of the state. Promotional partners endorse and publicize the program to their constituents. The WaterSense® webpage includes a rebate finder which presently features rebates by two Illinois municipalities. (3) Appendix C contains the "Comprehensive List of All Frequent Questions" from the EPA WaterSense® website. (4)

Water Management Laws in Illinois

In the *Drought Response Plan for the City of Bloomington, Illinois Water Department*, the author indicates the two most important water management laws in Illinois are the 1951 *Water*

Authorities Act and the 1983 *Water Use Act* as amended. (5) The following excerpt from this plan explains how Illinois water supply (generally, in east central Illinois) is presently managed based on these laws:

> Section 5 of this law deals with the problem of water conflict resolution:
>
> > *In the event that a land occupier or person proposes to develop a new point of withdrawal, and withdrawals from the new point can reasonably be expected to occur in excess of 100,000 gallons on any day, the land occupier or person shall notify the District before construction of the well begins. The District shall in turn notify other local units of government with water systems who may be impacted by the proposed withdrawal. The District shall then review with the assistance of the Illinois State Water Survey and the State Geological Survey the proposed point of withdrawal's effect upon other users of the water. The review shall be completed within 30 days of receipt of the notice. The findings of such reviews shall be made public. (Source: P.A. 85-1330.) The long history of hydrologic analysis in the state is generally associated with the work done by the State Water Survey (ISWS) and is a legacy of their leadership in the field. However, the ISWS has primarily been a research organization rather than a water manager.*
>
> Other than the indirect reference to their role in the *Water Use Act*, the ISWS has no statutory authority to manage water use from aquifers or surface water supplies. Annual water use is voluntarily reported to the ISWS by all high capacity users and, unless a neighbor notices a problem with their supply well there are no regulations of water withdrawals. In-stream flow requirements are indicated by the limits imposed by the low flow requirements of individual NPDES discharge permits and the restrictions built into federal permits for power plant cooling water from surface waters.
>
> For the past 50 years only the local water utilities have done planning for water use by planning for expansion. Local declines in water levels in the deep aquifer and pollution of the shallow aquifers in the more populated areas created new boundary conditions for community planning. …. Illinois has recently found that state laws provide for a strong water research mission but there is no statutory water management authority. Given this policy vacuum, it is incumbent on local governments that are located in areas of the state that may be vulnerable to shortages (especially those already experiencing both rapid growth and limited supplies) to begin or continue the planning process. …"

Source: *Drought Response Plan: City of Blooming Illinois Water Department*, Whittman Hydro Planning Associates, Inc., July, 2006, pp. 2-3, excerpt.

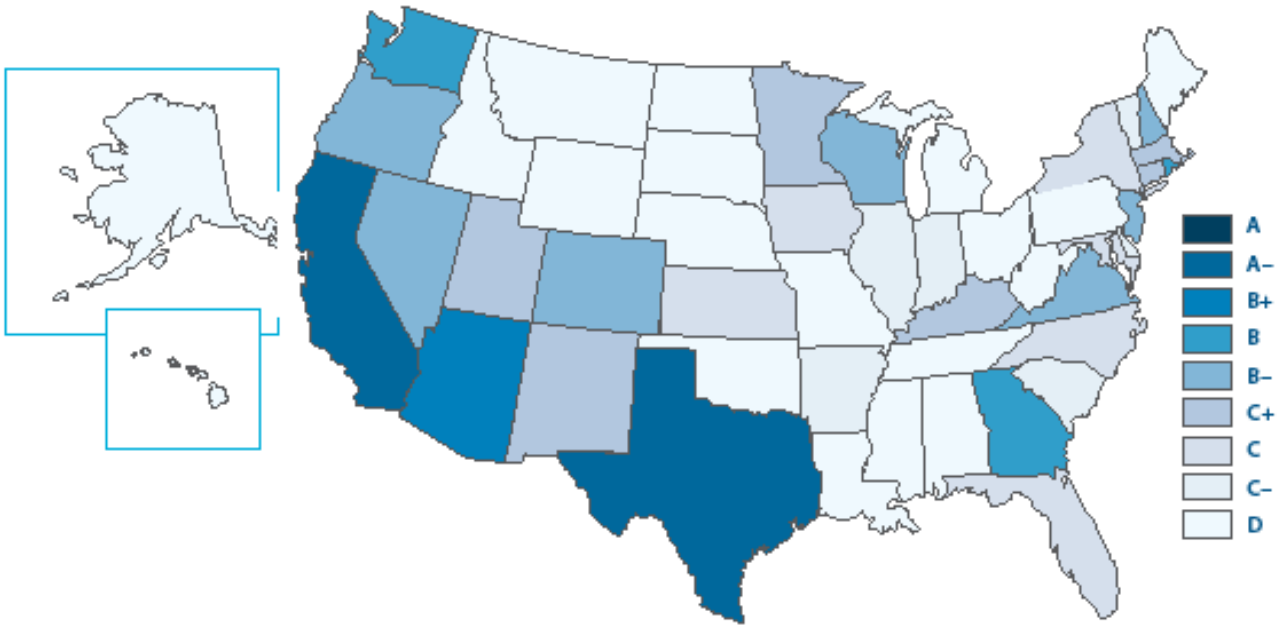
Executive Order 2006-01

Executive Order 2006-01, issued by the Illinois Governor in January 2006, marked the beginning of the most comprehensive state and regional water supply planning and management effort in the state in recent history. Appendix D contains a brief review of water supply planning and management in East Central Illinois.

Illinois 2011/2012 Water Efficiency and Conservation Scorecard

Table 1 (on the following page) displays recent survey results regarding water conservation and water efficiency measures in place in Illinois. The survey results are from a report entitled "The Water Efficiency and Conservation State Scorecard: An Assessment of Laws and Policies" provided online in September 2012 by the nonprofit organizations Alliance for Water Efficiency (AWE) and Environmental Law Institute (ELI). The survey ranked all state-level laws and policies related to water efficiency and conservation. Illinois received a grade of C-.
Figure 1 displays the relative scoring of all states based on survey results.

Figure 1: AWE Water Efficiency and Conservation State Scorecard Graphic



Source: AWE website, http://www.allianceforwaterefficiency.org/final-scorecard.aspx

As expected, the highest scoring states (e.g., Arizona, California and Texas) have the most experience in addressing existing and imminent water supply shortages. The majority of case studies and best practices examples regarding water conservation and efficiency are available from the highest ranked states shown.

Table 1: Illinois 2011/2012 Water Efficiency and Conservation State Scorecard

1	What state agency or agencies are in charge of drinking water conservation/efficiency?	Illinois Department of Natural Resources (IDNR)
2	Does the state have a water consumption regulation for toilets that is more stringent than the federal standard?	No
3	Does the state have a water consumption regulation for showerheads that is more stringent than the federal standard?	No
4	Does the state have a water consumption regulation for urinals that is more stringent than the federal standard?	No
5	Does the state have a water consumption regulation for clothes washers that is more stringent than the federal standard?	No
6	Does the state have a water consumption regulation for pre-rinse spray valves that is more stringent than the federal standard?	No
7	Does the state have mandatory building or plumbing codes requiring water efficient products that exceed the federal standard?	No
8	Does the state have any regulations or policies for water utilities regarding water loss in the utility distribution system?	Yes, but only in regard to Lake Michigan water allocations. (1)
9	Does the state require conservation activities as part of its water permitting process or water right permit?	Yes, but only in regard to Lake Michigan water allocations. (2)
10	Does the state require preparation of drought emergency plans by water utilities or cities on any prescribed schedule?	No
11	Does the state have a mandatory planning requirement for potable water conservation/efficiency separate from drought emergency plans?	No
12	Does the state have the authority to approve or reject the conservation plans?	No
13	How often does the state require the water utilities to submit a potable water conservation plan (not part of a drought emergency plan)?	n/a
14	If the state has a mandatory planning requirement for potable water conservation separate from drought emergency plans, is there a framework or prescribed methodology?	n/a
15	Does the state require water utilities to implement conservation measures, beyond just the preparation and submittal of plans?	No
16	Does the state offer financial assistance to utilities, cities, or counties for urban water conservation programs such as a revolving loan fund? Grants? Bonds? Appropriations?	Nothing beyond the DWSRF (3) and CWSRF (4)
17	Does the state offer technical assistance for urban water conservation programs?	No
18	Does the state require volumetric billing?	No

continued

Table 1: Illinois 2011/2012 Water Efficiency and Conservation State Scorecard (continued)

19	What percentage or number of publicly supplied water connections (residential and nonresidential) are metered in your state?	n/a
20	Does the state provide statewide ET microclimate information for urban landscapes? (5)	No
extra credit: Soil moisture sensors are required for irrigation systems		

Source: AWE webpage, http://www.allianceforwaterefficiency.org/Illinois-Policy-Info-2012.aspx

Table 1 Notes

1) Excerpts of Illinois Administrative Code Title 17, 17, § 3730.307(b) and Illinois Administration Code Title 17, § 3730.309(a) are provided as Reference Note 5.
2) Excerpt of Illinois Administrative Code Title 17, § 3730.307 is provided as Reference Note 6.
3) DWSRF is an acronym for 'Drinking Water State Revolving Fund.'
4) CWSRF is an acronym for 'Clean Water State Revolving Fund.'
5) ET is an acronym for 'evapotranspiration.'

Illinois Energy Conservation Code

The Illinois Energy Conservation Code (IECC) contains standards regarding heating systems and equipment, and includes minimum criteria to effectively heat and deliver hot water.

Illinois law requires all new commercial and residential construction for which a building permit application is received by a municipality or county to follow the comprehensive IECC. Renovations, alterations, additions, and repairs to most existing commercial and residential buildings must follow the IECC. (8) Administrative Rules to adopt the 2012 IECC with amendments were approved by the Joint Committee on Administrative Rules on December 11, 2012. The 2012 IECC took effect in Illinois beginning January 1, 2013. (9)

Landscape Irrigation Water Efficiency ICC Standards

The International Code Council (ICC) promotes an agenda of safety, sanitation and both energy and water efficiency through the development of model codes to help protect the health, safety and welfare of people in the built environment. The ICC Consensus Committee on Landscape Irrigation Emission Devices (IS-IEDC) held public meetings during 2011 and 2012 to

develop the first public comments draft of the ASABE/ICC 802-201, *Landscape Irrigation Sprinkler and Emitter Standard*, dated December 2012. Public comments on the first draft will be accepted through February 18, 2013. (10)

Home Rule and Non-Home Rule Municipalities

Appendix E details the powers of a home rule and non-home rule municipalities. (11)

BEST PRACTICES AND TRENDS

Well-known and established non-profit organizations are key resources for obtaining information regarding up-to-date water conservation best practices, including information relevant to development of water restriction ordinances and drought response measures.

Alliance for Water Efficiency

The Alliance for Water Efficiency (AWE) is dedicated to the efficient and sustainable use of water. (12) AWE works to support and enhance water conservation efforts, providing benefit to water utilities, water conservation professionals, planners, regulators, and consumers. The AWE website provides a water conservation clearinghouse with access to water conservation and water efficiency product information, best practices specifications, research reports, training materials, program descriptions, codes and standards, program evaluation tools, drought planning and response, and professional expertise. (13)

Appendix F contains a copy of the AWE webpage 'Drought and Drought Response Introduction.' A "drought response program,' 'water efficiency program' (a.k.a. 'water conservation program), are two very different actions for two different problems." (14) Excerpts of the AWE drought response information follows:

> "Voluntary action from water users can result in up to 25% water use reduction for short periods of time. Mandatory restrictions have resulted in as much as a 40% reduction of water use.

> … [T]he public seldom sustains the voluntary water conservation levels more than a few months. Drought response actions, even mandatory water use restrictions, are designed to be suspended once the drought is deemed over.
>
> Water efficiency programs are designed to effect long-term (even permanent) water use reductions; drought response is designed to solve short term water supply deficits. Water efficiency programs can reduce the impact of subsequent droughts, but water efficiency strategies continue beyond the term of a drought. Water efficiency planning is usually based on the economics of avoided costs or least cost planning. Drought response is meant to solve an emergency supply shortfall; thus, does not always need to be justified by avoided costs."

Source: AWE website, http://www.allianceforwaterefficiency.org/Drought_Introduction.aspx

The AWE website contains an extensive 'Glossary of Common Water-Related Terms, Abbreviations, and Definitions' which includes the most commonly used water or conservation related terms. (15)

American Water Works Association

The American Water Works Association (AWWA) is described as "… the oldest and largest nonprofit, scientific and educational organization dedicated to safe and sustainable water in the world. … AWWA advances public health, safety and welfare by uniting the efforts of the entire water community." (16) Recent water use restriction information available from AWWA includes the *AWWA Manual M60*, "Drought Preparedness and Response" which features the following 7-step planning and implementation process:

1. *Form a water shortage response team.*
2. *Forecast supply in relation to demand.*
3. *Balance supply and demand and assess mitigation options.*
4. *Establish triggering levels.*
5. *Develop a staged demand reduction program.*
6. *Adopt the plan.*
7. *Implement the plan.*

Source: AWWA website, http://www.awwa.org/store/productdetail.aspx?ProductId=26750

The primary focus of the AWWA 7-step process is on developing a water shortage response plan. Developing a 'water use restriction' ordinance would be considered as an action item to be implemented in the final step, and the ordinance would be developed based on the plan adopted.

Appendix G contains an excerpt from the Water Shortage Contingency Planning Checklist in the AWWA *M60* manual (16) and a copy of the online AWWA "Water Conservation Communications Guide." (17)

US Green Building Council

The U.S. Green Building Council (USGBC) is dedicated to sustainable building design and construction.

> "Buildings are one of the major pieces of the puzzle when it comes to being ready for disaster or being prepared for changing temperatures, stronger storms, more flooding and lengthier droughts. But it's our cities and counties that are on the frontlines dealing with all the pieces of the puzzle… " (18)
>
> *Jason Hartke, USGBC, National Leadership Speaker Series on Resiliency and National Security in the 21st Century, October, 2012*

The USGBC is the developer of the 'Leadership in Energy and Environmental Design' (LEED) building rating system, described as a voluntary, consensus-based, market driven and green building program. (19) Appendix H contains a brief explanation of the LEED program.

Sustainable Sites Initiative

The Sustainable Sites Initiative (SITES™) is an interdisciplinary effort by the American Society of Landscape Architects, the Lady Bird Johnson Wildflower Center at The University of Texas at Austin and the United States Botanic Garden to create voluntary national guidelines and performance benchmarks for sustainable land design, construction and maintenance practices. The U.S. Green Building Council (USGBC) is a stakeholder in SITES™ and anticipates incorporating these guidelines and performance benchmarks into future iterations of the LEED® LEED Green Building Rating System.™ (20)

Additional Resources

Appendix I contains a copy of the POLIS Project on Ecological Governance published *Thinking Beyond Pipes and Pumps: Top 10 Ways Communities Can Save Water and Money*. The top ten options identified are complementary and synergistic ideas which can be integrated by a municipality as parts of a municipal water conservation program. The outreach and education and social marketing sections of this publication are relevant to development of a water use restriction ordinance.

Drought Ready Communities

Drought-Ready Communities (DRC) was a two-year project sponsored by the Sectoral Applications Research Program of the National Oceanic and Atmospheric Administration during 2008-2010. The project was a collaborative effort by the National Drought Mitigation Center, the Oklahoma Climatological Survey, the Illinois State Water Survey and State Climatologist's Office, and the Lower Platte River Corridor Alliance. Three pilot communities (Nebraska City, NE; Decatur, IL; and Norman, OK), representing a range of water supply sources, population sizes, and economic baselines, participated in the development of a best practices methodology and approach to drought preparation. The DRC project report entitled 'Guide to Community Drought Preparedness,' updated in 2011, is available as a download on the "Drought-Ready Communities" webpage, and is provided as Appendix J.

As of 2011, the National Drought Mitigation Center and the National Integrated Drought Information System are working with the American Planning Association on a *Planning Advisory Service* report to help planners integrate drought planning into other community planning processes. (21).

Illinois American Water - Water Supply Conservation Ordinance Template

Illinois American Water (IAWC) is the locally managed utility supplying water to Champaign, Urbana, and some smaller communities in Champaign County. The *Champaign County Land Resource Management Plan* contains the following description of IAWC:

> "IAWC owns subsidiaries that manage municipal water and wastewater systems under contract and others that supply homeowners, businesses, and communities with water resource management products and services. Rates charged by IAWC are set and approved by the Illinois Commerce Commission (ICC). Changes in IAWC customer rates must be filed with the ICC and are approved only after due process, which includes the opportunity for customer and public intervention. IAWC operates under rules and regulations established by the U.S. Environmental Protection Agency (EPA), Illinois Environmental Protection Agency (IEPA) and the Illinois Department of Public Health."
>
> The source of supply for the IAWC Champaign County District is groundwater from sand and gravel aquifers, including the Glasford Aquifer and the Mahomet Aquifer. Currently 21 large capacity wells deliver water for treatment to two lime-softening plants: the East Plant located in Urbana, and the West Plant, located in Champaign. The wells are primarily located in two areas. The north well field taps the Glasford Aquifer and consists of seven wells that supply the East Plant. The west well field consists of 14 wells that draw from the Mahomet Aquifer and supply water to both the East and West Plants. The wells range from 150 to 366 feet in depth and are protected from surface contamination by geologic barriers in the aquifers.
>
> IAWC recently completed a long-range comprehensive facilities plan that includes construction of a new water treatment plant in Champaign County to support anticipated growth of communities served by IAWC within the County. During the last 20 years, water demand within the IAWC service areas of Champaign County increased 35 percent while the number of IAWC customers increased by 40 percent."
>
> *Source: Champaign County Land Resource Management Plan, dated 2010.*

IAWC representatives have made available a *Water Supply Conservation Ordinance Template* prepared by IAWC. This IAWC template is provided as Appendix K.

REFERENCES

1) WaterSMART webpage, http://www.usbr.gov/WaterSMART/water.html, accessed online 12/27/2012. WaterSMART contains the acronym 'SMART' for 'Sustain and Manage America's Resources for Tomorrow.'

2) WaterSMART "Frequently Asked Questions" webpage, http://www.doi.gov/watersmart/html/faq.html, accessed online 12/27/2012.

3) WaterSense® webpage, http://www.epa.gov/watersense/, accessed online 12/23/2012.

4) WaterSense® "Comprehensive List of All Frequent Questions" webpage, www.epa.gov/watersense/full_list.html, accessed online 12/23/2012.

5) *Drought Response Plan: City of Blooming Illinois Water Department*, Whittman Hydro Planning Associates, Inc., July, 2006, pp. 2-3.

6) Illinois Administrative Code Title 17, 17, § 3730.307(b) states:

"As a condition of receiving an allocation of Lake Michigan water, all permittees will agree to submit to the Department proposals designed to reduce or eliminate wasteful water use and to reduce unaccounted-for flows to 8% or less, based on net annual pumpage, and procedures used to determine efficiency of water metering or accounting in permittee's system."

Illinois Administration Code Title 17, § 3730.309(a) states:

"Within 60 days of the end of each accounting period, all permittees shall furnish the following information and such other information relevant to the Lake Michigan allocation as the Department may require on forms provided by the Department … 9) The amount and percentage of water from all sources for the accounting period used for each of the following purposes … O) Unaccounted for, and P) Unavoidable leakage … 10) Summaries of the results and recommendations of any leak surveys conducted in the accounting period;"

7) Illinois Administrative Code Title 17, § 3730.307 states:

"(b) As a condition of receiving an allocation of Lake Michigan water, all permittees will agree to submit to the Department proposals designed to reduce or eliminate wasteful water use and to reduce unaccounted-for flows to 8% or less... (c) The Department shall require evidence of adoptions by the permittee of the following conservation practices as applicable to the particular user: 1) Leakage monitoring and correction for storage, transmission and distribution systems. 2) Metering of all new

construction. 3) Metering of existing nonmetered services as part of any major remodeling. 4) The adoption of ordinances which require installation of the following water efficient plumbing fixtures… in all new construction and in all repair or replacement of fixtures or trim… 5) The adoption of ordinances which require the installation of closed system air conditioning in all new construction and in all remodeling. 6) The adoption of ordinances which require that all lavatories for public use in new construction or remodeling be equipped with metering or self-closing faucets. 7) The adoption of ordinances which require that all newly constructed or remodeled car wash installations be equipped with a water recycling system. 8) The adoption of ordinances which restrict non-essential outside water uses to prevent excessive, wasteful use."

8) 2012 Illinois Energy Conservation Code (2012 IECC), Illinois Capital Development Board webpage, http://www2.illinois.gov/cdb/business/codes/Pages/default.aspx, accessed online 1/8/2012.

9) Illinois DCEO webpage, http://www.ildceo.net/dceo/Bureaus/Energy_Recycling/IECC.htm, accessed online 1/8/2013.

10) ICC Consensus Committee on Landscape Irrigation Emission Devices webpage, http://www.iccsafe.org/cs/standards/IS-IEDC/Pages/802-201Dev.aspx, accessed online 1/7/2013.

11) From the Illinois General Assembly webpage, an excerpt from the Constitution of the State of Illinois, Article VII, Local Government, consisting of Section 6-8. http://www.ilga.gov/commission/lrb/con7.htm, accessed online, 12/20/2012.

12) Alliance for Water Efficiency (AWE) webpage, http://www.allianceforwaterefficiency.org/, accessed 1/2/2013.

13) AWE Resource Library webpage, http://www.allianceforwaterefficiency.org/resource-library/default.aspx, accessed online 1/2/2013.

14) AWE Drought and Drought Response Introduction webpage, http://www.allianceforwaterefficiency.org/Drought_Introduction.aspx, accessed online 1/8/2013.

15) AWE Glossary of Common Water-Related Terms, Abbreviations, and Definitions webpage, http://www.allianceforwaterefficiency.org/Glossary.aspx, accessed online 1/2/2013.

16) American Water Works Association (AWWA) webpage, http://www.awwa.org/about-us.aspx, accessed online 12/27/2012.

17) AWWA Water Conservation Communications Guide, http://www.awwa.org/Portals/0/files/resources/public%20affairs/pdfs/conservationGuideBook.pdf, accessed online 12/27/2012.

18) US Green Building Council (USGBC) article, http://new.usgbc.org/articles/usgbc-and-iclei-bring-together-leading-mayors-addressing-solutions-support-resilient-commun, accessed online 1/10/2013.

19) USGBC "LEED" webpage, http://new.usgbc.org/leed, accessed online 1/10/2013

20) Sustainable Site Initiative webpage, http://www.sustainablesites.org/about/, accessed online 1/10/2013.

21) National Drought Mitigation Center, Drought-Ready Communities webpage, http://www.drought.unl.edu/Planning/PlanningProcesses/DroughtReadyCommunities.aspx accessed online, 1/10/2012.

22) National Drought Mitigation Center, *Guide to Community Drought Preparedness* http://www.drought.unl.edu/portals/0/docs/DRC_Guide.pdf, accessed online, 1/10/2012.

1) Brief description of federal and state agencies which administer water resource-related standards

Environmental Protection Agency (EPA)
"EPA enforces federal clean water and safe drinking water laws, provides support for municipal wastewater treatment plants, and takes part in pollution prevention efforts aimed at protecting watersheds and sources of drinking water." (1) Earliest water resource regulatory efforts of EPA were primarily pollution prevention and water quality standards. By 2012, the EPA expanded its purview to include the 'nexus between energy and water' to address concerns regarding both water quality and efficient use of water. (2)

Department of Interior (DOI)
The DOI leads the national water conservation initiative and assessing the use and availability of the nations' water supply. The DOI oversees the U.S. Geological Survey and the Bureau of Reclamation. (3, 4)

IEPA
In accordance with *Clean Water Act* standards, the IEPA reports to the EPA on the quality of Illinois surface water and groundwater resources and provide a list of those waters where their designated uses are rated as "impaired." Additionally, the IEPA assesses the water quality of all publicly-owned lakes. To make these determinations, the IEPA annually collects chemical, physical, biological, habitat, and toxicity data regarding water quality of Illinois surface and groundwater resources. (5)

IDNR-OWR
The IDNR-OWR is the state agency primarily involved in matters pertaining to water conservation and efficiency. The IDNR-OWR oversees "…regulatory programs over construction in the floodways of rivers, lakes, and streams; construction in the shore waters of Lake Michigan; construction and operation of dams; construction in public bodies of water; diversion of water from Lake Michigan; and withdrawal of water from Lake Shelbyville, Carlyle Lake, and Rend Lake. The [IDNR-OWR] ..is the lead state agency for water resources planning, navigation, floodplain management, the National Flood Insurance Program, and interstate organizations on water resources. Interagency duties include the state water plan, drought response, flood emergency situation reports, and the comprehensive review of Illinois water use law." (6)

Illinois Department of Commerce and Economic Opportunity (DCEO)
DCEO offers public sector electric efficiency programs within ComEd, Ameren Illinois, NICOR, Peoples and North Shore electric and natural gas service territories. DCEO is a partner in the Illinois Home Performance with Energy Start Program (IHPwES), described online as follows:

> "Home Performance with ENERGY STAR® is an innovative whole-house approach to improving the energy efficiency, comfort, and safety of existing homes. IHPwES trains contractors to consider all energy options when retrofitting houses. Under IHPwES, a qualified energy analyst first performs a thorough energy inspection of the home to gauge its energy efficiency and determine the cause of any problems the homeowner may be experiencing. Homeowners then receive a list of home energy upgrades prioritized according to their impact on energy efficiency and cost-effectiveness, plus a list of qualified contractors trained in whole-house energy-efficiency improvements. Quality work, based on building science principals, will emphasized as participating contractors will be required to be Building Performance Institute Building Analyst and Envelope Specialist certified. To support these efforts, the Department is facilitating BPI trainings throughout the state to build a qualified workforce. Once the work is completed, a post-inspection visit will verify the quality and benefits of the work. Homeowners are then eligible for rebates administered through their utilities. Currently the Department is working with the Midwest Energy Efficiency Alliance.. , and Illinois electric and gas utilities to create a set of statewide standards for IHPwES. This program allows Illinois residents to save money while increasing the comfort and safety of their homes." (7)

2) <u>Brief description of federal standards related to water as a resource</u>

Safe Water Drinking Act
The Safe Drinking Water Act (SDWA), established in 1974, is intended to protect the quality of drinking water in the U.S, from either underground sources or above-ground sources.
The Act enables EPA to establish minimum standards to protect drinking water and requires all owners or operators of public water systems to comply with these standards. The amendments to the Act in 1996 require that EPA review a detailed risk and cost assessment, and best available peer-reviewed science, when developing SDWA standards. The amendments to the Act in 1996 allows the EPA to approve State governments to implement SDWA standards, including minimum SDWA standards to protect underground sources of drinking water from endangerment by underground injection of fluids. (8)

Clean Water Act
The Clean Water Act (CWA), reorganized and expanded in 1972, establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. The CWA authorizes the EPA to implement pollution
Clean Water Act (continued)

control programs such as setting wastewater standards for industry, and setting water quality standards for all contaminants in surface waters. (9)

Energy Policy Act
The *Energy Policy Act* (EPAct), passed in 1992 and subsequently amended, sets goals, creates mandates, and amends utility laws to increase clean energy use and improve overall energy efficiency in the U.S. In 1992, EPAct consisted of 27 titles detailing various measures designed to lessen the nation's dependence on imported energy, provide incentives for clean and renewable energy, and promote energy conservation in buildings. Title I the EPAct established a comprehensive energy efficiency program that included incentives for energy conservation in buildings and created efficiency standards for appliances. EPAct impacts electric power deregulation, building codes and new energy efficient products. EPAct is also responsible for the mandate of low flush toilets and outlawing the installation of toilets that flush more than 1.6 gallons (6 liters) of water. Subsequent amendments to EPAct 1992 include the *Energy Independence and Security Act of 2007*, *Executive Order 13423*, and *EPAct 2005*. (10)

SECURE Water Act
The *SECURE Water Act,* passed in 2009*,* provides authority to the DOI to enable federal water and science agencies to work together with the states and local water managers to plan for climate change and the other threats to our water supplies, and take action to secure our water resources for the communities, economies, and the ecosystems they support.

3) EPA *Principles for an Energy Water Future: A Foundation for a Sustainable America*

The EPA *Principles for an Energy Water Future: A Foundation for a Sustainable America,* are advisory principles supported by the EPA, and are listed on the following page.

EPA Principles for an Energy Water Future
A Foundation for a Sustainable America

The nexus between energy and water is an increasingly important area for focus. There are significant societal and environmental benefits to be derived from improving coordination between the two sectors. Government should take a leadership role in this relationship and lead by example. EPA is proposing principles for government, service providers, and ratepayers to foster valuable collaboration in both the water and energy sectors to work together to meet our water and energy needs nationally and locally. The principles also serve as a reminder that rising water treatment costs or necessary tradeoffs such as stricter water treatment levels can be mitigated by efforts elsewhere such as reducing demand for energy and water.

Efficiency in the use of energy and water should form the foundation of how we develop, distribute, recover, and use energy and water. EPA supports:

- Encouraging energy and water efficiency by the ratepayer through the use of efficient products, like ENERGY STAR and WaterSense labeled products, supplemented by informed and wise use of resources;
- Improving system-level energy and water efficiency by water, wastewater, stormwater and energy utilities and encouraging strategic investments in efficiency;
- Using full cost rate structures while ensuring access to clean and safe water for low income households;
- Recognizing and reducing the embedded water and energy in manufactured and agricultural products; and
- Relying on education and outreach, in collaboration with local communities, to be at the forefront of encouraging efficiency.

The exploration, production, transmission and use of energy should have the smallest impact on water resources as possible, in terms of water quality and water quantity. EPA supports:

- Reducing consumption or use of water for producing energy and fuels: reduce, recover, reuse and recycle;
- Analyzing, recognizing and minimizing any impacts on groundwater, water quality, water quantity, and the aquatic environment including wetlands when choosing between sources of energy; and
- Practicing good stewardship to minimize potential impacts and avoid contaminants that reduce water's value or require additional energy for treatment.

The pumping, treating, distribution, use, collection, reuse and ultimate disposal of water should have the smallest impact on energy resources as possible. EPA supports:

- Creating an energy efficiency management plan using established energy auditing tools;
- Establishing plans to repair leaks in water distribution and wastewater collection systems;
- Using nearby water sources where available, including rain harvesting and recycled water;
- Treating water to a level that matches the end use; and
- Avoiding unnecessary transport of water and wastewater for treatment or disposal.

Wastewater treatment facilities, which treat human and animal waste, should be viewed as renewable resource recovery facilities that produce clean water, recover energy and generate nutrients. EPA supports:

- Using wastewater and associated organic solids and treatment byproducts, such as methane gas, as a source of renewable energy that can be used by treatment plants to reduce net 'on-grid' energy use or to become zero net energy consumers;
- Using wastewater for irrigation, accounting for the nutrients in the water as a way to reduce the need for additional fertilizers;
- Recycling or reusing water for appropriate uses with no resulting loss of downstream use and habitat, minimizing energy used for treatment, and becoming a reliable source for the future; and
- Extracting and recycling nutrients from wastewater.

(continued)

EPA Principles for an Energy Water Future
A Foundation for a Sustainable America (continued)

The water and energy sectors – governments, utilities, manufacturers, and consumers – should move toward integrated energy and water management from source, production and generation to end user. EPA supports:

- Encouraging the water and energy sectors – both governments and utilities –to continue to align themselves to breakdown institutional barriers, improve transparency, and maximize efficiencies;
- Encouraging government agencies to look across missions and private utilities to look across sectors to achieve integrated energy and water management, maximize efficiencies and avoid unintended consequences;
- Encouraging partnerships between government and service providers to leverage and expand upon existing successes and institutions; and
- Promoting transparency and collaboration related to research, funding and policy within institutions and across sectors, which are essential and will help to leverage lessons learned and expand successes.

Maximize comprehensive, societal benefits. EPA supports:

- Articulating and recognizing the benefits for the larger sphere of influence of public and private investment – beyond direct cost savings – in energy and water efficiencies;
- Enhancing, promoting, and targeting financial incentives and other societal benefits, including market-based benefits such as rebates and government programs such as state revolving funds, taxes and tax credits; and
- Planning to build resiliency for climate change impacts on water infrastructure and water quality to minimize vulnerabilities.

Source: EPA Energy/Water webpage, http://water.epa.gov/action/energywater.cfm, accessed 12/31/2012.

Appendix A Notes

1) EPA Water webpage, http://www.epa.gov/lawsregs/topics/water.html#surface, accessed online 12/28/2012, and The Environmental Planning Handbook For Sustainable Communities and Regions, Daniels and Daniels, American Planning Association, 2003, pp. 75-80.

2) EPA Water & Energy Efficiency webpage, http://water.epa.gov/infrastructure/sustain/waterefficiency.cfm, accessed online 1/3/2013.

3) The United States Geological Service (USGS) provides reliable scientific information to describe and understand the earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life. As the nation's largest water, earth, and biological science and civilian mapping agency, the USGS collects, monitors, analyzes, and provides scientific understanding about natural resource conditions, issues, and problems. The diversity of USGS scientific expertise enables it to carry out large-scale, multi-disciplinary

investigations and provide impartial scientific information to resource managers, planners, and other customers.

4) The Bureau of Reclamation (BR) is the Department of the Interior's main water management agency, best known for the more than 600 dams, reservoirs, power plants, and canals it constructed in the 17 western states, including Hoover Dam on the Colorado River and Grand Coulee on the Columbia River. These water projects led to homesteading and promoted the economic development of the west.

The BR is the largest wholesale water supplier and the second largest producer of hydroelectric power in the U.S., with operations and facilities in the 17 western states. BR is a contemporary water management agency with a strategic plan to assist in meeting the increasing water demands of the western states, while protecting the environment and the public's investment in these structures.

The BR plays a key role in the WaterSMART program, through the administration of grants, scientific studies, technical assistance, and scientific expertise, with a focus on improving water conservation and helping water and resource managers make wise decisions about water use.

5) EPA Water Resource Assessments webpage, http://www.epa.state.il.us/water/water-quality/index.html, accessed online 12/27/2012.

6) IDNR Office of Water Resources Programs webpage, http://www.dnr.illinois.gov/waterresources/pages/programs.aspx, accessed online 12/20/2012.

7) DCEO Illinois Energy Office, Illinois Energy Efficiency Portfolio, October, 2011. Public Sector Electric Efficiency Programs webpage, http://www.ildceo.net/dceo/Bureaus/Energy_Recycling/, accessed online 1/8/2013.

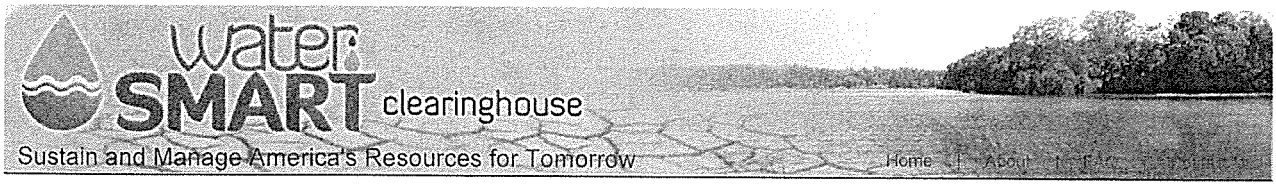
8) EPA Summary of the Safe Drinking Water Act webpage, http://www.epa.gov/lawsregs/laws/sdwa.html, accessed online 12/21/2012.

9) EPA Summary of the Clean Water Act webpage, http://www.epa.gov/regulations/laws/cwa.html, accessed online 12/21/2012.

10) DOE Federal Energy Management Program, Energy Policy Act of 1992 webpage, http://www1.eere.energy.gov/femp/regulations/epact1992.html, accessed online 12/21/2012.

11) DOI Bureau of Reclamation SECURE Water Act Report to Congress webpage, http://www.usbr.gov/climate/SECURE/, accessed online 12/20/2012.

U.S. Department of the Interior



Frequently Asked Questions

Q: Who is eligible to submit content to the WaterSMART Clearinghouse?
A: With the launch of the WaterSMART Clearinghouse the Department of Interior is building capacity to share information and tackle America's water challenges. The initial phase of the Clearinghouse is focused on gathering information from governmental agencies and land grant universities. The types of entities which can submit information to the Clearinghouse will be expanded in the future.

Q: What kinds of information should I expect to find in the WaterSMART Clearinghouse?
A: Web sites, press releases, research, and best practices from a variety of governmental organizations and land grant universities involved with conserving and maintaining water supplies and water use.

Q: What does WaterSMART mean by "Best Practices" and the other searchable topics listed on the WaterSMART home page?
Best Practices: Descriptions of proven, effective, state-of-the-art practices or approaches developed by governments, organizations, and communities to meet the challenges of water conservation and sustainable use. The practices can be adopted or emulated by others.
Case Studies: Examples of how innovative and cost-effective technologies and strategies are used by governments, organizations, and communities to successfully meet the challenges of water conservation and sustainable use.
Education and Outreach: Education, outreach, and awareness programs and resources for all levels from "K to Gray" are provided by governments, organizations, and communities to promote water conservation and the adoption of best practices. The information and programs are relevant for all levels, from the individual homeowner, farmer, rancher, and small business owner, to communities and beyond.
Energy and Water: Identifying, quantifying, and responding to the impacts of conventional and renewable energy extraction and use on water availability and quality relative to domestic, agricultural, recreational, and other uses, including within ecosystems.
Financial Assistance: Sources for grants and other financial resources and incentives to implement best practices and to promote the development and application of cost-effective strategies and state-of-the-art technologies to ensure sound water conservation, management, and use. These resources are aimed at facilitating a wide range of activities including water supply and demand studies, water efficiency, conservation and management projects, infrastructure needs and feasibility analysis, and water marketing.
Laws, Regulations, Policies: Information about and links to local, State, tribal, and national laws, regulations, and policies governing water use, quality, and conservation by all sectors, public and private.
Products and Services: Products and services to help governments, communities, and citizens conserve, protect, and efficiently manage and use water resources, including tools to measure the effectiveness of water conservation efforts.
Research: Information about research (basic to applied) and monitoring efforts to (1) assess surface and groundwater resource distribution, quantity, quality, and use; (2) identify effective conservation strategies; (3) understand the environmental response to water management; (4) determine the impacts of climate change on water supplies; and (5) assess the implications and impacts of competition for water resources to support population growth and urban expansion, agriculture, industry, energy development and use, and other societal needs.
Water Data and Information: Local, regional, and national data and information on groundwater and surface-water quantity, quality, distribution, and use—data necessary for accurate analysis and for sound decision-making.

Q: How do I perform a search by a specific State, River Basin or Tribal Area?
A: This location search is performed by selecting an option from the three drop down menus to the right of the topic options. The default options are Any State, Any River Basin and Any Tribal Area. By clicking on a menu, you will be presented with a list of specific options under that main heading. Where there is no content for the specific State, River Basin, or Tribal Area selected, only content that is national in scope will be displayed.

Q: How do I enter my topic if it is not included in the "Search by Topic" list?
A: Enter it in the "Search WaterSMART" box below the Welcome banner on the home page.

Q: How do I share my information?
A: If you represent a governmental agency, including Federal, State, County, Municipal, Interstate, Provincial, and Tribal governments within the United States, you can submit information and a web site URL by using the Share Information with the Clearinghouse link on the home page. Land grant universities from all fifty states and the US provinces will also be considered eligible entities for the purposes of submitting information to this site.

Q: Does the Department of the Interior endorse any products or services?
A: No. The Department of the Interior does not endorse any products or services. Please read the Disclaimer for more information.

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General Questions

- Why did EPA create WaterSense?
- Why does the United States need a water-efficiency program?
- What is the goal of WaterSense?
- How will success be measured?
- What products will be included in the WaterSense program?
- How will water-efficient products and programs be labeled or recognized?
- How can I find more information about product certification and labeling?
- What are the WaterSense label and logos?
- How are specifications for products determined?
- How does EPA ensure that products meet the criteria?
- Why did EPA choose third-party certification instead of self-certification?
- Is there an opportunity for public comments on proposed specifications?
- How does EPA plan to coordinate with local water utilities?
- How is WaterSense similar to ENERGY STAR®? How is WaterSense different from ENERGY STAR?
- What more can I do to save water for future generations?
- Is water supply an issue everywhere in the United States?
- How can water efficiency help local communities?
- Which areas of the country have the largest water supply challenges?

Certification Programs for Irrigation Professionals Questions

- How did EPA set the final specifications for certification programs for irrigation professionals?
- What certification programs are eligible for the WaterSense label?
- How can certification programs for irrigation professionals use the label?
- Can certified irrigation professionals use the WaterSense label?

Product Certification and Labeling Questions

General

- Why does EPA require third-party certification?
- Will certification apply to all product categories?
- Are there licensed certifying bodies that can certify all products?
- How can stakeholders provide input on the specification development and certification processes?
- How does EPA maintain the integrity of the WaterSense label?

Manufacturers

- How can my product earn the WaterSense label?
- Why can't I receive the label for my product?
- Which certifying bodies can certify my products?

- What is generally involved in product certification?
- How will consumers know that my product has been certified?
- What is the cost of certification to product manufacturers?
- How will this certification process impact smaller product manufacturers?
- How long will the process take from the time I submit my product for certification until the time when I can apply the WaterSense label to products?
- I am an overseas manufacturer looking to get my products certified to WaterSense specifications. Will there be certifying bodies in my country that can conduct the certification?

WaterSense Product Certification System

- What is the product certification system and how is it different than the interim certification process?
- How does this new product certification system affect manufacturers whose products are currently in the draft or notice of intent stage of specification development?
- My organization certifies products. How can I become a licensed certifying body for WaterSense?
- My organization tests products. How can I participate in the WaterSense product certification process?
- Under this new certification system, is my irrigation program eligible for certification?
- Under this new certification system, is my product eligible for certification and the WaterSense label?
- What kind of accreditation are you offering and how can I get it?

High-Efficiency Toilet (HET) Questions

- How did EPA set the specification for toilets?
- How was UNAR developed?
- What percentage of toilets currently qualify under the specification?
- How does the specification ensure that these toilets will perform as expected?
- How will EPA verify the testing?
- Are toilets that meet the WaterSense specifications more expensive than other toilets?
- Will the installation of HETs lead to drainline and sewer problems due to the reduced water flows?

High-Efficiency Bathroom Sink Faucet Questions

- How was the final specification for high-efficiency faucets developed?
- What are the details of the specification?
- Who will certify that products meet the specification?
- What types of products can earn the WaterSense label under this specification?
- What is a faucet accessory?
- Are bathroom sink faucets that meet the WaterSense specification more expensive than other bathroom sink faucets?
- If WaterSense labeled aerators are so easy to install, what would prevent their removal?

Flushing Urinals Questions

- What is the new WaterSense specification?
- How was the final specification for flushing urinals developed?
- What types of products can earn the WaterSense label under this specification?
- Why are non-water urinals not included in this specification?
- What are the details of the specification?
- Who will certify that products meet the specification?
- If flushing devices and urinal fixtures are labeled and sold separately, how will purchasers know which components should be used together to ensure water efficiency and performance?
- Are urinals that meet the WaterSense specification more expensive than other urinals?
- How much water will a WaterSense labeled flushing urinal save the average facility?

WaterSense Labeled New Homes Questions

- Why label new homes?
- How did EPA develop the WaterSense Single-Family New Home Specification?
- What is included in the specification?
- How much will a WaterSense labeled new home save?

- Does a WaterSense labeled new home cost more to build/own?
- What about the quality of WaterSense labeled new homes?
- Why did EPA include a landscaping requirement?
- Who can participate in the program?
- How will homeowners know their homes have earned the WaterSense label?
- How can I find a WaterSense builder partner?
- Why did EPA limit the size and type of homes that can earn the label? Are homes three stories high with an underground basement eligible?
- What about existing homes?

General Questions

Why did EPA create WaterSense?

EPA realized that managing water supplies was becoming an increasingly important issue to local markets around the country. Through this national program, local water utilities, product manufacturers, and retailers will work with EPA to encourage the use of water-efficient products and practices among consumer and commercial audiences.

Why does the United States need a water-efficiency program?

Water is a finite resource. Between 70 and 75 percent of the Earth's surface is covered with water, but only 1 percent of that is available for human use. While both population and demand on freshwater resources are increasing, supply remains constant—there is the same amount of water now as there was 2 billion years ago. Water efficiency helps preserve our water supply for future generations.

What is the goal of WaterSense?

The main goal of the program is to decrease indoor and outdoor nonagricultural water use through more efficient products, equipment, and programs. With its recognizable label, WaterSense helps consumers easily identify water-efficient products in the marketplace while ensuring product performance and encouraging innovation in manufacturing.

How will success be measured?

EPA will estimate gallons of water saved by individuals and organizations purchasing water-efficient products instead of those that use more water. EPA will also examine the savings that result from using irrigation professionals that are certified in water-efficient installation and maintenance practices and the increase in awareness of water-efficient products and practices.

What products will be included in the WaterSense program?

Irrigation professionals and residential plumbing products are among the first categories in the program. EPA plans to research several options to expand product areas in the future, including additional indoor and outdoor home products, as well as commercial products.

How will water-efficient products and programs be labeled/recognized?

EPA developed the WaterSense label to differentiate products in the marketplace that meet EPA criteria for efficiency and performance, as well as programs that meet EPA criteria for water efficiency. The label will appear on product cartons and packaging, be adhered directly to the product, be featured on in-store displays, and be found in manufacturer literature and Web sites. EPA also maintains a registry of labeled products on the WaterSense Web site.

How can I find more information about product certification and labeling?

Products bearing the WaterSense label are certified to conform with the relevant specification by an EPA licensed certifying body. Manufacturers apply directly to the licensed certifying body for certification and to obtain the WaterSense label.

There are several key steps involved with using the WaterSense label. Please review the Product Certification and Labeling Frequent Questions below or the WaterSense Product Certification and Labeling fact sheet, or visit the WaterSense product certification page for more information.

What are the WaterSense label and logos?

WaterSense has two different labels and two different logos that have specific purposes. For more information, please visit the What are the WaterSense Label and Logos? page.

How are specifications for products determined?

For each product under consideration, EPA conducts extensive market research to analyze potential specifications. EPA develops specifications with stakeholder input and prepares draft efficiency and performance criteria as an open process, soliciting input from stakeholders to ensure that the most appropriate criteria for each product category is included. Once EPA finalizes the draft specification, it is available for public comment. EPA will refine the draft specifications based on the comments and feedback, and then will release them again in either draft or final form. The number of rounds of public review will depend on the product schedule, and the nature and extent of comments on the prior draft.

How does EPA ensure that products meet the criteria?

Products are independently certified by a third party to confirm that they meet EPA's criteria for efficiency and performance. Before a product receives the WaterSense label, an EPA-licensed certifying body must certify that it conforms to the relevant WaterSense product specification. Labeled products are also subject to ongoing surveillance to ensure that they continue to conform to the relevant WaterSense specification.

Effective as of April 2009, EPA has instituted its own product certification system. This system specifies the requirements for the product certification process and establishes a mechanism for EPA-approved accreditation organizations to approve and oversee WaterSense-related product certifications in accordance with international guidelines.

Why did EPA choose third-party certification instead of self-certification?

EPA chose independent certification by a third party to confirm that the product meets the WaterSense efficiency and performance criteria.

Is there an opportunity for public comments on proposed specifications?

Yes. The program will strive to use a process similar to ENERGY STAR to solicit public comments on proposed specifications. There will be an open workshop 4-6 weeks after the draft specification is released to receive comments. EPA will also receive written comments from those unable to attend to meeting.

How does EPA coordinate with local water utilities?

Local water utilities have been very supportive in the development of the program. Many utilities already have efforts in place to increase the water efficiency of residential and commercial irrigation systems. Utilities are encouraged to incorporate WaterSense into their local water-efficiency and conservation efforts.

How is WaterSense similar to ENERGY STAR? How is WaterSense different from ENERGY STAR?

WaterSense is similar to ENERGY STAR in that both programs work toward market enhancement and public recognition through the labeling of products and programs. One of the main differences between these two programs is that WaterSense requires third-party certification of its products and services, ensuring that they comply with WaterSense's specifications. Another major difference is that WaterSense focuses on water-using products and services that don't require energy to run, solely focusing on their water-efficient properties. ENERGY STAR includes water-using products that conserve energy.

What more can I do to save water for future generations?

EPA conducts a number of activities to encourage consumers and organizations to use less water. Information on how to use water efficiently is posted on our Web site and available on our fact sheets and other publications. This new program adds the product focus to our ongoing activities.

Is water supply an issue everywhere in the United States?

There are many markets in the United States that already face water shortages, and the number of markets facing this issue is projected to grow in the future. A Government Accountability Office survey of water managers across the country showed that 36 states were anticipating local, regional, or statewide water shortages by 2013, even under non-drought conditions. Water efficiency is a much more cost-effective tool to help local markets manage water supply issues than developing new sources.

How can water efficiency help local communities?

Water supply infrastructure is a major cost for most local markets across the United States. In 2002, an EPA report identified a $224 billion gap in planned infrastructure investment as compared to needs. Water efficiency is one key way that local communities can help manage their infrastructure needs.

Which areas of the country have the largest water supply challenges?

Water use varies greatly depending on geographic location and season, largely as a result of differences in climate. For instance, water use needs tend to be higher in the West and Southwest than in the East or Midwest. However, water and wastewater infrastructure systems across the country are being challenged by population growth and aging components. Water efficiency can lessen the stress on these systems and

extend their useful life. Further complicating the issue of water supply and availability is the fact that population growth is greatest in states that have more limited water resources.

Certification Programs for Irrigation Professionals Questions

How did EPA set the final specifications for certification programs for irrigation professionals?

EPA set the final specifications for certification programs for irrigation professionals to address both efficient irrigation system components and services. This will help customers identify professional service providers that embrace and encourage the use of water-efficient practices to enhance performance and efficiency.

What certification programs are eligible for the WaterSense label?

WaterSense has recognized certification programs for irrigation professionals that meet the specification criteria. The specifications address certification programs in three categories:

- **Irrigation Auditor:** Applies to programs that certify irrigation professionals who assess the proper functioning of existing irrigation systems, perform water audits, and recommend watering schedules.
- **Irrigation Installation and Maintenance Professional:** Applies to programs that certify irrigation professionals who install new irrigation systems and/or repair and maintain existing irrigation systems.
- **Irrigation Designer:** Applies to programs that certify irrigation professionals who develop the design of new irrigation systems and/or modifications to existing irrigation systems.

How can certification programs for irrigation professionals use the label?

In order to use the label, the certifying organization must have signed a partnership agreement with EPA and have applied for and been accepted to use the label for its certification program(s).

Can certified irrigation professionals use the WaterSense label?

Individuals who become certified under a WaterSense labeled certification program are not allowed to use the WaterSense label directly on their business cards, vehicles, promotional materials, etc. However, professionals certified under WaterSense labeled programs that provide services consistent with WaterSense specifications, can become WaterSense partners and use the WaterSense partner logo to promote their certification.

Product Certification and Labeling Questions

General

Why does EPA require third-party certification?

EPA wants to ensure the WaterSense program's integrity and sustainability. EPA also wants to ensure consumer confidence in the products that bear the WaterSense label.

Licensed certifying bodies, independent of EPA and the product manufacturers, test products for both efficiency and performance, certify product conformance to WaterSense specifications, authorize use of the WaterSense label, and conduct periodic market surveillance. Third-party certification is the framework already established in the United States to independently verify that products in the marketplace meet specifications and standards.

Will certification apply to all product categories?

EPA will require all WaterSense labeled products to be certified by a licensed certifying body. EPA may, however, adjust the specific certification requirements as appropriate for individual product categories.

Are there licensed certifying bodies that can certify all products?

There are licensed certifying bodies that are currently accredited to certify a majority of the products for which EPA is interested in developing specifications. EPA anticipates that more licensed certifying bodies will obtain accreditation to certify products as additional WaterSense specifications are developed.

How can stakeholders provide input on the specification development and certification processes?

EPA is interested in input from all stakeholders in the specification development and certification processes. EPA has established a list to notify interested persons when various programmatic elements are developed and released for public input. Please visit the Contact Us page to be added to the WaterSense e-mail and mailing list; remember to specify your interest in becoming part of the specification and certification development processes in the "Message" field.

How does EPA maintain the integrity of the WaterSense label?

EPA maintains the integrity of the WaterSense label through several mechanisms:

- Through the independent third-party certification process, licensed product certifying bodies provide surveillance for the proper use of the WaterSense label for the products that they certify—typically through periodic store audits or warehouse inspections.
- WaterSense encourages its partners to be vigilant and report any suspected label misuse to EPA. If you see a product you believe to be improperly labeled, please contact the WaterSense Helpline at (866) WTR-SENS (987-7367), or e-mail us.
- WaterSense encourages partners to submit print and Web materials for pre-press review. EPA provides prompt review and ensures that the use of the label is consistent with WaterSense guidelines.
- WaterSense conducts periodic reviews of partner Web sites to ensure that the label is used properly.
- WaterSense conducts periodic Google image searches to detect misuse of the label by non-partners. When label misuse occurs by a WaterSense partner, EPA contacts the relevant licensed certifying body, which handles necessary corrective actions. If a non-partner misuses the label, EPA engages in corrective action directly with the infringing party. In all instances, EPA strives to resolve matters quickly and fairly in order to preserve public confidence in the WaterSense program.

Manufacturers
How can my product earn the WaterSense label?

The first step toward obtaining the WaterSense label is for the product manufacturer to enter into a WaterSense partnership agreement with EPA. Manufacturers can sign a WaterSense partnership agreement with EPA once a draft specification has been released for a product they produce or manufacture under a private label. Under the partnership agreement, manufacturers will have 12 months to obtain certification for a product that conforms to the relevant WaterSense specification.

The second step is to have one of EPA's licensed certifying bodies certify your product for conformance to the relevant WaterSense specification. Manufacturers apply directly to the licensed certifying body for certification. Once your product is certified, the licensed certifying body will provide you with artwork for the WaterSense label, including the name of the licensed certifying body. You must use this label in accordance with the WaterSense label use guidelines.

Which certifying bodies can certify my products?

A listing of EPA licensed certifying bodies is posted on the WaterSense Web site or may be obtained from the WaterSense Helpline at (866) WTR-SENS (987-7367). Certifying bodies are approved for each individual specification, so be sure to choose one that is licensed to the WaterSense specification relevant to your products. Products may be certified by any licensed certifying body listed for the relevant WaterSense specification.

What is generally involved in product certification?

Product certification involves product testing and an assessment of the production process and quality management system, both initially and on an ongoing basis. This may include factory visits, periodic product retesting, or other approaches to monitor the product's continued conformance to WaterSense specification requirements.

The general certification requirements applicable to all product categories are described in the WaterSense product certification system. EPA will evaluate and specify additional certification details for each new product category as part of the product specification development process.

How will consumers know that my product has been certified?

Only products certified to WaterSense specifications are allowed to bear the WaterSense label. In addition, EPA maintains a Web registry of WaterSense labeled products. To get your products included on this list you must submit to EPA a new certified product notification form for toilets or for bathroom sink faucets for each certified model. EPA will verify the product certification information with the licensed certifying body that conducted the certification. This process, from notification to listing on the WaterSense Web site, may take up to two weeks.

What is the cost of certification to product manufacturers?

The cost structure for product certification is determined by the licensed certifying bodies. EPA anticipates that the testing fee and cost for certification of products, which may include opening a new certification file or adding models to an existing file, will be in line with the current cost structure to have plumbing products certified by an accredited certifying body.

How will this certification process impact smaller manufacturers of products?

In the development of its product certification system, EPA considered the impact on smaller manufacturers and worked to balance the cost and burden of the process with the rigor the program needs to maintain the WaterSense label's integrity.

While there will be some cost impact on all manufacturers to submit a product for certification, the strength of the WaterSense label should help products stand out in the marketplace. This should be of particular value to small business partners.

How long will the process take from the time I submit my product for certification until the time when I can apply the WaterSense label to products?

The exact process and timing will be determined by the licensed certifying body conducting the certification. Licensed certifying bodies recognize that time to market is an important consideration and will compete for a manufacturer's business in this area. EPA anticipates that the time to achieve product certification to WaterSense specifications will be similar to the time it currently takes to get plumbing products certified to American Society of Mechanical Engineers (ASME) and other relevant standards.

I am an overseas manufacturer looking to get my products certified to WaterSense specifications. Will there be certifying bodies in my country that can conduct the certification?

WaterSense anticipates that at least some of its licensed certifying bodies will have offices worldwide with the capability to conduct product certifications for WaterSense. Please keep in mind, however, that to be eligible for the WaterSense label, you must sell or intend to sell products in the United States that meet the relevant WaterSense specification within one year of partnership with EPA. Please contact one or more of EPA's licensed certifying bodies to determine if they certify products in your area.

WaterSense Product Certification System
What is the product certification system and how is it different than the interim certification process?

Under the interim certification process, EPA relied on current American National Standards Institute (ANSI) accredited certifying bodies to certify products in accordance with their existing certification schemes. Now, under the WaterSense product certification system, EPA has specified the minimum requirements that licensed certifying bodies must follow when certifying products for WaterSense. In addition, an EPA-approved accreditation body accredits certifying bodies specifically for their capability and competence to meet these requirements. The WaterSense product certification system enables EPA to:

- Ensure consistent application of its minimum product certification requirements.
- Establish uniformity in the certifying body accreditation process, while making the process open to all qualified accreditation organizations.
- Provide fully transparent criteria for product certification and the accreditation of product certifying bodies.

How does this new product certification system affect manufacturers whose products are currently in the draft or notice of intent stage of specification development?

As new final specifications are developed for WaterSense, the certification and labeling process will occur in accordance with the final WaterSense product certification system. WaterSense will work with potential certifying bodies and accreditation bodies in advance of the release of any new final specification to ensure that there are licensed certifying bodies available to certify applicable products.

My organization certifies products. How can I become a licensed certifying body for WaterSense?

The first step toward becoming a licensed certifying body is to seek accreditation from an EPA-approved accreditation body in accordance with the final WaterSense product certification system for one or more of the WaterSense product specifications. Upon accreditation, please contact the WaterSense Helpline for application procedures and to obtain a copy of the licensing agreement for product certifying bodies.

My organization tests products. How can I participate in the WaterSense product certification process?

WaterSense licenses product certifying bodies, not individual testing facilities or laboratories. Certifying bodies certify products in accordance with ISO/IEC Guide 65, *General requirements for bodies operating product certification systems*, which includes product testing and conducting ongoing surveillance of product conformity. If your organization tests products in accordance with ISO/IEC 17025, *General requirements for the competence of calibration and testing laboratories*, a licensed certifying body may subcontract testing services to you as part of the product certification process. EPA is not involved in this subcontracting arrangement; it must be made between the licensed certifying body and laboratory testing facility.

Under this new certification system, is my irrigation program eligible for certification?

The WaterSense product certification system applies only to the procedures and requirements for product certification. It does not apply to or address programs for the certification of irrigation programs or professionals. Information related to professional certification programs may be found on the WaterSense Web site under Landscape Irrigation Services.

Under this new certification system, is my product eligible for certification and the WaterSense label?

This certification system does not impact which products are eligible for the WaterSense label; this is dictated by the release of final WaterSense product specifications for a particular product or product category. Specifications are developed after careful evaluation of technical and market factors that influence the viability of the WaterSense label for the product. For more information on the specification development process, please visit the Specification Development Process page on the WaterSense Web site. To view the product specifications that the program has released and those product categories that are currently eligible for certification and the WaterSense label, please visit the compendium of WaterSense product specifications.

What kind of accreditation are you offering and how can I get it?

EPA does not offer accreditation. EPA does require its third-party licensed certifying bodies to be accredited to the Water Sense certification system. In order to be eligible for accreditation, your organization must be a product certifying body that meets the minimum requirements as outlined in the WaterSense product certification system. These requirements include operation in accordance with ISO/IEC Guide 65 and International Accreditation Forum (IAF) Guidance on the Application of (ISO/IEC) Guide 65 and the capability and competence to certify products in accordance with one or more of the individual WaterSense product specifications. If your organization meets these minimum requirements, please contact the WaterSense Helpline for application procedures and to obtain a copy of the licensing agreement for product certifying bodies.

High-Efficiency Toilet (HET) Questions

How did EPA set the specification for toilets?

The specification is based on the widely accepted Uniform North American Requirements (UNAR) (PDF) (16 pp, 2.6MB, About PDF) EXIT Disclaimer for tollets and EPA industry and product research, in collaboration with external stakeholders. The EPA specification sets the water use level at 1.28 gallons per flush or less, includes design requirements, and has a higher requirement for flush performance to ensure optimal user satisfaction.

How was UNAR developed?

Uniform North American Requirements (UNAR) were developed by a collaboration of water utilities to establish a standard for toilets in rebate programs that would perform to customer expectations, save water and maintain water savings over the long term.

What percentage of toilets currently qualify under the specification?

The most recent list of toilets in the market shows approximately 249 models. There are currently more than 100 models, or about 40 percent, that might meet the HET specification.

How does the specification ensure that these toilets will perform as expected?

The specification includes a performance requirement. A collaboration of U.S. and Canadian water utilities developed a flush performance test protocol called the Maximum Performance (MaP) test EXIT Disclaimer to provide a uniform measure of toilet performance. Requirements for this test protocol have been included in the HET specification.

How will EPA verify the testing?

Products will be independently certified by a third party to confirm that the product meets EPA criteria for efficiency and performance.

Are toilets that meet the WaterSense specification more expensive than other toilets?

No. MaP testing results have shown no correlation between price and performance. Prices for toilets can range from less than $100 to more than $1,000. Much of the variability in price is due to style, not functional design. Toilets that could potentially bear the WaterSense label are currently in the low to middle range of about $200. There is a lot of competitive pressure on manufacturers to lower prices; therefore, it can be expected that as more toilets become certified, the average price should fall.

Will the installation of HETs lead to drainline and sewer problems due to the reduced water flows?

Since the introduction of the 1.6 gallons per flush toilet in the early 1990s, questions have been raised about whether sufficient water exists to move solid wastes in the building drainlines and in the municipal sewer system. To date, there has been no evidence to show that waste transport problems occur because of the use of the original low-flow toilets. The introduction of HETs in the late 1990s precipitated the same concerns. As a result, a collaboration of water utilities sponsored a full laboratory study to address the

issue. The drainline study, completed in 2004, concluded that HETs flushing with as little as 1 gallon provide sufficient water in residential applications to move the waste from the fixtures to the sewer.

With regard to municipal sewer lines, the transport of waste has not proven to be an issue of concern in those areas with a concentration of high-efficiency toilets. Supplementary wastewater flows from other end-uses are always sufficient to move solids through the system. Furthermore, some wastewater utilities are co-funding and sponsoring the toilet replacement programs and other water efficiency initiatives of the water utilities for the very purpose of reducing sewer flows to their treatment plants.

High-Efficiency Bathroom Sink Faucet Questions

How was the final specification for high-efficiency faucets developed?

All WaterSense specifications are developed through a market research, technical review and stakeholder input process. In developing the specification, EPA collaborated with interested parties representing industry, water utilities, and water-efficiency advocacy groups. EPA industry and product research, as well the American Society of Mechanical Engineers (ASME) A112.18.1/Canadian Standards Association (CSA) B125.1 standard for Plumbing Supply Fittings, form the basis for the WaterSense bathroom sink faucet specification.

What are the details of the specification?

The WaterSense specification sets the maximum flow rate of faucets and aerators at 1.5 gallons per minute (gpm), tested at a flowing pressure of 60 pounds per square inch (psi, common water pressure in most households). The specification also includes a minimum flow rate of 0.8 gpm, tested at a flowing pressure of 20 psi, to ensure performance across a variety of different household conditions.

Who will certify that products meet the specification?

All WaterSense labeled, high-efficiency bathroom sink faucets and aerators must be tested and certified by an independent, EPA-approved licensed certifying body. Manufacturers can use the WaterSense label in conjunction with faucets and aerators that are certified by licensed product certifying bodies to conform to WaterSense criteria for both performance and efficiency. Only faucets and aerators that are certified through this process can bear the WaterSense label.

What types of products can earn the WaterSense label under this specification?

Provided the products meet the WaterSense specification, bathroom sink faucets and aerators (or other faucet accessories, such as laminar flow devices) can be certified to meet EPA criteria and labeled under this specification. This specification applies to bathroom sink faucets or aerators intended for private use, such as in residences or in private restrooms in hotels and hospitals.

Faucets that are not eligible to earn the WaterSense label under this specification include metering faucets (those that dispense a pre-determined volume of water or operate in the "on" position for a pre-determined period of time); bathroom sink faucets intended for public use (those found in office buildings, restaurants, airports, and stadium restrooms, etc.); and residential kitchen sink faucets.

What is a faucet accessory?

A faucet accessory is a device that can be added to or removed from a bathroom sink faucet (typically, it screws onto the tip of the faucet spout).

Aerators control flow rate either through flow restriction (narrowing the opening through which the water is discharged from the faucet) or flow regulation (adapting the width of the opening through which the water is discharged from the faucet based upon fluctuations in water pressure to maintain a constant flow rate).

Are bathroom sink faucets that meet the WaterSense specification more expensive than other bathroom sink faucets?

Consumers can purchase WaterSense labeled aerators separately from bathroom sink faucets, and can easily replace existing accessories that do not meet the WaterSense specification.

Aerators can be purchased at retail locations and typically cost only a few dollars. Most high-efficiency faucet accessories that restrict flow are no more expensive that their conventional counterparts. However, pressure compensating faucet accessories that are designed to provide and maintain a constant flow rate despite fluctuations in water pressure typically cost a few dollars more.

If WaterSense labeled aerators are so easy to install, what would prevent their removal?

The water efficiency benefits of aerators, in addition to their low cost and relative ease of installation, outweigh the risk of their removal. Aerators typically cost no more than a few dollars, and using WaterSense labeled faucets or aerators could reduce a household's faucet water use by more than 500 gallons annually.

Additionally, performance is a major component of all WaterSense specifications. The faucet specification accounts for user satisfaction in different situations, including low water pressure, so removal should not be a major issue.

Flushing Urinals Questions

What is the new WaterSense specification?

The new WaterSense specification applies to flushing urinals. Flushing urinals that meet the final WaterSense specification will use no more than 0.5 gallons per flush (gpf). This is one half of the 1.0 gallon per flush (gpf) federal standard for urinals set by the Energy Policy Act of 1992. Of the 12 million urinals currently in use in the United States, up to 65% are inefficient units with flush volumes exceeding the 1.0 gpf federal standard, some by as much as 3.0 gpf. On average, a urinal gets flushed about 20 times a day; therefore a business will save 4,000 gallons or more per year for every WaterSense labeled urinal it installs.

How was the final specification for high-efficiency flushing urinals developed?

All WaterSense specifications are developed through a process that includes market research, technical review, and stakeholder input. In developing the specification, EPA collaborated with interested parties representing industry, water utilities, and water-efficiency advocacy groups. EPA industry and product research, as well nationally recognized performance standards developed by the American Society of Mechanical Engineers (ASME), the Canadian Standards Association (CSA), the International Association of Plumbing and Mechanical Officials (IAPMO), and the American Society of Sanitary Engineering (ASSE), form the basis for the WaterSense flushing urinal specification. These standards include:

- ASME A112.19.2/CSA B45.1 *Ceramic Plumbing Fixtures*
- ASME A112.19.3/CSA B45.4 *Stainless Steel Plumbing Fixtures*
- IAPMO Z124.9 *Plastic Urinal Fixtures*
- ASSE #1037 *Performance Requirements for Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures*

What types of products can earn the WaterSense label under this specification?

All flushing urinals—meaning those that use water to convey liquid waste through a trap seal into a gravity drainage system—can earn the WaterSense label. This includes both the urinal fixture, which can be made of ceramic (vitreous china), plastic, or stainless steel, and the pressurized (flushometer valve) or gravity tank-type flushing device.

Non-water urinals, composting urinals, and retrofit devices or other aftermarket retrofit systems are not included in the scope of this specification and cannot earn the WaterSense label at this time.

Why are non-water urinals not included in this specification?

Non-water urinals, although often very similar in appearance to flushing urinals, are different in their design, components, and functionality (i.e., how they remove waste). In addition, non-water urinals are subject to significantly different performance standards than flushing urinals. These standards are designed to ensure a high level of performance for non-water urinals, and WaterSense has no basis to propose improvements to these existing standards at this time. As a result, WaterSense has no means to help purchasers distinguish among these products based on either their efficiency or performance.

Although the specification does not apply to non-water urinals, it is not WaterSense's intention to preclude or prevent their use in water efficiency, green building, or other conservation programs. Non-water urinals continue to be compatible with and a key component of, the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) and other green building programs. WaterSense encourages designers, program administrators, and facility managers to consider *all* available technologies when making purchasing decisions concerning water-using products, including non-water urinals. The specification and WaterSense label are simply one of many tools available to help consumers make informed purchasing decisions. If decision-makers decide to specify and install water-using urinals, then WaterSense encourages them to choose products with the WaterSense label.

What are the details of the specification?

The WaterSense specification sets the maximum flush volume for flushing urinals at 0.5 gallons per flush (gpf), when tested in accordance with national performance standards (i.e., ASME A112.19.2/CSA B45.1 [ceramic urinals], ASME A112.19.3/CSA B45.4 [stainless steel urinals], IAPMO Z124.9 [plastic urinals], ASSE #1037 [pressurized flushing devices]). The specification also includes three requirements to ensure the long-term performance and water savings of these high-efficiency devices. These are:

- The primary actuator must be a non-hold-open design to limit the amount of water released per flush, regardless of how long the actuator is held opened.

- The device's flush volume can be adjustable, but only to within ± 0.1 gpf of its rated flush volume. This will allow for field adjustments that may be necessary depending on building water pressure or other onsite conditions.
- The device should be designed to prohibit the interchangeability of replaceable or maintainable parts with parts that would cause it to exceed its rated flush volume.

Who will certify that products meet the specification?

All WaterSense labeled flushing urinals must be tested and certified by an independent, EPA-licensed certifying body. Manufacturers can use the WaterSense label to identify flushing urinal fixtures and/or flushing devices that are certified to conform to WaterSense criteria for both performance and efficiency. Only products certified through this process can bear the WaterSense label.

If flushing devices and urinal fixtures are labeled and sold separately, how will purchasers know which components should be used together to ensure water efficiency and performance?

EPA will maintain a registry of WaterSense labeled products that are certified and labeled in accordance with the flushing urinal specification. Within this registry, EPA will provide tools that will help purchasers identify flushing devices and urinal fixtures that have the same rated flush volume in order to ensure that the complete system meets the requirements of this specification for water efficiency and performance. In addition, EPA requires manufacturers to supply similar information in their product documentation to facilitate matching of parts that, when used together, will meet the requirements of the specification.

Are urinals that meet the WaterSense specification more expensive than other urinals?

No. Our product research has found that high-efficiency urinal fixtures and flushing devices are no more expensive than their standard (1.0 gpf) counterparts. The average price of a new high-efficiency or standard urinal fixture is about $350 and the average cost for a high-efficiency or standard pressurized flushing device (flushometer valve) is approximately $200. Because there is very little to no cost difference between high-efficiency flushing urinals and standard flushing urinals, installing high-efficiency models in new construction or as part of the natural replacement process is cost-effective with immediate payback in water cost savings.

How much water will a WaterSense labeled flushing urinal save the average facility?

Replacing an older, inefficient 1.5 gpf flushing urinal with a 0.5 gpf WaterSense labeled flushing urinal can save as much as 4,600 gallons of water per year. This assumes that the average urinal is flushed approximately 18 times per day and is in use 260 days per year. Replacing that same older urinal with a WaterSense labeled flushing urinal with a 0.25 or 0.125 gpf flush volume could save more than 5,800 and 6,400 gallons of water per year per urinal, respectively.

WaterSense Labeled New Homes Questions

Why label new homes?

Residential water use accounts for more than half of the publicly supplied water in the United States. With more than one million new homes now built each year in this country, EPA recognized a tremendous opportunity to promote water efficiency in the new housing sector while creating livable communities that help families save resources for the future.

How did EPA develop the WaterSense Single-Family New Home Specification?

WaterSense spent more than three years working with hundreds of builders, utilities, trade associations, manufacturers, landscape and irrigation professionals, and certification providers to develop efficiency and performance criteria for water-efficient new homes. EPA drafted two versions of the specification for public comment, developed a certification system, and conducted dozens of meetings with key stakeholders before it finalized the specification.

What is included in the specification?

In order to earn the label, homes must feature WaterSense labeled plumbing fixtures, efficient hot water delivery systems, and yards designed with water savings in mind. If they are included with the home, clothes washers and dishwashers must be ENERGY STAR® qualified models, and irrigation systems, if incorporated, must be designed or installed and audited by WaterSense irrigation partners.

How much will a WaterSense labeled new home save?

WaterSense labeled homes should save homeowners at least 10,000 gallons of water per year, enough to fill a backyard swimming pool. But the savings don't stop there. Because these homes also realize energy efficiency from heating less water, they save enough energy each year to power a television for four years. Combined, these savings help homeowners reduce their utility bills by at least $100 to $200 per year.

Does a WaterSense labeled new home cost more to build/own?

As is the case with other green building certification programs, EPA estimates some additional costs to builders to ensure their new homes meet the specification. With the utility savings homeowners realize from using less energy and water, any additional costs could pay for themselves in as little as six years.

What about the quality of WaterSense labeled new homes?

Just as products are required to be tested and certified by an independent third party before they can earn the WaterSense label, WaterSense labeled new homes must be inspected and certified by a licensed certification provider to ensure that they meet EPA's criteria for efficiency and performance. WaterSense labeled homes mean getting and doing more with less water, so you can expect all the comforts of a new home *and* save water.

Why did EPA include a landscaping requirement?

On average, American homes use 30 percent of their water outdoors, but that number can be as high as 50 to 70 percent in drier regions of the country. The front yards (and back, if installed by builders) of WaterSense labeled new homes will use less water while providing curb appeal and low maintenance. EPA offers two options for builders to meet the landscaping requirement: using a "water budget" tool to determine a mix of regionally-appropriate plantings based on the climate and watering requirements of the region, or a set percentage of turfgrass, which often receives more water than a mix of local, drought-tolerant plants.

Who can participate in the program?

Home builders and their trade associations can join as WaterSense partners and commit to building homes to the specification. Home efficiency raters can serve as inspectors, green building organizations can serve as program administrators, and certification organizations are approved to become EPA licensed certification providers.

How will homeowners know their homes have earned the WaterSense label?

Builder partners provide homeowners of WaterSense labeled new homes with a certificate signed and dated by the inspector and the licensed certification provider indicating that the home meets EPA's criteria for efficiency and performance. Homeowners will also receive a manual from the builder that identifies all of the water-efficient features of the home, based on a template EPA provides to its builder partners.

How can I find a WaterSense builder partner?

Builders and licensed certification providers who partner with WaterSense are listed on the Meet Our Partners page.

Why did EPA limit the size and type of homes that can earn the label? Are homes three stories high with an underground basement eligible?

EPA limited the size of homes eligible for the WaterSense label in order to be consistent with homes built to the International Residential Code. The "three stories" limit applies to above-grade stories, so a home with three stories above ground and one story below ground would be eligible.

What about existing homes?

While this specification is currently only for single-family new homes of three stories or less, WaterSense encourages consumers interested becoming more energy- and water-efficient to look for WaterSense labeled plumbing fixtures and other efficient appliances when renovating their homes. A complete water-efficiency makeover can save a home as much as $170 per year in utility costs.

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1) Current Water Supply Planning in East Central Illinois

The Mahomet Aquifer Consortium (MAC) is a consortium dedicated to the long term viability of the Mahomet aquifer in central Illinois. The mission of MAC is "to further study the Mahomet aquifer system, the river basins and surface waters located in the 15-county regional water supply planning area and to develop and recommend options for the planning and management of these valuable public resources." (1)

During 2006-2009, MAC provided guidance to the three-year regional water supply planning process for the East-Central Illinois region, with grant funding from the IDNR/OWR. MAC designated a Regional Water Supply Planning Committee to oversee development of water demand scenarios for the region through 2050. MAC continues its efforts to influence and support water supply planning and management in East Central Illinois.

In June, 2009, MAC and the designated Regional Water Supply Planning Committee (RWSPC) collaboratively issued: "A Plan to Improve the Planning and Management of Water Supplies in East-Central Illinois." (2) The plan contains a framework for action and action items, and reviews the recent history of water supply planning and management in East-Central Illinois in its Appendix 2. (This review of recent history is provided as Part 2 of this Appendix D.)

In 2011, the Illinois State Water Survey issued Contract Report 2011-08, "Meeting East-Central Illinois Water Needs to 2050: Potential Impacts on the Mahomet Aquifer and Surface Reservoirs." (3) The report examines the impact of current and selected projected future water demands on streams and aquifers in East-Central Illinois through the use of computer-based models. The report states that none of the current groundwater users in the Mahomet Aquifer could be considered "at risk" for a future water shortage under three demand scenarios; however that hydraulic conditions vary across the aquifer and that impacts to private wells may not be acceptable under some circumstances. The communities of Bloomington, Danville, Decatur and Springfield rely on surface water reservoirs; and the report states that drought preparation through water conservation measures could reduce the probability of water shortages in these communities, but not to the extent where the overall drought vulnerability classification for any of these communities would be changed.

2) Excerpt containing Appendix 2 of A Plan to Improve the Planning and Management of Water Supplies in East-Central Illinois

This excerpt begins on the following page.

Appendix 2

An Overview of Water Supply Planning and Management Relevant to East-Central Illinois

Contents

Introduction

Water supply planning is not new in Illinois. Although a constituent-based, regional water supply planning approach is new to most of Illinois, other states already have adopted this approach. This chapter provides, in chronological order, historical information on water supply planning and management in Illinois relevant to East-Central Illinois.

Early planning efforts

Water supply planning has long been characterized by a complex interplay among federal, state and local interests and authorities supported by scientific and engineering studies.

In Illinois, most water supply planning and management has been conducted in piecemeal manner at the local level. There are a few exceptions. Upon completion of the Chicago Sanitary and Ship Canal in 1900 the Chicago River was reversed, thus enabling the diversion of water from Lake Michigan. The water permitted to be diverted from Lake Michigan and its watershed is apportioned by the State of Illinois among municipalities, political subdivisions and agencies in the region for domestic use or for direct diversion into the Sanitary and Ship Canal to maintain it in a reasonably satisfactory sanitary condition, in such manner and amounts and by and through such instrumentalities as the state may deem proper, subject to any regulations imposed by Congress, in the interests of navigation or pollution control[1].

Historically, groundwater and surface water have to a large extent been managed separately, despite being interconnected.

As long ago as 1920, Illinois State Water Survey Chief Arthur M. Buswell proposed a comprehensive survey of the volume of groundwater available in Illinois. Twelve years later, Buswell broadened his proposal to include all the state's water resources and to estimate future demand. Although this project was included in the budget requests for several years, it was not funded[2].

Studies by Illinois State Geological Survey scientists and engineers, such as the work of Horberg in the 1940s and 1950s[3,4], provide a foundation for our current understanding of the glacial geology of the Mahomet Aquifer system in East-Central Illinois [i.e., the Mahomet Aquifer and overlying shallow aquifers within the boundary of the Mahomet Bedrock Valley]. In recent years, the Illinois State Water Survey has integrated geology, hydrology and climatology to provide a comprehensive framework for regional water supply planning. At both the Illinois State Water Survey and Illinois State Geological Survey the development and application of mathematical computer models has enabled the integration of the knowledge base in these disciplines and the simulation of possible future environmental conditions.

Institutional and legal changes to manage water supplies also have occurred. In 1948 The Association of Illinois Soil and Water Conservation Districts was formed. It is made up and serves Illinois' 98 Soil and Water Conservation Districts (SWCDs). Each SWCD is a unique local governmental entity mandated by state statute to protect the land, water and related resources located within its borders. Emphasis is on local control and local solutions[5].

The Water Authorities Act of 1951 allowed the establishment of water authorities with broad powers of control over local water supplies, excluding water used for agricultural and most domestic purposes[6]. The powers include the following requirements: the provision by well owners of data and information on water supply, withdrawals and use; the registration of withdrawal facilities; the permitting of withdrawals; the reasonable regulation of water use; the levy and collection of a general property tax; and approval of water facility plans by the Environmental Protection Agency. Today, there are 17 Water Authorities in Illinois, including 13 in East-Central Illinois.

Late 19th century legislation created extensive changes in local landscapes and initiated the organization of many local governmental units managing surface water drainage improvements.

> "These units have their beginnings in the Levee Act and the Farm Drainage Act which became law in 1879 and provided for the construction, reparation and protection of drains, ditches and levees, across the lands of others, for agriculture, sanitary and mining purposes, and to provide for the organization of drainage districts. As the need became more evident, more Acts providing for Sanitary Districts, Surface Water Protection Districts, River Conservancy Districts, Soil Conservation Districts and Public Water Districts were passed by the Illinois legislature. The Act closest in area of jurisdiction to the Water Authorities Act is the Public Water Districts Act of July 25, 1945 which provides areas having a population of not more than 500,000 inhabitants with powers to construct or acquire "Water works properties," and by amendment of July 16, 1951, "sewerage properties" "[7].

The establishment of water authorities and communities taking their own actions to control development near their water supply facilities are reflections of local efforts to protect local interests. A goal of regional water supply planning is to facilitate communication and cooperative management among all local interests for a common good, not to usurp local powers and authorities.

The 1967 state water plan

Recognizing a need for a state water plan, Governor Otto Kerner in 1965 designated Water Survey Chief William C. Ackermann as director of a task force to formulate a comprehensive state plan for water resources[2]. A state water plan was released in 1967[8] and included a recommendation for the state to initiate an integrated and intergovernmental approach to the management of water resources of each region, including the establishment and support of regional water resources commissions. This ambitious and costly state water plan was largely a top-down approach driven by state officials.

In the state water plan, 1965 population of the 15-county region of East-Central Illinois population was given as 745,200 with municipal, industrial and rural water withdrawals of 183 mgd. Population in 2020 was projected to be 1,605,000 with a water demand of 453 mgd. The plan identified many potential reservoir sites of 40 acres or more with a total yield of about 212 mgd in a 1 in 40 year drought. Potential water supplies from major streams (with 95 percent availability) were given as 13,640 mgd and potential practical sustained yields of groundwater supplies as 1,135 mgd. About 98 percent of the streamflow sources were in Cass, Mason, Tazewell and Woodford Counties, which also contained 43 percent of the groundwater potential yields. It was concluded that the increased demands to 2020 were generally within the capability of the resource[8].

The 1967 plan provided policy and program guidance in water resources management through state agencies for such matters as groundwater protection, competition for water, erosion and sediment control, flood damage mitigation, water conservation, aquatic and riparian habitat, recreation, climate change, drought and emergency interruption of supplies and water use law. It recommended that the legal framework governing water be designed so as to create a legal environment which would promote, not restrain, optimum water management; otherwise, it apprehended that the legal framework would be the result of discontinuous, piecemeal development based on short-range considerations and crisis planning. A better state water resources planning program also was recommended.

The 1980 state water plan

Recognizing that the 1967 plan had become increasingly obsolete and observing a trend to shift water resources planning from the federal to state level, Governor James R. Thompson appointed a Task Force in 1980 to produce a new state water plan, primarily to develop an improved water management system[9]. The Task Force consisted of policy-level individuals from state water agencies who sought outside advice, conducted public hearings, and organized 5 regional advisory committees. The problems addressed were of statewide importance, but a detailed inventory of water resources was not required.

Since 1980, the Illinois State Water Plan Task Force has coordinated the activities of state agencies and served as a valuable forum for discussion. The Governor's Drought Response Task Force meets as needed to monitor the conditions of the state's water resources and systems and coordinate the state's response to drought situations. Beck *et al.*[10] reported that the State Water Plan Task Force has

identified the lack of statutory authority to take more action to alleviate water shortage problems as the most important weakness of the Drought Response Task Force.

The 1983 Water Use Act

The Water Use Act of 1983[11] brought Illinois under a unified doctrine of common law which covers the development and use of both surface water and groundwater resources. This doctrine is based on the riparian doctrine of reasonable use. Some important aspects of the Water Use Act of 1983 are listed below[10,12].

- Water is a common resource to be shared by all for beneficial use; individuals do not own water rights as they do in some other states.

- The terms "riparian landowner" and "overlying landowner" are considered interchangeable in Illinois water law doctrine.

- All riparian landowners and overlying land owners are entitled to a reasonable use of water in streams and aquifers respectively.

- Reasonable use means the use of water to meet natural wants and a fair share for artificial wants. The key words of this definition are "natural wants" and "artificial wants", which are not defined further in the Act. These terms or words also are not defined or used in any of the leading common law groundwater cases in Illinois. However, it has been reported[13] that these terms were clearly defined in Illinois common law in the 1842 Illinois Supreme Court case of *Evans v. Merriweather.* In a discussion of various common law rules of groundwater rights[10], reference is made to a discussion by Mann *et al*. [13]. In this discussion, the authors summarized the court's definition of natural uses as quenching thirst, for household purposes, and for cattle and other domestic purposes. It specifically excluded water for irrigation and water used for propelling machinery. The authors felt that domestic use was limited to uses of persons living on proprietors land and questioned whether the court meant to include large commercial herds of cattle.

- Wasteful or malicious uses of water are unreasonable.

- The priority uses in times of shortage are natural wants (i.e., domestic uses).

- In the case of a complaint, courts are allowed to consider the relative needs of landowners in order to determine the reasonable artificial uses of water.

- The state does not require registration or permits for allocation of surface water or groundwater withdrawals.

- The lowering of the water table or reduction in water pressure by a groundwater user that reduces or eliminates the use of a neighbor's well is not necessarily unreasonable.

- Seniority in length of use does not increase the right of use.

- The right to transport water for use or sale away from overlying land does not exist without statutory authority.

- The state can encourage but not require effective planning by water supply planners and users.

- There is no general statute in Illinois allowing comprehensive water resource management at the state level.

- Drainage law usually is not included with water quantity law.

- The state does not have statutory authority to intervene in water conflicts between water development entities.

- The General Assembly has authority to modify Illinois water law, but vested interests must be protected. Even under present law, courts in other jurisdictions have determined that the right of the riparian owner is not absolute; it is conditioned on the equal right of every other riparian owner to the use of water[10]. "Thus, if the modifications simply further define and clarify what is considered "reasonable" – an arguably nebulous and uncertain area under present law – persuasive argument can be made that no valid constitutional problems should arise" to the modification of riparian rights[10].

An important component of the Water Use Act is to establish a means of reviewing potential groundwater conflicts before damage to any person is incurred and to establish a rule for mitigating groundwater shortage conflicts. In the event that a land occupier or person proposes to develop a new point of groundwater withdrawal, and withdrawals from the new point can reasonably be expected to occur in excess of 100,000 gallons on any day, the land occupier or person is required to notify the Soil and Water Conservation District before construction of the well begins. The District in turn is required to notify other local units of government with water systems which may be impacted by the proposed withdrawal. The District then is required to review with the assistance of the Illinois State Water Survey and the Illinois State Geological Survey the proposed point of withdrawal's effect upon other users of the water. The findings of such reviews are to be made public. However, this is an unfunded mandate for the Soil and Water Conservation Districts and the Scientific Surveys and reviews are not conducted.

Statutory law and case law, policies, legal opinions, and court decisions guide water management in the state. Management practices are implemented through the state's water management institutions that include public and private entities operating at state, regional and local levels. The policies, regulations, and actions of the management institutions directly and indirectly influence the interface of the demands of water users and the supply of the state's groundwater and surface water resources[10].

Stress on water resources, highlighted by the 1988 drought, led to Governor Jim Edgar's 1992 appointment of a Water Resources and Land Use Priorities Task Force. The Task Force concluded[14] that competition for available water supplies will generate increasing levels of conflict in the context of existing law, especially during droughts. The first recommendation of the Task Force was adoption of a consolidated water resources act, but there was agreement among legislators that sound scientific information on the state's water resources was needed before a comprehensive act could move forward.

A 1996 report on water quantity law[10] – the result of a Task Force recommendation – identified the fractured nature of water use law in Illinois and noted that water quantity law was not comprehensive, was located in numerous areas of the law that divided responsibilities among many state agencies, and was governed to a significant degree by common law and court precedent. It was concluded that elements of the law are outdated, confusing, misinterpreted, or not aligned technically with contemporary water management. The law is fraught with uncertainty and provides users of water with only limited guidance to answering many issues that will likely arise in the future. The authors expressed the opinion that, as demand for water escalates, water users will increasingly look to the courts to resolve disputes.

Entering the 21st century

The Mahomet Aquifer Consortium was formed in November 1998 to further study the Mahomet Aquifer on a regional basis and to develop options for the management of this valuable resource[15]. The Consortium facilitates communication and cooperative management among local interests for a common good, has more than 70 members and the members meet quarterly. Activities to date have focused on further studying the Mahomet Aquifer, but the Mahomet Aquifer Consortium's current role in supporting and facilitating the establishment and work of the Regional Water Supply Planning Committee moves it a step forward in its mission to develop options for the management of the Mahomet Aquifer.

On 6 June 2000, Governor George H. Ryan established a Governor's Water Resources Advisory Committee to focus on water resources and their usage, including water usage by peaker power plants. The Committee met several times, did not produce a report, but identified 12 consensus principles for water supply planning and management.

On 22 April 2002, Governor George H. Ryan signed Executive Order 2002-5 requiring the Interagency Coordinating Committee on Groundwater, chaired by the Illinois Environmental Protection Agency, to report each January on progress in establishing a water quantity planning procedure[16]. Initially, an Interagency Coordinating Committee on Groundwater sub-committee chaired by the Illinois Department of Natural Resources was charged to produce an integrated water resources agenda (groundwater and surface water) and a report assessing the state of water supplies in the state. Building on the consensus principles identified by the Water Resources Advisory Committee, the report of the subcommittee argued that expanded, regional water quantity planning and management is needed to address some of the critical water conflicts emerging in Illinois and recommended an interim framework for establishing regional water management consortia to begin planning[17]. The consensus principles of the Water Resources Advisory Committee can be found on page 10 of the subcommittee's report.

The Interagency Coordinating Committee on Groundwater accepted most of the recommendations of the Subcommittee on Integrated Water Planning and Management and found that the operating principle for water supply planning is simple: the necessary groundwork – including extensive stakeholder involvement – must be developed first, before moving into legislative and regulatory solutions. The Interagency Coordinating Committee on Groundwater and its Groundwater Advisory Committee stated that a new paradigm is essential to get concurrence from constituent groups, including both private and governmental special interest groups and the public, by creating consensus on a planning procedure. Initiating discussion of proposed solutions driven by legislative and regulatory proposals to identify program parameters, without having a defined planning procedure, has proven,

historically, to be an arduous task with unpredictable outcomes. As priority water quantity planning areas are identified, the Interagency Coordinating Committee on Groundwater recommended that the state should nurture the development of voluntary, cooperative regional water management consortia in those areas by providing technical and financial assistance for planning and management efforts[18].

In November 2001, the Illinois State Water Survey and Illinois State Geological Survey produced reports on the scientific needs for improving water supply planning and management[19,20] in response to May 2001 resolutions passed by the General Assembly: Senate Resolution 0137 and House Resolution 0365. In 2006, the Illinois State Water Survey published a framework for drought and water supply planning[21]. In response to the recommendations of the Interagency Coordinating Committee on Groundwater[18] and the Subcommittee on Integrated Water Planning and Management[17], the Illinois State Water Survey identified priority aquifers and watersheds for water supply planning[22]. Two priority areas were Northeastern Illinois and East-Central Illinois. East-Central Illinois was identified as a priority water quantity planning area because of expanding use of the Mahomet Aquifer, the aquifer's connections to shallower aquifers and surface streams, especially the Sangamon River, and proposals to develop new groundwater and surface water supplies.

Functions of water agencies

Today, numerous institutions are involved in some facet of water supply planning and management[23]. Most are government entities, but some are private corporations with which municipalities contract. It is handy to think of them on geographical scales: municipal, regional, state, interstate, and federal.

Municipalities, the smallest entities, have control over local water supplies and waterworks. These either operate as local public agencies or as corporations with which the municipality contracts for water. There are more than 1,800 virtually autonomous community water systems in Illinois, each created under separate statutes that provide them with different and sometimes overlapping and conflicting powers[10].

The Illinois Municipal Code (65 ICLS 5)[24] allows corporate authorities to (1) provide for a supply of water by the boring of artesian wells, or by the digging, construction, or regulation of wells, pumps, cisterns, reservoirs, or waterworks, (2) borrow money for these purposes, (3) authorize any person to bore, dig, construct, and maintain the same for a period not exceeding 30 years, (4) prevent the unnecessary waste of water, (5) prevent the pollution of water, and (6) prevent injuries to the wells, pumps, cisterns, reservoirs, or waterworks. The jurisdiction of the city or village to prevent or punish any pollution or injury to the stream or source of water, or to waterworks, extends as far as the waterworks may extend. Each city or village may go beyond its corporate limits to acquire and hold property for the purpose of establishing and operating water works. In the past, concerns about development of groundwater supplies have caused more than 15 communities in East-Central Illinois to invoke the Illinois Municipal Code to try to control groundwater resources development near their wells and well fields[25].

Regional water entities comprise the next spatial group. Illinois has five types: 1) regional water commissions that serve two or more municipalities, 2) water service districts for unincorporated areas, 3) public water districts, 4) water authorities that mix municipalities and rural areas, and 5) river conservancy districts. The Rend Lake Conservancy District, formed in 1960 and is an example of the

latter type. It led to the construction of Rend Lake in the 1960s and subsequent development of an intercity water system that supplies water to six southern Illinois counties.

The state of Illinois has several agencies that deal with water supplies. The Illinois Department of Natural Resources is the primary water quantity management agency[26]. First formed in 1823, the Office of Water Resources has a long history beginning with flood control and navigation issues that later grew to include regulation of streams and rivers, locks and dams, construction issues, water conservation, the National Flood Insurance Program and more. There are certain public rights in public waters that are reserved for the citizens of the state and the Office of Water Resources issues permits for activities in and adjacent to the public waters of the state – 8 percent of the total stream miles in the state. Public waters generally may be described as the commercially navigable lakes and streams and the backwater areas of those streams. A list of the public waters of the state is provided[27]. Pursuant to the 1911 Rivers, Lakes and Streams Act [615 ILCS 5], proposed activities in and adjacent to public waters are reviewed to ensure that the public's rights are not diminished by the activities. The maintenance of minimum instream flows in public waters is regarded as a benefit to the public and low flows are protected. Permits are issued to demonstrate that proposed activities do not diminish the public's rights; they are not issued to allocate water use. However, this regulation can pose limitations for obtaining water supply from major public rivers, especially during periods of drought. In East-Central Illinois, the Illinois River, the Lower Sangamon River to approximately one mile south of Mechanicsburg Road bridge, and the Sangamon River South Fork to approximately two miles upstream from the mouth are classified as public waters of the state.

Minimum instream flow in public waters generally is defined as the average flow measured during the 7 consecutive days of lowest flow during any given year. The 7-day 10-year low flow (Q7,10) is a statistical estimate of the lowest average flow that would be experienced during a consecutive 7-day period with an average recurrence interval of ten years. Low flow maps for streams in East-Central Illinois have been published by the Illinois State Water Survey[28]. The Q7,10 protected flow is considered an interim surrogate value where there is insufficient information to define instream flow needs.

The Q7,10 values are affected by natural climate variability, withdrawals, return flows, and streamflow regulation. Because the Q7,10 values can change over time, they are updated approximately every 15 years to account for changes in low flow conditions. Over the past several decades, average streamflow amounts and low flows have increased due to an increase in precipitation; but the first half of the 19th Century was much drier and streamflows were lower (Appendix 1). If such historical dry conditions recur in the future, it could be questioned whether low flows established for a recent 10-year wet period would continue to be appropriate for water resources management. Low flows are expected to increase in streams that receive substantial increases in wastewater discharges.

The Illinois Environmental Protection Agency ensures that (1) Illinois' rivers, streams and lakes will support all uses for which they are designated, including protection of aquatic life, recreation and drinking water supplies, (2) every Illinois Public Water system will provide water that is consistently safe to drink, and (3) Illinois' groundwater resource is protected for designated drinking water and other beneficial uses[29].

The Agency conducts a groundwater protection program with a mission of restoring, protecting and enhancing the state's groundwater as a natural and public resource[30]. The program derives much of its program authority from the Illinois Groundwater Protection Act that emphasizes a prevention-oriented

process and relies on a state and local partnerships. The program focuses upon uses of the resource and establishes statewide protection measures directed toward potable water wells[31].

Integration of wellhead protection programs are implemented for community water supply wells in priority groundwater protection planning regions. In general, the first step of developing a groundwater protection program involves determining the recharge area for the wells in unconfined aquifers utilizing existing aquifer property data. The recharge area is based on a five-year time of travel delineation. The second step involves determining the potential sources, potential routes, and the land use zoning within these recharge areas. The Central Groundwater Protection Planning Region includes Peoria, Tazewell, Woodford and Mason Counties[32].

The Illinois Environmental Protection Agency implements permit programs to regulate wastewater discharges and stormwater runoff to Illinois streams and lakes, including storm water runoff. Permits can also provide the facility owner with an approval of the treatment systems about to be built[33]. The Agency also is responsible for monitoring the quality of Illinois' surface water resources[34] and implements watershed management programs[35]. A list of impaired waters has been produced[36] and reports on total maximum daily loads of specified pollutants have been prepared for lakes, streams and watersheds in East-Central Illinois[37]. A total maximum daily load evaluation determines the greatest amount of a given pollutant that a water body can receive without violating water quality standards and designated uses. Pollution reduction goals then are set to improve the quality of impaired waters. Low flows are used in the application of water quality standards.

The Illinois State Water Survey[38] and the Illinois State Geological Survey[39], divisions within the University of Illinois at Urbana-Champaign, collect data and conduct research, as do several other academic institutions.

Under the 1970 Environmental Protection Act, the Illinois Pollution Control Board is responsible for adopting Illinois' environmental regulations and deciding contested environmental cases[40]. The Illinois Environmental Protection Act, under Title IV, indicates that there should be continuous operation and maintenance of public water supply installations in order to protect the public from disease and to assure an adequate supply of pure water for all beneficial uses. This concept is carried forward in the Pollution Control Board Rules, in particular 601.101. This could be interpreted as a 100 percent dependability standard.

The Illinois Department of Agriculture[41] implements the Cooperative Groundwater Protection Program (8 Illinois Administrative Code 257) that establishes a potable water supply well setback zone for a community water supply well. The Department also distributes funds to Illinois' 98 Soil and Water Conservation Districts for programs aimed at reducing soil loss and protecting water quality. It also helps to organize the state's annual soil survey to track progress toward the goal of reducing soil loss on Illinois cropland to tolerable levels.

A major consideration in constructing new wells is to prevent contamination from entering the well. To ensure the safety of these water supplies, the Illinois Department of Public Health[42] and local health departments review water well installation plans, issue permits for new well construction and inspect wells, and deal with the sealing of abandoned wells. The Department also oversees construction and operation of non-community public water systems to make sure water is safe to drink and use.

The Illinois Commerce Commission[43] regulates 33 water, 5 sewer, and 14 investor-owned, combination water and sewer utilities that provide water service to almost 1.15 million people. The Commission also provides comparisons of water and sewer rates.

Interstate compacts comprise the next spatial level of institutions. Illinois is a member of compacts with Missouri, Indiana, the Great Lakes states, and Ohio River states, and these groups deal with regional water issues.

Beck *et al.*[10] discuss federal control of water in Illinois. At least six federal agencies have powers and activities affecting the water supply of Illinois. These include the U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, and the Departments of the Interior, Agriculture, Commerce, and Housing and Urban Development. Many of these institutions interact directly with Illinois state agencies. The U.S. Supreme Court also makes decisions relating to the use and allocation of water supplies. In 1992, the Federal Energy Policy Act[44] established national water efficiency requirements on new and renovated residential and non-residential facilities.

Conclusions

The all-embracing nature of the water cycle and the wide-ranging characteristics of aquifers and watersheds necessitate consideration of time and space scales that are long and broad. Regional water supply planning and management provides an opportunity for all constituents in East-Central Illinois to improve communication and coordination in identifying and addressing issues that transcend local, short-term interests and authorities, but does not detract from these authorities.

Executive Order 2006-01[45] embodies many lessons learned from earlier initiatives in Illinois. In implementing the Executive Order, the Illinois Department of Natural Resources, Illinois State Water Survey, Illinois State Geological Survey and the Regional Water Supply Planning Committee are drawing on lessons learned from other states that have well-established regional water quantity planning procedures, especially from Texas. Texas has a comprehensive, regionalized, stakeholder-to-state-bureau management system coordinating the planning of its many different and variously stressed regions.

Executive Order 2006-01 can be viewed as a continuation of a 50-year trend towards improved water supply planning and management in Illinois. The Foreword to the 1967 State Water Plan[9] began with the assertive statement that “Illinois must plan the long-range development of its water resources, if the state is to meet the needs of the future.” Forty years later this challenge remains.

It is clear from the long history of local action and management in Illinois that the success of any future effort to organize the management of water resources must include the provision of responsible roles for all stakeholders.

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Appendix D Notes

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Constitution of the State of Illinois
ARTICLE VII, LOCAL GOVERNMENT

Excerpt of Article VII, consisting of Sections 6-8
Source: http://www.ilga.gov/commission/lrb/con7.htm

SECTION 6. POWERS OF HOME RULE UNITS

(a) A County which has a chief executive officer elected by the electors of the county and any municipality which has a population of more than 25,000 are home rule units. Other municipalities may elect by referendum to become home rule units. Except as limited by this Section, a home rule unit may exercise any power and perform any function pertaining to its government and affairs including, but not limited to, the power to regulate for the protection of the public health, safety, morals and welfare; to license; to tax; and to incur debt.

(b) A home rule unit by referendum may elect not to be a home rule unit.

(c) If a home rule county ordinance conflicts with an ordinance of a municipality, the municipal ordinance shall prevail within its jurisdiction.

(d) A home rule unit does not have the power (1) to incur debt payable from ad valorem property tax receipts maturing more than 40 years from the time it is incurred or (2) to define and provide for the punishment of a felony.

(e) A home rule unit shall have only the power that the General Assembly may provide by law (1) to punish by imprisonment for more than six months or (2) to license for revenue or impose taxes upon or measured by income or earnings or upon occupations.

(f) A home rule unit shall have the power subject to approval by referendum to adopt, alter or repeal a form of government provided by law, except that the form of government of Cook County shall be subject to the provisions of Section 3 of this Article. A home rule municipality shall have the power to provide for its officers, their manner of selection and terms of office only as approved by referendum or as otherwise authorized by law. A home rule county shall have the power to provide for its officers, their manner of selection and terms of office in the manner set forth in Section 4 of this Article.

(g) The General Assembly by a law approved by the vote of three-fifths of the members elected to each house may deny or limit the power to tax and any other power or function of a home rule unit not exercised or performed by the State other than a power or function specified in subsection (l) of this section.

(h) The General Assembly may provide specifically by law for the exclusive exercise by the State of any power or function of a home rule unit other than a taxing power or a power or function specified in subsection (l) of this Section.

(i) Home rule units may exercise and perform concurrently with the State any power or function of a home rule unit to the extent that the General Assembly by law does not specifically limit the concurrent exercise or specifically declare the State's exercise to be exclusive.

(j) The General Assembly may limit by law the amount of debt which home rule counties may incur and may limit by law approved by three-fifths of the members elected to each house the amount of debt, other than debt payable from ad valorem property tax receipts, which home rule municipalities may incur.

(k) The General Assembly may limit by law the amount and require referendum approval of debt to be incurred by home rule municipalities, payable from ad valorem property tax receipts, only in excess of the following percentages of the assessed value of its taxable property:

(continued)

SECTION 6. POWERS OF HOME RULE UNITS (continued)

(1) if its population is 500,000 or more, an aggregate of three percent; (2) if its population is more than 25,000 and less than 500,000, an aggregate of one percent; and (3) if its population is 25,000 or less, an aggregate of one-half percent. Indebtedness which is outstanding on the effective date of this Constitution or which is thereafter approved by referendum or assumed from another unit of local government shall not be included in the foregoing percentage amounts.

(l) The General Assembly may not deny or limit the power of home rule units (1) to make local improvements by special assessment and to exercise this power jointly with other counties and municipalities, and other classes of units of local government having that power on the effective date of this Constitution unless that power is subsequently denied by law to any such other units of local government or (2) to levy or impose additional taxes upon areas within their boundaries in the manner provided by law for the provision of special services to those areas and for the payment of debt incurred in order to provide those special services.

(m) Powers and functions of home rule units shall be construed liberally.

(Source: Illinois Constitution.)

SECTION 7. COUNTIES AND MUNICIPALITIES OTHER THAN HOME RULE UNITS

Counties and municipalities which are not home rule units shall have only powers granted to them by law and the powers (1) to make local improvements by special assessment and to exercise this power jointly with other counties and municipalities, and other classes of units of local government having that power on the effective date of this Constitution unless that power is subsequently denied by law to any such other units of local government; (2) by referendum, to adopt, alter or repeal their forms of government provided by law; (3) in the case of municipalities, to provide by referendum for their officers, manner of selection and terms of office; (4) in the case of counties, to provide for their officers, manner of selection and terms of office as provided in Section 4 of this Article; (5) to incur debt except as limited by law and except that debt payable from ad valorem property tax receipts shall mature within 40 years from the time it is incurred; and (6) to levy or impose additional taxes upon areas within their boundaries in the manner provided by law for the provision of special services to those areas and for the payment of debt incurred in order to provide those special services.

(Source: Illinois Constitution.)

SECTION 8. POWERS AND OFFICERS OF SCHOOL DISTRICTS AND UNITS OF LOCAL GOVERNMENT OTHER THAN COUNTIES AND MUNICIPALITIES

Townships, school districts, special districts and units, designated by law as units of local government, which exercise limited governmental powers or powers in respect to limited governmental subjects shall have only powers granted by law. No law shall grant the power (1) to any of the foregoing units to incur debt payable from ad valorem property tax receipts maturing more than 40 years from the time it is incurred, or (2) to make improvements by special assessments to any of the foregoing classes of units which do not have that power on the effective date of this Constitution. The General Assembly shall provide by law for the selection of officers of the foregoing units, but the officers shall not be appointed by any person in the Judicial Branch.

(Source: Illinois Constitution.)

Drought and Drought Response Introduction

The word “drought” is a relative term, and is defined differently by different regions and sources. Webster’s Dictionary defines drought as “a long period of no rain”; though this is an inadequate definition for the water supply industry. Wikipedia describes drought in stages and effects: “As a drought persists, the conditions surrounding it gradually worsen and its impact on the local population gradually increases. Droughts go through three stages before their ultimate cessation.

1. Meteorological drought is brought about when there is a prolonged period with less than average precipitation. Meteorological drought usually precedes the other kinds of drought.
2. Agricultural droughts are droughts that affect crop production or the ecology of the range. This condition can also arise independently from any change in precipitation levels when soil conditions and erosion triggered by poorly planned agricultural endeavors cause a shortfall in water available to the crops. However, in a traditional drought, it is caused by an extended period of below average precipitation.
3. Hydrological drought is brought about when the water reserves available in sources such as aquifers, lakes and reservoirs falls below the statistical average. Like an agricultural drought, this can be triggered by more than just a loss of rainfall.”

Defining Drought

As used in the water industry, "drought" is a subjective and relative term. In most of the arid regions of Western states, seven months of no rainfall (March through October) would not be labeled as a drought. In the Midwestern states, as few as seven weeks without rain could be considered a drought. Similarly, an annual rainfall of 25 inches would be considered a wet year in Mesa Arizona; and considered a severe drought in Waterloo Illinois. In addition, the water supply of many western states is more dependent on snowfall in mountain ranges located hundreds of miles away, than the local rainfall. Drought conditions and appropriate response is specific to a region and the local conditions. Below are a few examples of different drought definitions used in different locations.

South Carolina Department of Natural Resources (official state web site):

> “*Drought is a period of time with less-than-normal rainfall. No region, including South Carolina, is immune to the possibility of drought. Droughts are naturally occurring events. It is often difficult to determine when a drought has begun or ended. The seriousness of a drought depends upon geographic location, weather patterns, soils, water use patterns, and overall water quantity. The greater the demands placed on an area's water resources, the more serious the drought. Recovery from drought may take months or sometimes years of above average precipitation. There are different kinds of drought. A meteorological drought occurs when precipitation consistently falls short of average levels for periods of months or years. A hydrological drought occurs when the amount of water needed by crops for growth exceeds the amount available in the soil.*”

California Department of Water Resources, Urban Drought Guidebook:

"In the most general sense, drought is a deficiency of precipitation over an extended period of time, resulting in a water shortage for some activity, group, or environmental sector. Whatever the definition, it is clear that drought cannot be viewed solely as a physical phenomenon. A water shortage occurs when supply is reduced to a level that cannot support existing demands. Natural forces, system component failure or interruption, or regulatory actions may cause these water shortages. Such conditions could last two to three months or extend over many years."

City of Phoenix Arizona (official city web site):

"Though definitions vary, drought is generally interpreted as a set of complex physical and sociological influences over a large geographical area. It is not a distinct event, such as a hurricane, a fire, or a flood, but a combination of many coincidental factors working together over a period of time. In simple terms, a drought occurs when water supplies cannot meet established demands for a period of time that cannot be defined.

In its broadest sense, drought can be caused by seasonal or multi-year weather conditions, a curtailment of delivery from raw water suppliers because of water quantity or quality problems, a supply deficiency due to water supply system structural failure, or any of a number of natural or man-made situations. A supply insufficiency occurs when the water available in an area is not sufficient to meet immediate unrestricted demand. While drought is usually systemic and regional in nature and of indeterminable length, a supply insufficiency may be system-wide or very localized, can be of relatively short duration, and may be caused by unforeseen increases in water demand or failure of a localized part of the storage or delivery system to provide a sufficient unrestricted supply of water."

To most water suppliers, a drought is defined as much by the demand for the water as by the availability of water. Rainfall or lack thereof is no longer the sole factor is declaring a drought. Some droughts are caused by unusual demand increases even when the water supply is at normal levels such as: hot dry summers causing increased irrigation needs. Whatever the reasons for the drought, the water supplier must take action to mitigate the effects of the water shortage and assure a reliable water supply is available to meet the health and safety needs of the community.

"And it never failed that during the dry years the people forgot about the rich years, and during the wet years they lost all memory of the dry years. It was always that way."
- John Steinbeck, East of Eden

Drought Response

When drought occurs, the water supplier and community must take action to reduce the demand for water. While increasing water supplies would be of benefit, most such remedies require more than 5 years to plan and construct new reservoirs, canals, and/or groundwater sources. Reducing water demand can result in significant positive effects within only a few days. A drought response plan can be implemented where good pre-planning has already laid the groundwork for actions.

It is important to prepare a drought response plan before a drought occurs. This allows time for the plan to receive public review and comment while not in a crisis mode. Contingency planning before a shortage allows selection of appropriate responses consistent with the varying severity of shortages. Most water utilities and communities define different stages (severity) of drought, and appropriate action for each stage. Public outreach and education programs should be prepared in advance, with printed materials readily available for distribution.

Voluntary action from water users can result in up to 25% water use reduction for short periods of time. Mandatory restrictions have resulted in as much as a 40% reduction of water use. This savings effect is directly related to: a) the public's belief that the emergency is real; b) the public clearly understands the actions required to reduce water use; and c) the active enforcement of mandatory water use restrictions. It is very important for water suppliers to understand the public

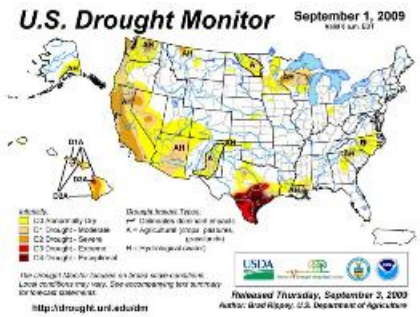
seldom sustains the voluntary water conservation levels more than a few months. Drought response actions, even mandatory water use restrictions are designed to be suspended once the drought is deemed over. Drought response programs and water efficiency programs are two very different actions for two different problems.

Water efficiency programs are designed to effect long-term (even permanent) water use reductions; drought response is designed to solve short term water supply deficits. Water efficiency programs can reduce the impact of subsequent droughts, but water efficiency strategies continue beyond the term of a drought. Water efficiency planning is usually based on the economics of avoided costs or least cost planning. Drought response is meant to solve an emergency supply shortfall; thus, does not always need to be justified by avoided costs.

Drought Guidance and Resources

California Department of Water Resources provides and excellent guidebook for drought planning and mitigation. You can view and download a copy of their 2008 Urban Drought Guidebook here. Additionally, a March 2010 update has been released and is available for download - CA 2010 Drought Report Update.

The National Drought Mitigation Center at the University of Nebraska was established in 1995 and offers updated information on drought conditions, planning, and response actions. The National Drought Mitigation Center hosts the U.S. Drought Monitor which releases updated drought maps on a weekly basis each Thursday.



The 2003 GAO report on freshwater supply and states' view on potential federal assistance in times of shortage.

California 20x2020 Draft Water Conservation Plan (April 2009)

Association of California Water Agencies (ACWA) - California Drought - Actions Taken by Local Agencies

California Urban Water Conservation Council Drought Site

Guiding Principles

Alliance for Water Efficiency

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The Alliance for Water Efficiency is committed to promoting the efficient and sustainable use of water. Conserving water and using water efficiently is critical to ensuring that water resources are available now and in the future to support healthy economies, ecosystems, communities and individuals.

The Alliance for Water Efficiency uses the following principles to guide its research, advocacy, outreach and educational efforts.

1. Significant opportunities exist for increasing water efficiency and water conservation.
2. Everyone has a responsibility to use water efficiently and not waste water.
3. Saving water helps save money and reduces future water supply and infrastructure costs.
4. Saving water helps save energy and reduces climate change impacts.
5. Maintaining the sustainable, natural function of our water resources is essential to their continued use for all living things in this and future generations.
6. Water efficiency and conservation best management practices are essential to restore impaired water resources.
7. Water efficiency and conservation are fundamental resource planning tools and should be considered equally with other means of meeting our water needs.
8. Cost-effective water efficiency and conservation options should be maximized prior to developing new sources of water.
9. Water supply and water/wastewater services should be priced at full cost of development, treatment, and distribution, including depreciation.
10. In all its efforts, the Alliance will strive to:
    a. Engage all stakeholders involved in resource efficiency issues.
    b. Actively build and promote productive and positive relationships among stakeholders.
    c. Promote increased scientific rigor for analysis and verification of water efficiency and conservation programs.
    d. Develop and promote water-conserving best management practices that increase the efficiency of water use.
    e. Promote strong water efficiency codes, uniform standards, incentives and policies.
    f. Promote the inclusion of the best available water efficiency technology, designs and practices in all green building programs.
    g. Stand as the premier source of information on water efficiency and conservation programs, products, and policies.
    h. Achieve climate neutrality.
    i. Urge the Alliance membership to commit to practicing these principles in their own organizational activities.

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Standards & Codes for Water Efficiency

Standards and codes for plumbing, equipment, appliances, and green building are important in advancing the development of water efficient practices and products and in assuring the longevity of water savings. The Alliance for Water Efficiency participates in all of the key codes and standards-making organizations to ensure that the most water-efficient and cost-effective practices, products, and technologies are recognized.

What are Standards?

Webster's defines a standard as: "...something set up as a rule for measuring or as a model to be followed..." In the world of water-efficient products, standards (or "rules for measuring") are necessary to establish standard dimensional requirements and the minimum performance level for all manufacturers to meet with their products. Compliance with established standards, however, is voluntary. That is, until such time as an American National Standards Institute (ANSI) consensus standard is adopted into law by regulation (e.g., building codes) or legislation (e.g., the National Energy Policy Act – EPAct), the standards have no force of law.

Once adopted, however, new products from new manufacturers entering the U.S. marketplace, or new product models introduced by existing manufacturers, must be measured against the relevant standards and meet specified minimum requirements in order to be sold in the marketplace or installed in buildings.

Many different U.S. organizations are approved by ANSI as standards-writing bodies, having met certain stringent requirements. Standards committees and project teams are comprised of a variety of stakeholder interests, and they are required by ANSI to maintain a "balance" of those interests. As such, these groups include representatives of manufacturers, laboratories, government, private sector consultants, and others. Generally speaking, standards (and their implementing codes) have focused primarily on protecting public health and safety. In the past 20 years, though, the goal of achieving water use efficiency has been added to the process in many cases.

Latest Information

- Plumbing Codes - Introduction and Background
- Plumbing Standards - Introduction and Background
- Green Building and Water Efficiency Introduction
- Green Building Programs - Introduction and Background
- Appliance Industry and Efficiency Organizations Agree on New Standards
- Toilet Performance Testing - Information and Results

AWE Resource Library

Learn more about plumbing standards here.

Learn more about green building standards here.

What are Codes?

In addition to standards, plumbing and building codes play an important role in governing the installation and use of water-efficient products. Codes are promulgated by code authorities and adopted by jurisdictions to protect the health and safety of the citizens. It is important to note that, whereas the national standards approved by ANSI are voluntary consensus-based standards, the codes (which may or may not adopt the national standards by reference) are usually mandatory within the jurisdiction that adopts them.

Like the standards process, the model codes process is complex. There once were five different plumbing code development organizations in the U.S., but mergers have reduced this number to only two key groups. The International Association of Plumbing and Mechanical Officials (IAPMO) produces the Uniform Plumbing Code (UPC), and the International Code Council (ICC) produces the International Plumbing Code (IPC). In general, the IPC is more prevalent in the eastern part of the US, and the UPC is more prevalent in the west. Both model codes continuously evolve as a result of constant amendments. Public participation in the amendment process is encouraged by both organizations. Each of the code-authoring organizations follow a 3-year development cycle to update and publish their respective model codes. When the new updated version of the code is published, IAPMO and ICC encourage all of the jurisdictions to adopt the newest version of the code.

The model plumbing and building codes themselves have no legal status until adopted by jurisdictions such as cities, counties and states. Where adopted, the codes become as local ordinances and laws. All jurisdictions can amend the model code before and after adoption, and some do this to better suit local conditions.

For further information on the code process, go here.

EPAct

The National Energy Policy Act of 1992 (EPAct 92) sets maximum water consumption standards for showerheads, faucets, urinals, and toilets; pre-rinse spray valves (PRSVs) followed in 2005. Just how those standards are manifested in fixtures (toilets and urinals) and fixture fittings (faucets, showers, and PRSVs) is a function of standard setting and the adoption of those requirements into the plumbing codes as noted above.

Resources

U.S. National Efficiency Standards (fixtures and appliances)

The following link navigates to a PDF document that lists National Efficiency Standards for 14 water-using fixtures and appliances. The

document also lists specifications for WaterSense, Energy Star, and the Consortium for Energy Efficiency, and includes links to related resources.

National Efficiency Standards and Specifications for Residential and Commercial Water-Using Fixtures and Appliances

U.S. "Green" Specifications for Indoor Fixtures and Appliances

Various "green" standards and guidelines exist for plumbing fixtures and appliances beyond the U.S. National Standards. These standards and guidelines may be part of voluntary programs such as WaterSense Single-Family New Homes and USGBC LEED for Homes, or codes such as the IAPMO Green Plumbing and Mechanical Code Supplement and the ICC International Green Construction Code. The linked PDF below contains information on specifications for a variety of standards, codes, and voluntary initiatives.

Water Efficient Indoor Products and Systems - Standards, Codes, and Voluntary Initiatives

Impact of Standards on Water Infrastructure Investments

AWWA (2001) Impact of the National Plumbing Efficiency Standards on water Infrastructure Investments

Standards & Codes

Background Information on Plumbing Standards

Plumbing standards are one key avenue to advancing water efficiency in plumbing fixtures and fixture fittings. Since 1994, water utilities have become more aware of and involved in this standard-setting process. The Alliance is one of those interests represented in the processes, and works aggressively to help the evolution toward more efficient products. There are numerous committees and teams that develop ANSI-approved plumbing fixture standards, such as the following:

- ASME A112.19.2-2008/CSA B45.1-08 – Ceramic Plumbing Fixtures
- ASME A112.19.5-2011/CSA B45.15-11 – Flush valves and spuds for water closets, urinals, and tanks
- ASME A112.19.14-2006 – Six-Liter Water Closets Equipped with a Dual Flushing Device
- ASME A112.19.10-2003 – Dual Flush Devices for Water Closets (after-market devices)
- ASME A112.19.19-2006 – Vitreous China Nonwater Urinals
- ASME A112.18.1-2010/CSA B125.1-10 – Plumbing Supply Fittings
- ASSE 1002 – Anti-siphon Fill Valves (Ballcocks) for Gravity Water Closet Flush Tanks
- ASSE 1016 – Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations
- ASSE 1037: Performance Requirements for Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures
- CSA B45.5-10/IAPMO Z124-10 – Plastic plumbing fixtures

« Back to Codes & Standards

Codes & Standards

Background Information on Plumbing Codes

In addition to plumbing standards, plumbing and building codes play an important role in governing the installation, use, and maintenance of water-efficient products. Codes are promulgated by code authorities and adopted by jurisdictions in order to protect the health and safety of the citizens. Whereas the national standards approved by the American National Standards Institute are voluntary consensus-based standards, the codes (which may or may not adopt the national standards by reference) are mandatory within the jurisdiction that adopts them.

Several areas are of current interest to water-efficiency practitioners. For example, research is underway to investigate hot water distribution systems within residential dwellings and commercial buildings. The ultimate goal is to amend the plumbing and building codes to require that certain efficient design and construction practices be incorporated into new buildings. These design changes are intended to reduce the amount of water and energy lost with existing design and construction practices. The process of amending plumbing codes to achieve resource efficiencies is laborious, usually contentious, and in need of support from the water stakeholders. The Alliance's representation in the plumbing code development process helps ensure that water efficiency is considered a priority alongside health and safety. The plumbing codes themselves have no legal status until adopted by jurisdictions such as cities, counties and states. Where adopted, the codes become as local ordinances and laws. All jurisdictions can amend the code before and after adoption, and some do this to better suit local conditions. For example: a city in a Montana would probably amend the code to increase measures to protect pipes in buildings from freezing in harsh winters, while a city in Florida might require measures to resist the corrosive conditions of brackish water prevalent in the area. Except for these special conditions, jurisdictions usually adopt the code of choice (UPC or IPC) as it is written. Each of the codes contains more than 400 pages of complex requirements; unfortunately, few jurisdictions have the ability to review and analyze every single provision before adopting the code as law.

The basis of the codes dates back to the early 1900s when water was plentiful in high population areas. The lack of proper sanitation was of greater concern, as disease was rampant in large cities. Water was needed to move the waste out of the cities —- and water was considered a cheap and plentiful resource. While the codes have been updated through the years to reflect federal laws (such as the National Energy Policy Act), the codes have never implemented measures solely to ensure water efficiency. In the past, sanitation and safety was the primary focus of the IAPMO and ICC in the code process.

Green Building Guidelines & Standards

Background Information - Green Building Guidelines & Standards

There is a clear link between the efforts of the water efficiency community and the green building movement. Particularly in residential green building programs, a significant opportunity exists for partnership in areas of hot water plumbing design, high-efficiency plumbing fixtures and appliances, and outdoor landscaping and irrigation system design. Most green building initiatives focus on energy efficiency and sustainable materials construction. Water efficiency is not yet a prominent piece of many existing green building programs, although that has begun to change.

The U.S. Green Building Council (USGBC) has been a leader in the green building movement. Their LEED program (Leadership in Energy and Environmental Design) is the most prominent and well-known of the green building programs. There are, however, a number of other green building standards either extant or emerging.

Typical water use efficiency categories within many of the national green building programs (guidelines and standards) include:

1. Plumbing fixtures and fixture fittings
2. Residential appliances (clothes washers, dishwashers)
3. Water treatment equipment (softeners, filtering systems)
4. Landscape & landscape irrigation
5. Pools, fountains, and spas
6. Cooling towers
7. Decorative and recreational water features
8. Water reuse & alternate sources of water (graywater, rainwater and stormwater, cooling condensate and cooling tower blowdown, foundation drain water)
9. Specialty processes, appliances and equipment (food service, medical, laboratories, laundries, others)
10. Metering & submetering
11. Once-through cooling
12. Vegetated green roofs
13. Building water pressure

Green building water conservation strategies under LEED and other similar programs typically fall into five categories:

- Efficiency of potable water use through better design/technology (fixtures, appliances, processes, equipment, HVAC, and other systems).
- Capture of gray water – non-fecal waste water from lavatory sinks, bathtubs, showers, washing machines, etc. – and use for irrigation.
- On-site storm water capture for use or groundwater recharge.
- Rainwater capture and reuse.
- Recycled/reclaimed water use, including on-site treatment of non-potable water.

Green Building Guidelines: USGBC - LEED Program

The USGBC estimates that a 30% indoor and a 50% outdoor water savings is possible and commonly achieved. Irrigation and Indoor Water Use Reduction were two of the most common "credits" earned by LEED aspirants, due largely to the 'ease' with which the indoor credits could be obtained. This was due, in part, to the fact that LEED allowed baseline faucet flow rates in VIOLATION of the model plumbing codes and national standards, thereby making water use 'reductions' from a false baseline water use relatively easy! LEED failed to recognize that the national standard (incorporated by reference into the codes) provided for a 0.5 gpm flow rate for non-residential lavatory faucets. The USGBC finally acknowledged that they had made an error in earlier versions of LEED and finally corrected this mistake in LEED 2009.

In addition to correcting the baseline water use error in 2009, LEED also incorporated a pre-requisite into their system that called for a 20 percent reduction in indoor water use before earning any LEED credits. This one significant measure made water use efficiency a high priority item within LEED.

National Green Building Standards

It is important to understand the difference between green building standards and green building guidelines. While guidelines provide thresholds for efficiency, they are not generally written in code-adoptable language, and compliance is usually voluntary. Standards, on the other hand, provide definitive efficiency thresholds, are written in language that is enforceable, and are readily adopted by reference into codes and other regulations as mentioned above.

For example, the well-entrenched LEED Program consists of a set of guidelines that designers and builders may voluntarily choose to comply with (although some jurisdictions are choosing to mandate compliance with LEED to some level and use credits as the measure of compliance). As such, these guidelines are not generally written in language suitable for direct adoption or reference as codes or other regulations.

Currently, national green building standards include these initiatives, each of which was or is being developed through the ANSI (American National Standards Institute) consensus process as an American National Standard:

- ASHRAE ANSI Standard 189.1 Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings
- Green Globes-Green Building Initiative (GBI) ANSI Standard 01-2008: Green Building Assessment Protocol for Commercial Buildings
- ASHRAE Proposed ANSI Standard 191 - Standard for the Efficient Use of Water in Building, Site and Mechanical Systems

Comparisons of the provisions of these three ANSI standards with the requirements of the model 'green' codes are shown in the following four tables:

NATIONAL GREEN BUILDING STANDARDS, CODES, & GUIDELINES
with water use efficiency provisions

	Applications	Guidelines, code or standard?	Code-adoptable language?	Minimum thresholds or points?	Status
California: CalGreen	Residential & non-residential	Code	Yes	Minimum thresholds	Became effective in 2011
USGBC LEED-NC et al.	All except Single Family Residential	Guidelines	No	Prerequisite + points	LEED 2009 mandates 20% reduction from baseline; 2012 version in development
USGBC LEED-Homes	Single Family Residential (SFR)	Guidelines	No	Both	Active – being updated
Green Globes – Green Bldg Initiative 01-200XP	Residential above 3 stories + all commercial	ANSI Standard	Yes	Points	Final standard ANSI-approved; published in April 2010
ASHRAE S189.1 – High Performance Buildings	Residential above 3 stories + all commercial	ANSI Standard	Yes	Minimum thresholds	Final standard ANSI-approved; published in January 2010; now in sustaining process
ASHRAE S191 – Water Efficiency	All except SFR	ANSI Standard	Yes	Minimum thresholds	Process began July 1, 2008; provisions being drafted
ICC 700 - NAHB Green Bldg Standard for Homes	Residential	ANSI Standard	Yes	Points	Final standard ANSI-approved; published in Jan 2009 as ICC-700
IAPMO Green Plumbing & Mechanical Code Supplement	Residential above 3 stories + all commercial	Code	Yes	Minimum thresholds	Completed and published in February 2010; first update in process
ICC Green Construction Code	Residential above 3 stories + all commercial	Code	Yes	Minimum thresholds	Development underway; 2nd draft considered released for public comment in 2011; publish 2012
U.S. EPA WaterSense for New Homes	Residential	Guidelines	No	Minimum thresholds	Final specification issued in December 2009

Updated: October 2011

Prep by John Koeller

NATIONAL GREEN BUILDING STANDARDS & CODES
Comparison of specific water use efficiency provisions – maximum water use

PLUMBING	CalGreen*	ASHRAE SS189.1	ASHRAE S191 (draft)	ICC-NAHB HOMES	IAPMO Green Plumbing & Mech Code Supplement	ICC Green Code (PV2 draft)
Residential toilets (per flush)	HET: 1.28g	HET: 1.28g	HET: 1.28g	HET: 1.28g	HET: 1.28g	HET: 1.28g + WaterSense
Commercial toilets (per flush)					1.6g	1.6g
Urinals (per flush)	HEU: 0.5g	HEU: 0.5g	HEU: 0.5g	HEU: 0.5g	HEU: 0.5g	HEU: 0.5g + WaterSense (if a flushing urinal)
Residential & commercial "private" lavatory faucets (per minute)	1.5gpm**	1.5gpm	1.5gpm	1.5gpm	1.5gpm	1.5 gpm + WaterSense
Commercial "public" lavatory faucets (per min.)	0.4gpm	0.5gpm	0.5gpm		0.5gpm	0.5 gpm
Commercial metering faucets (per cycle****)	0.20 gpc	0.25 gpc	0.20 gpc		0.25 gpc	0.25 gpc
Residential kitchen faucets (per minute)	1.8 gpm***	2.2 gpm	2.2 gpm			2.2 gpm
Residential showerheads (per minute)	2.0 gpm	2.0 gpm	2.0 gpm	2.5 gpm	2.0 gpm	2.0 gpm + WaterSense
Residential showering compartment – size increment		2600 sq. in.	3000 sq. in.		1800 sq. in.	
Commercial pre-rinse spray valve (per minute)		1.3 gpm	1.3 gpm		1.6 gpm	1.3 gpm

*Prescriptive option only
**Also a minimum flow rate of 0.8 gpm at 20 psi
***Kitchen faucets may "temporarily" flow at 2.2 gpm, but must default to 1.8 gpm maximum
****Metering faucets have **no flow rate maximum**

Updated: June 2011

Prep by John Koeller

NATIONAL GREEN BUILDING STANDARDS & CODES
Comparison of specific water use efficiency provisions – maximum water use

Appliances, Equipment, Irrigation & Alternate Water	CalGreen*	ASHRAE SS189.1	ASHRAE S191 (draft)	ICC 700-(NAHB) HOMES	IAPMO Green Plumbing & Mech Code Supplement	ICC Green Code (draft)
Residential dishwasher (total water per full cycle)	*(defers to Calif Energy Commission)*	Energy Star & 5.8 gal – 22L	Energy Star & 5.0 gal – 19L	Energy Star	Energy Star	Energy Star
Residential clothes washer (water factor)		Energy Star & 6.0 gal – 23L	Energy Star & 4.5 gal – 17L	Energy Star	Energy Star	Energy Star
Graywater treatment system	*(future)*	Encouraged through the treatment and use of alternate (non-potable) sources of water		Points available for use of alternate sources	Specific provisions for equipment installation & water treatment	
Rainwater harvesting	*(future)*					
Landscape irrigation	Weather-based irrigation controllers req'd	ET-based; smart technology; restrictions on turf	ET-based; smart technology; restrictions on turf	Non-mandatory provisions; some turf restrictions	Only as related to treatment & use of water from alternate sources; some specific landscape provisions	
Water features (fountains, etc.)		Use alternate water sources (non-potable); recirculation required			Use alternate water sources (non-potable)	To use potable water, must comply with 1 project elective
Residential water softeners					Permitted where water hardness ≥ 8 grains/gallon (137 mg/L)	Demand-initiated regeneration reqd; max water use 5 gal (19L) per 1K grains of hardness removed; salt efficiency requirements
Water-powered pumps					Water-powered sump pumps prohibited	Water-powered sump pumps prohibited, except for emergency

*Prescriptive option only

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NATIONAL GREEN BUILDING STANDARDS & CODES
Comparison of specific water use efficiency provisions – maximum water use

Metering and Commercial Food Service	CalGreen*	ASHRAE SS189.1	ASHRAE S191 (draft)	ICC 700-(NAHB) HOMES	IAPMO Green Plumbing & Mech Code Supplement	ICC Green Code (draft)
Sub-metering tenant water use (usage per day)	Yes, where >100g** + all bldgs where >1000g	Yes, where >1,000 g	Yes, where >1,000 g		Yes, where >500 g	All tenants
Sub-metering processes – industrial/commercial (usage per day)		Yes, where >1,000 g	Yes, where >1,000 g		Yes, where >1,000 g	Yes, where >1,000 g
Sub-metering irrigation	Yes, where >1,000 sq.ft.**	Yes, >25,000 sq.ft.	Yes, >10,000 sq.ft.		Yes, >15,000 sq.ft.	Yes, all automatic systems
Building Meter Data Management System		Require remote data communication to central system, recording hourly consumption data			Connection to central building system not required	
Commercial food service – ice makers	*(defers to Calif Energy Commission on food service appliances)*	Energy Star (air cooled)	Energy Star (air cooled)		Energy Star (air cooled)	Energy Star (air cooled)
Commercial food service – food steamers (per hour)		2.0 g	2.0 g		2.0 g	2.0 g
Commercial food service – dishwashers		Energy Star	Energy Star		Energy Star	Energy Star OR meet specified thresholds
Commercial food service – combination ovens (per hour)		10 g	10 g		10 g	10 g
Commercial food service – dipper wells (per minute)					Max flow per min equal to the capacity of the DW	1.0 g

*Prescriptive option only
**Non-residential only
Updated: June 2011 © 2010-2011 Koeller & Company Prep by John Koeller

Resources

U.S. National Efficiency Standards (fixtures and appliances)

The following link navigates to a PDF document that lists National Efficiency Standards for 14 water-using fixtures and appliances. The document also lists specifications for WaterSense, Energy Star, and the Consortium for Energy Efficiency, and includes links to related resources.

- National Efficiency Standards and Specifications for Residential and Commercial Water - Using Fixtures and Appliances

U.S. "Green" Specifications for Indoor Fixtures and Appliances

Various "green" standards and guidelines exist for plumbing fixtures and appliances beyond the U.S. National Standards. These standards and guidelines may be part of voluntary programs such as WaterSense Single-Family New Homes and USGBC LEED for Homes, or codes such as the IAPMO Green Plumbing and Mechanical Code Supplement and the ICC International Green Construction Code. The linked PDF below contains information on specifications for a variety of standards, codes, and voluntary initiatives.

- Water Efficient Indoor Products and Systems - Standards, Codes, and Voluntary Initiatives

Other

Appliance Industry and Efficiency Organizations Agree on New Standards
Read More >>

Background information on Plumbing Codes
Plumbing Codes and Water Efficiency

Background information on Plumbing Standards
Plumbing Standards and Water Efficiency

Latest MaP and UNAR Toilet Testing Results and Information
Toilet Performance Testing and Fixture Ranking

Green Building and Water Efficiency Introduction

Is your water turning green? We hope so! But what is Green? What is Sustainable?

Today, everyone seems to be talking “green” and “sustainable”. When it comes to water-efficiency and water conservation, these terms represent extremely important trends affecting design professionals, building owners and managers, manufacturers, end-users, water utilities, government and certainly the water-efficiency practitioner.

Opinions and definitions vary from individual to individual on the meaning of the terms “green” and “sustainable”. The Alliance for Water Efficiency offers a few definitions from other sources to improve understanding of what is meant by these terms.

Definitions

Green Building -

A holistic approach to design, construction, and demolition that minimizes the building’s impact on the environment, the occupants, and the community. (California Building Standards Commission)

Sustainable Development -

- A pattern of resource use that aims to meet human needs while preserving the environment so that these needs can be met not only in the present, but in the indefinite future. (Wikipedia)
- A systematic approach to achieving human development in a way that sustains planetary resources, based on the recognition that human consumption is occurring at a rate that is beyond Earth's capacity to support it. (Answers.com)
- A practice that ‘meets the needs of the present without compromising the ability of future generations to meet their own needs’ (1987 UN Convention on Environment and Development)

Guidelines and Standards

Many jurisdictions (municipalities and other local authorities and state governments with the power to mandate, approve, disapprove, or influence project design and construction) are developing guidelines and minimum standards for new construction and renovations. These actions mandate or “suggest” design or construction practices, technologies, performance thresholds and metrics in a variety of categories including, but not limited to:

Category	Generally inclusive of…
Siting and Site Sustainability	Site selection, site development, stormwater control, landscape, mitigation of heat island effect, and light pollution reduction.

Energy Efficiency and Metering	Energy efficiency for buildings and appliances, for on-site renewable energy systems, and for energy metering.
Indoor Environmental Quality	Indoor air quality, ventilation, environmental tobacco smoke control, outdoor air delivery monitoring, thermal comfort, building entrances, acoustic control, daylighting, and low emitting materials.
Atmosphere, Materials and Resources	Construction waste management, refrigerants, storage and collection of recyclables and hazardous materials, and reduced impact materials; life cycle analyses and assessment; transportation of materials.
Construction and Operation Plans	Building commissioning, building acceptance testing, measurement and verification, energy and water use reporting, durability, transportation management, erosion and sediment control, construction, and indoor air quality during construction.
Water Use Efficiency and Metering	(see below)

Typical water use efficiency categories within many of the national green building programs include:

- Plumbing fixtures and fixture fittings
- Residential appliances (clothes washers, dishwashers)
- Water treatment equipment (softeners, filtering systems)
- Landscape & landscape irrigation
- Pools, fountains, and spas
- Cooling towers
- Decorative and recreational water features
- Water reuse & alternate sources of water (graywater, rainwater and stormwater, cooling condensate and cooling tower blowdown, foundation drain water)
- Specialty processes, appliances and equipment (food service, medical, laboratories, laundries, others)
- Metering & submetering
- Once-through cooling
- Vegetated green roofs
- Building water pressure

It is important to understand the difference between green building standards and green building guidelines, because while guidelines do provide thresholds for efficiency, compliance is usually voluntary. On the other hand, standards provide definitive efficiency thresholds, but are written in language that is enforceable and is also readily adopted by reference into codes and other regulations.

For a more complete discussion of guidelines vs. standards and for a comparison of the provisions within the various national initiatives, go here.

Water efficiency practitioners must become involved in the larger green building task. Because many local green building programs fail to consider or emphasize water efficiency, instead focusing on other important environmental issues, there is a need to bring water efficient practices, designs, and products to the attention of the sponsors and originators of these programs.

Here are some suggestions for increasing the profile and influence of water efficiency in these efforts:

- Learn about and monitor the green building programs that are operating in your area, including both voluntary guidelines and mandates that might be promulgated by your local municipalities.
- Actively seek out and provide advice and input to local governments, the programs, and their managers on water efficient practices and technologies and their importance to local area sustainability. The Alliance recommends a set of water-efficiency thresholds for a range of applications that can be employed for that purpose.
- Monitor the national standards that are likely to be candidates for adoption (and enforcement) by the local authorities within your own area and by your state government. Where the local or state mandates are still being considered and developed, provide advice from a national viewpoint in order to achieve commonality.
- Be observant for greenwashing and the tendency to endorse or adopt practices, products, and initiatives that, in fact, are water wasting. To recognize legitimate practices and products and discern when greenwashing is occurring, always look for independent studies that verify the claims made for water efficiency by the advocates of those practices and products. Ask manufacturers to substantiate their claims with real world proof of savings and consumer acceptance.

Alliance for Water Efficiency

AWE Template of Suggested Water Use Thresholds - Gallons

Fixture, Fitting, Appliance, or Equipment	Probable Application	Reference Standard or Specification (if any)	Recommended Threshold of Water Use (maximum)	Other Parameters	Comments	For information and comparison only: Threshold prescribed in ASHRAE ANSI Standard S189.1 for high-performance buildings
Water Closet (Tank-type)	Residential & Light Commercial	WaterSense specification for HETs: www.epa.gov/watersense/docs/spec_het508.pdf	1.28-gpf effective flush volume	Applies only to tank-type fixtures	Support WaterSense. Fixture must be certified in accordance with WaterSense requirements; category includes light commercial applications.	WaterSense (1.28 effective flush volume)
Water Closet (Flushometer valve/bowl)	Non-Residential	ASME A112.19.2-2008/CSA B45.1-08 & related stds for valves; WaterSense specification applies to determining effective flush volume for dual-flush fixtures.	1.28-gpf effective flush volume	Applies only to flushometer valve/bowl combination fixtures (single- and dual-flush)	Effective flush volume for dual-flush fixtures determined in accordance with WaterSense specification. **NOTE: SEE AWE CAUTIONARY STATEMENT REGARDING DRAINLINE ISSUES ASSOCIATED WITH CERTAIN TYPES OF BUILDING INSTALLATIONS**	1.28-gpf effective flush volume
Urinal	All	ASME A112.19.2-2008/CSA B45.1-08, ASME A112.19.19, IAPMO Z124.9, and related ASSE std for valves	0.5-gpf	None at this time	Support WaterSense when spec is issued and finalized for flushing urinals. Category includes flushing and non-water urinals, but non-water urinals are not included in the first WaterSense Notice of Intent (NOI) for Urinals.	0.5-gpf
Lavatory Faucet	Residential	WaterSense specification for Resid Lavatory Faucets: www.epa.gov/watersense/docs/faucet_spec508.pdf	1.5-gpm	0.8-gpm minimum	Support WaterSense by adopting their thresholds (max & min).	WaterSense (1.5-gpm max; 0.8 gpm min)
Kitchen Faucet	Residential	ASME A112.18.1/CSA B125.1	2.2-gpm	None	Same as EPAct 92 maximum.	2.2-gpm
Pre-Rinse Spray Valve	Commercial	ASME A112.18.1/CSA B125.1	1.3-gpm	None	Could use the California list by the CEC if necessary. That spec requires a maximum 30 second cleaning time when tested using ASTM F-2324-03 test method. Other jurisdictions are currently using other metrics (i.e., 26 and 21 seconds).	1.3-gpm
Showerhead	Residential & Hospitality	ASME A112.18.1/CSA B125.1	2.0-gpm	Lower flow rates must be accompanied by automatic compensating valve tested & certified to the same flow rate or less.	WaterSense showerhead spec may be implemented in multiple phases due to the need to develop a full performance spec; phase 1 to establish a max flow rate possibly in the region of 2.0-gpm and a phase 2 may possibly define other performance metrics along with a lower flow rate.	2.0-gpm
Ice Machine	Commercial	Energy Star	None	Energy Star only lists air-cooled machines	By specifying Energy Star, water cooled machines are automatically excluded.	Energy Star

NOTE: Other items may be added to this listing as threshold requirements are defined through a stakeholder input process.

Updated: August 30, 2010

AWE Template of Suggested Water Use Thresholds - Litres

Fixture, Fitting, Appliance, or Equipment	Probable Application	Reference Standard or Specification (if any)	Recommended Threshold of Water Use (maximum)	Other Parameters	Comments	For information and comparison only: Threshold prescribed in ASHRAE ANSI Standard S189.1 for high-performance buildings
Water Closet (Tank-type)	Residential & Light Commercial	WaterSense specification for HETs: www.epa.gov/watersense/docs/spec_het508.pdf	4.8-lpf effective flush volume	Applies only to tank-type fixtures	Support WaterSense. Fixture must be certifed in accordance with WaterSense requirements; category includes light commercial applications.	WaterSense (4.8-lpf effective flush volume)
Water Closet (Flushometer valve/bowl)	Non-Residential	ASME A112.19.2-2008/CSA B45.1-08 & related stds for valves; WaterSense formula for effective flush volume for dual-flush	4.8-lpf effective flush volume	Applies only to flushometer valve/bowl combination fixtures	Effective flush volume for dual-flush fixtures determined in accordance with WaterSense specification. **NOTE: SEE AWE CAUTIONARY STATEMENT REGARDING DRAINLINE ISSUES ASSOCIATED WITH CERTAIN TYPES OF BUILDING INSTALLATIONS**	4.8-lpf effective flush volume
Urinal	All	ASME A112.19.2-2008/CSA B45.1-08, ASME A112.19.19, IAPMO Z124.9, and related stds for valves	1.9-lpf	None at this time	Support WaterSense when spec is issued and finalized for flushing urinals. Category includes flushing and non-water urinals, but non-water urinals are not included in the first WaterSense Notice of Intent (NOI) for Urinals.	1.9-lpf
Lavatory Faucet	Residential	WaterSense specification for Resid Lav Faucets: www.epa.gov/watersense/docs/faucet_spec508.pdf	5.7-lpm	3.0-lpm minimum	Support WaterSense by adopting their thresholds (max & min).	WaterSense (5.7-lpm max; 3.0-lpm min)
Kitchen Faucet	Residential	ASME A112.18.1/CSA B125.1	8.3-lpm	None	Same as U.S. EPAct 92 maximum.	8.3-lpm
Pre-Rinse Spray Valve	Commercial	ASME A112.18.1/CSA B125.1	4.9-lpm	None	Could use the California list by the CEC if necessary. That spec requires a maximum 30 second cleaning time when tested using ASTM F-2324-03 test method. Other jurisdictions are currently using other metrics (i.e., 26 and 21 seconds).	4.9-lpm
Showerhead	Residential & Hospitality	ASME A112.18.1/CSA B125.1	7.6-lpm	Lower flow rates must be accompanied by automatic compensating valve tested & certified to the same flow rate or less.	WaterSense showerhead spec may be implemented in multiple phases due to the need to develop a full performance spec; phase 1 will establish a max flow rate likely in the region of 7.6-lpm and a phase 2 may possibly define other performance metrics along with a lower flow rate.	7.6-lpm
Ice Machine	Commercial	Energy Star	None	Energy Star only lists air-cooled machines	By specifying Energy Star, water cooled machines are automatically excluded.	Energy Star

NOTE: Other items may be added to this listing as threshold requirements are defined through a stakeholder input process.

Updated: August 30, 2010

Appendix A

Water Shortage Contingency Planning Checklist

First Steps

- Designate water shortage response team leader
- Designate team members from each department or division
- Set priorities
- Identify potential supplemental supply sources
- Identify potential interconnections
- Identify regional suppliers for potential cooperative actions
- Establish a community advisory committee

Supply

- Quantify worst-case supply (minimum) for next five or more years
  - Local surface
  - Wholesale
  - Groundwater
  - Recycled
  - Other

Water Quality

- Project water quality changes by source
- Identify water treatment devices necessary to use on degraded quality sources
- Identify low-quality water sources and develop plan for blending

Demand

- Quantify worst-case demand (maximum) by season for next five or more years
  - Single Family
  - Multifamily
  - Commercial
  - Industrial
  - Institutional
  - Landscape
  - Recycled
  - Agricultural
  - Wholesale
  - New connections

Supply and Demand Balance

- Quantify yearly shortage for next five or more years
  - 2011
  - 2012
  - 2013
  - 2014
  - 2015

Increase Supply

- Project possible supplemental supplies and carryover
- Schedule well driller for new or rehabilitated wells
- Plan to increase supplier efficiency
  - Meters
  - System losses
  - System pressure
  - System flushing
  - Supplier landscaping

Decrease Demand

- Determine health and safety minimum supply
- Plan Stage 1—public relations campaign and recommend customer actions
- Adopt and publicize water-waste ordinance and time of day irrigation restrictions
- Make available nonpotable water stations for nonpotable uses
- Review pricing structure and rates by stage
- Select water allocation method by customer class and stage
- Adopt restriction enforcement rules and penalties
- Selected stage and customer class demand reduction programs to help customers
- Plan for catastrophes with cascading failures – 50 percent supply shortage or more

Complete Draft Water Shortage Contingency Plan

- Establish stage triggers based on priorities and quantifiable supply availability by source
- Include carefully crafted flexibility to triggers
- Identify lag-time and seasonal issues related to each reduction program
- Establish structure and impacts of limited-number-of-days irrigation programs
- Develop revenue plan to balance budget by stage

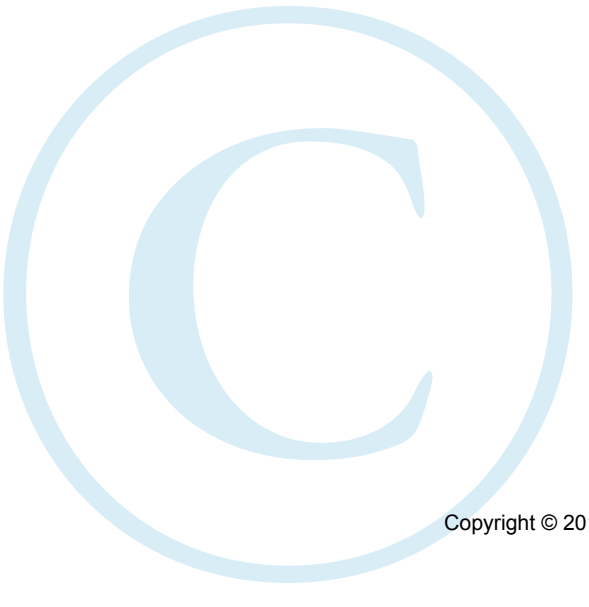
- Develop customer appeal procedure
- Establish monitoring program to track water production and use

Community Involvement

- Complete Draft Plan
- Provide Draft Plan to community
- Contact significantly impacted customers (agriculture, green industry, tourist industry, etc.) and request input
- Contact local suppliers and government agencies and request input
- Hold at least three public meetings to receive comments on Draft Plan
- Incorporate useful community suggestions into the Draft Plan
- Adopt the final Water Shortage Contingency Plan

Supplier Capabilities and Resources

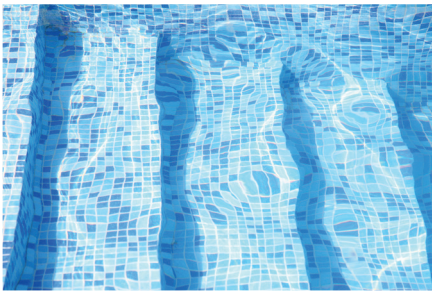
- Establish required computer capabilities for billing, data tracking, and customer support
- Identify required changes to existing computer systems
- Make required computer system changes and test thoroughly
- Prepare customer information brochures
  - Meter reading
  - Leak detection
  - Plumbing hardware recommendations and rebate programs
  - Customer assistance programs offered by supplier staff
- Identify needed new full-time and part-time contract staff
- Procure space for additional staff and increased customer visits
- Develop media contacts
- Identify and purchase water conservation devices for distribution to customers
- Develop training program for staff
- Develop training programs for affected businesses
- Establish water-waste and information hotline



Appendix G

WATER

CONSERVATION COMMUNICATIONS GUIDE



American Water Works Association

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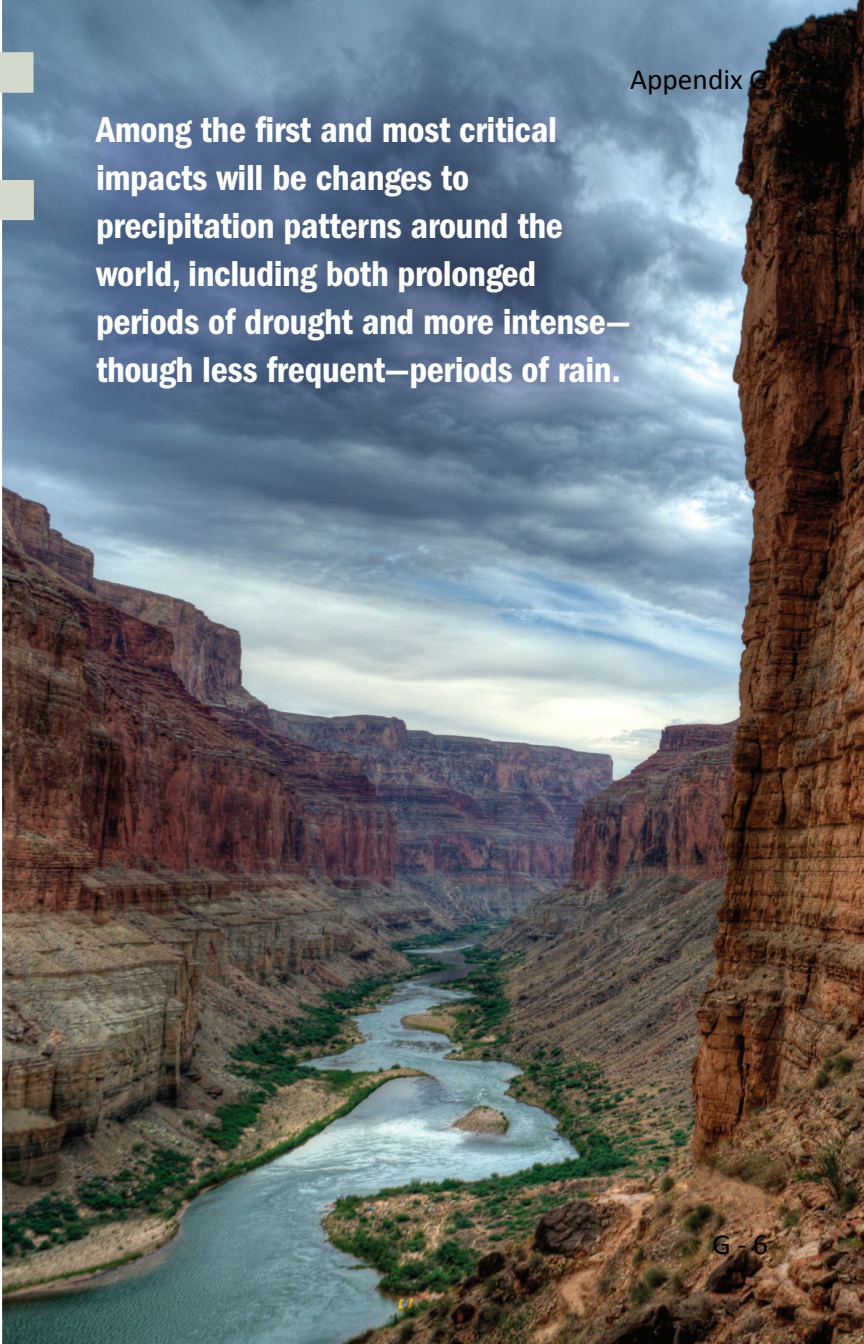
Synopsis

WATER CONSERVATION was once avoided by professionals in the water industry. The notion of actively trying to sell less of one's product was considered ludicrous.

However, recent science indicates that climate shift is occurring rapidly and that significant impacts to the environment will be felt during this century. Among the first and most critical impacts will be changes to precipitation patterns around the world, including both prolonged periods of drought and more intense—though less frequent—periods of rain. In mountainous areas, snow lines are rising, a greater percentage of overall precipitation is falling as rain rather than snow, and snowpack, one of nature's methods of storing water, is melting faster and earlier in the season. These changes will affect water availability, water resource management, water quality, capture and storage strategies and many other factors critical to water and wastewater utilities.

As a result, many water providers now find themselves grappling with water resource and treatment/conveyance capacity constraints. For those agencies, water conservation is beneficial and in some cases essential. Successful conservation efforts can also curb peak system demand, deferring the need for construction of new treatment, storage and conveyance facilities, as well as **reducing energy costs and wastewater infrastructure**, allowing water utilities to focus on replacement or rehabilitation of older existing infrastructure.



Among the first and most critical impacts will be changes to precipitation patterns around the world, including both prolonged periods of drought and more intense—though less frequent—periods of rain.

Conservation Outreach Strategy

The simplistic concept of a "water conservation program" does not reflect the reality of how people use water or how municipal water providers manage demand. In reality, conservation communications are not a single initiative but rather a portfolio of often interrelated but independently operated programs targeting **specific behaviors** and **market segments**.

It is important to understand that awareness and even belief do not necessarily translate to a desired behavior. **Conservation hinges upon an action; that is, a program in which people can participate or a regulation with which they can comply**. Effective conservation outreach efforts focus on bridging the chasm between thought and action to induce behaviors such as participating in an incentive program or complying with water use regulations, such as mandatory irrigation restrictions. To accomplish this, utility managers must think and behave like marketing experts, identifying target audiences and selecting paths and messages specific to their needs. In attempting to speak to everyone, there's potential to dilute the message so much that no one receives it.

Water agencies can no longer use a cookie-cutter approach any more than Procter and Gamble can market its diverse product line using a single campaign. Therefore, this communications plan will take a programmatic approach that relates specifically to each facet of the water agency's conservation program.

Conservation vs. Drought Response

There is an important distinction between permanent conservation measures and drought response. **Drought response is a temporary measure, often enacted during periods of severe resource challenges for a relatively short time, whereas permanent conservation represents a fundamental long-term shift in behaviors**. This distinction is important for several reasons. First and foremost, given the natural inclination of the public to rally in times of crisis, people are generally more accepting of short-term measures than permanent changes.

Less intrusive drought response measures can often be made permanent with few repercussions. An emergency can serve as a trial to demonstrate that measures have little to no impact on residents' quality of life. Transitioning short-term measures into permanent regulations can be an elegant way of achieving sustained conservation without undue strain on the relationship between utility and customer.

The distinction between permanent conservation and drought response also has financial implications for water utilities. Emergency measures are more painful fiscally in the short term, while long-term conservation measures have more modest but longer-lasting effects. Long-term conservation can be planned for through the budgeting process so that any associated revenue decrease is incorporated into the operating costs of the utility.

Operational Objectives

All effective public communication is designed to evoke either behavioral or perceptual change. While there may be an overarching operational objective of reducing per capita water use, no single communications initiative can be correlated to that goal. Rather, the objectives must be related to the individual water conservation programs, such as participation in a program, compliance with the watering schedule, etc., that can be translated directly to a reduction in water use. Before a water agency's leaders approve a communications program, they should have some way to quantify how much water they are "buying" through the combination of outreach and incentive dollars.

Therefore, each program's objectives must be evaluated individually. It is incumbent upon the agency's public affairs staff to work with operations, conservation professionals where such a function exists, or other appropriate technical staff in establishing specific operational goals for each program. "As much as we can get" is not an adequate target, either in terms of participation or Return on Investment (ROI). Participation should be measured either in whole numbers or market share, while compliance with regulations should be measured as a percentage based on either quantitative research, technical data such as Firefly meter readings, an observational field sample or a combination thereof.

Avoiding Conservation Backlash

Water utilities are sometimes surprised by backlash to water conservation outreach, particularly when it is related to a compulsory measure, such as a mandatory watering schedule or water use restriction. There is a certain segment of the population that will actively resist any effort that it believes may potentially affect quality of life, even if that belief is unfounded. While critics of water conservation measures have difficulty gaining traction for their positions—after all, who wants to promote water waste—they will frequently attempt to paint the sponsoring utility as hypocritical based on its own water use practices.

This approach is often successful at generating media interest, which may impact not only the water agencies but senior utility management and local elected officials. For that reason, it is critical that water utilities conduct a review of their own water use practices, and those of relevant officials where feasible, before publicizing new water use rules. By recognizing poor water use habits, the utility both establishes itself as a leader and inoculates itself against criticism.

Questions and Considerations

Before initiating a communications program designed to elicit behavioral change, it is useful to consider the key factors that will contribute to its success or failure. The list below is useful as a planning tool; when the communications program architects are comfortable that they understand the answers, the likelihood of successful implementation increases significantly.

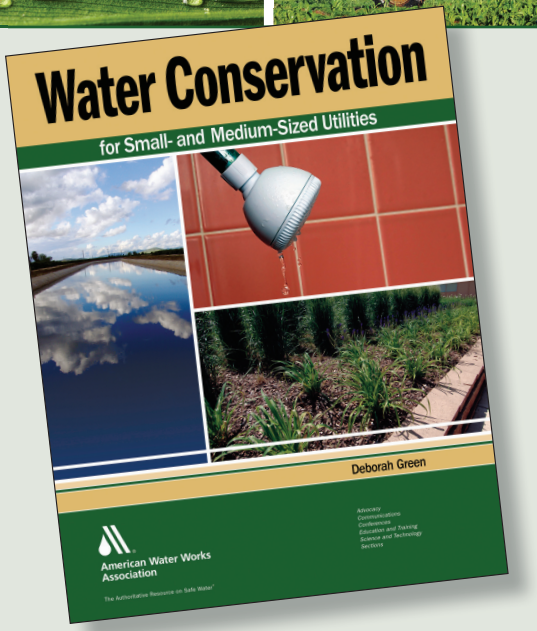
- Who is the target audience?
- What are their underlying socio-economic characteristics?
- What is the most efficient/effective way to reach them?
- What are the barriers to reaching that audience?
- How receptive is the audience to the new behavior?
- What are they specifically being asked to do?
- Will they be provided with any tools?
- Is the program new, or is it a revision of an existing program?
- How dramatic a change from the previous behavior is being sought?
- Is the utility asking for a one-time action or permanent change?
- Is the behavior easy/difficult, inexpensive/costly, simple/complicated?
- Can people do it themselves or will they need professional assistance?
- What are the consequences of not doing it?
- Will there be peer pressure for or against the proposed behavior?

Research and Evaluation

The importance of quantitative research to effective water efficiency communications programs cannot be overstated. Many of the questions above can only be answered through quantitative surveys. Properly conducted research serves five primary needs:

1. Answering many of the questions and considerations outlined above
2. Identifying specific target audience demographics to maximize advertising efficiency and messaging
3. Identifying barriers to participation and evaluating the potential effectiveness of different outreach strategies
4. Evaluating the effectiveness of various executions to enable course adjustments
5. Quantifying the effectiveness of outreach efforts and isolating factors that contribute to or detract from an initiative's success

Many agencies are reluctant to invest in quantitative research because of perceived cost. However, research generally represents less than 10 percent of communications-related expenditures and pays for itself through optimized communications tactics. It is better to invest in information first than to discover after expending the full budget whether or not the outreach assumptions are true.

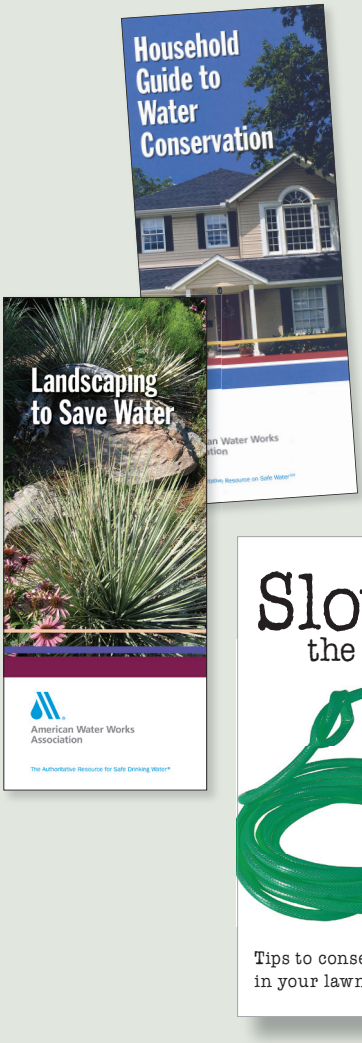


Outline of Outreach Initiatives

It's difficult to develop standard conservation communications tools for AWWA's member water purveyors due to the variety and individualized nature of local programs and restrictions. Therefore, this toolkit will take a template-based approach that may be modified or extrapolated to fit specific conditions at a given agency. Additional information on these types of programs can also be found in AWWA's *Water Conservation for Small- and Medium-Sized Utilities* publication.

Sample Conservation Bill Stuffers From AWWA

Bill Stuffers produced by AWWA can be purchased online at www.awwa.org/bookstore.



LEED

LEED is an internationally recognized green building program.

It provides building owners and operators with a framework for identifying and implementing practical and measurable green building design, construction, operations and maintenance solutions.

What is LEED?

LEED (Leadership in Energy and Environmental Design) is a voluntary, consensus-based, market-driven program that provides third-party verification of green buildings. From individual buildings and homes, to entire neighborhoods and communities, LEED is transforming the way built environments are designed, constructed, and operated. Comprehensive and flexible, LEED addresses the entire lifecycle of a building.

Participation in the voluntary LEED process demonstrates leadership, innovation, environmental stewardship and social responsibility. LEED provides building owners and

operators the tools they need to immediately impact their building's performance and bottom line, while providing healthy indoor spaces for a building's occupants.

LEED projects have been successfully established in 135 countries. International projects, those outside the United States, make up more than 50% of the total LEED registered square footage. LEED unites us in a single global community and provides regional solutions, while recognizing local realities.

How it works

For commercial buildings and neighborhoods, to earn LEED certification, a project must satisfy all LEED prerequisites and earn a minimum 40 points on a 110-point LEED rating system scale. Homes must earn a minimum of 45 points on a 136-point scale. Learn more

Learn about LEED

LEED is developed, implemented and maintained with the help of the LEED Committees. Focusing more on the application of LEED, the LEED International Roundtable identifies ways LEED can better meet the needs of global users. Together, these groups include representation from a variety of industries across the country and around the globe.

USGBC is your source for up-to-date, high quality education on the rating systems. We offer a variety of ways to learn about LEED. Explore our course catalog

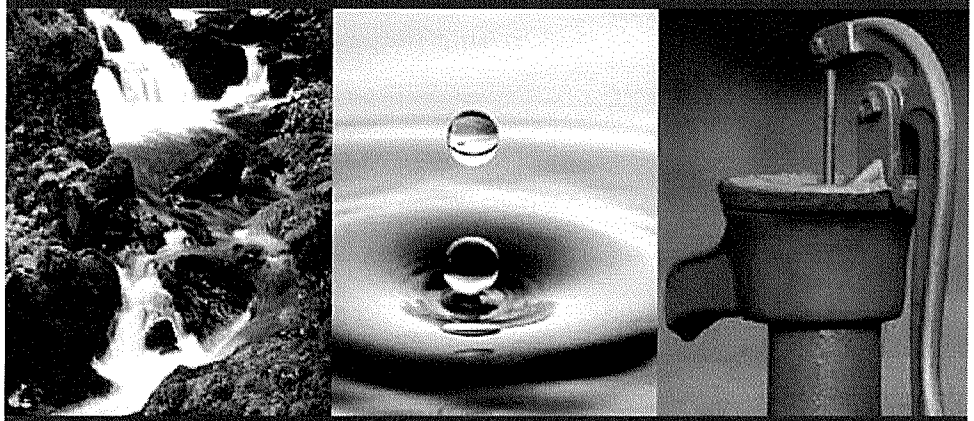
Why LEED?

LEED-certified buildings are designed to:

- Lower operating costs and increase asset value
- Reduce waste sent to landfills
- Conserve energy and water
- Be healthier and safer for occupants
- Reduce harmful greenhouse gas emissions
- Qualify for tax rebates, zoning allowances and other incentives in hundreds of cities

Thinking Beyond Pipes and Pumps

Top 10 Ways Communities Can Save Water and Money



POLIS Project on Ecological Governance
University of Victoria

By Oliver M Brandes, Tony Maas and Ellen Reynolds
University of Victoria
October 2006

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The POLIS Project on Ecological Governance, University of Victoria
October 2006

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The Water Sustainability Project

CWWA ACEPU

POLIS Project on Ecological Governance

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Table of Contents

Beyond Pipes and Pumps—A new water infrastructure

Thinking Beyond Pipes and Pumps presents an expanded definition of urban water infrastructure—one that goes beyond the existing physical infrastructure of pipes, pumps and reservoirs. This new infrastructure includes innovative physical components, water sensitive urban design and conservation programs designed to complement existing water supply networks. It emphasizes decentralized technologies and lasting local programs that inspire behavioural change. Most importantly, this new infrastructure relies heavily on building and maintaining "social infrastructure"—the planning processes, education programs, and financial and human resources needed to liberate the full potential of water efficiency and conservation, and to foster sustainable water use at the community level.

By developing such an infrastructure, water management shifts its focus beyond expensive, expansive and ecologically damaging physical infrastructure, toward dramatically increased water productivity. In this context, increasing water efficiency and conservation is more than just the right thing to do. It is the only way to address the dual goals of meeting human water demands and sustaining aquatic ecosystem health—foundations of lasting water security.

From research to action

Thinking Beyond Pipes and Pumps is intended to inspire and facilitate action. Based on three years of research by the Water Sustainability team at the University of Victoria's POLIS Project on Ecological Governance, this handbook integrates leading thinking on water conservation and sustainable water management. It is a practical resource designed for community leaders, water managers and policy makers seeking to make the case for, and promote, a comprehensive and long-term approach to water demand-side management. By illustrating the potential of this approach, it urges communities to take water security to the next step—to look "beyond the pipes and pumps" and develop new ways of managing water that offer opportunities for big savings, of both water *and* money.

WATER SECURITY

Water security means access to adequate quantities of water, of acceptable quality for human and environmental uses ... Water security for the protection of wetlands, aquatic ecosystems, and biodiversity is fundamental—not only for the well-being of these natural systems but also for human systems.

Source: Kreutzwiser, R. and R. de Loë. *Water Security: From Exports to Contamination of Local Water Supplies.* In B. Mitchell (Ed.), (2004). *Resource and Environmental Management in Canada: Addressing Uncertainty* (3rd Ed.). Toronto: Oxford University Press. pp. 166-7.

DEMAND-SIDE MANAGEMENT

Demand-side Management (DSM), or demand management, is an approach that uses policies and measures to control or influence demand for a good, service or resource. Water demand management, as a comprehensive and long-term approach, seeks to improve overall water productivity and deliver water services matched to the needs of end users.

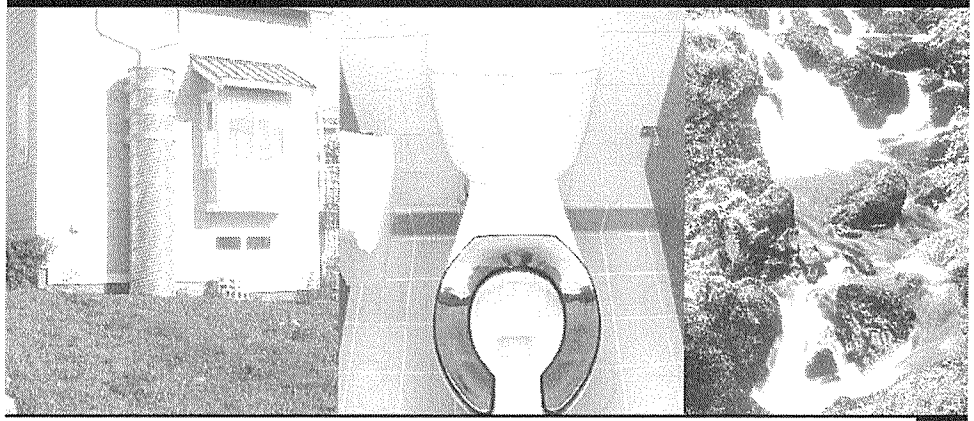
From the exclusively supply-side infrastructure of the Roman aqueduct and the modern dam... Photo of Ruskin Dam: BC Hydro.

The handbook begins with The ***POLIS Top 10***—a list of immediate opportunities for communities to take action. The list includes standard water saving measures such as metering, volume-based pricing, education and fixture rebates, along with more cutting-edge strategies such as rainwater harvesting, reuse and recycling, community-based social marketing and urban (re)design for water conservation. The *POLIS Top 10* includes valuable experiences from communities that have started down this path and are already capitalizing on innovative thinking, technologies and institutions.

Each of the *Top 10* represents an opportunity for individuals, utilities and, most importantly, communities to save water *and* money. Together, they represent a suite of actions that can be tailored to create made-at-home water management approaches on a community-by-community basis.

The second portion of the handbook establishes the context and rationale for why a new approach to urban water management is not only possible, but desperately needed. It

...to the "new infrastructure" of decentralized technologies, water conservation and healthy ecosystems. Photo (far left): UBC Design Centre for Sustainability.



Makes the Case—from both business and ecological perspectives—for integrating water efficiency and conservation into daily activities in Canadian communities. It points ***Toward Solutions*** by emphasizing the power of managing water demand as a core element of sustainable water management. And finally, it ***Looks to the Future*** of water management and presents a living example of a community-level project at the vanguard of 21st century urban planning.

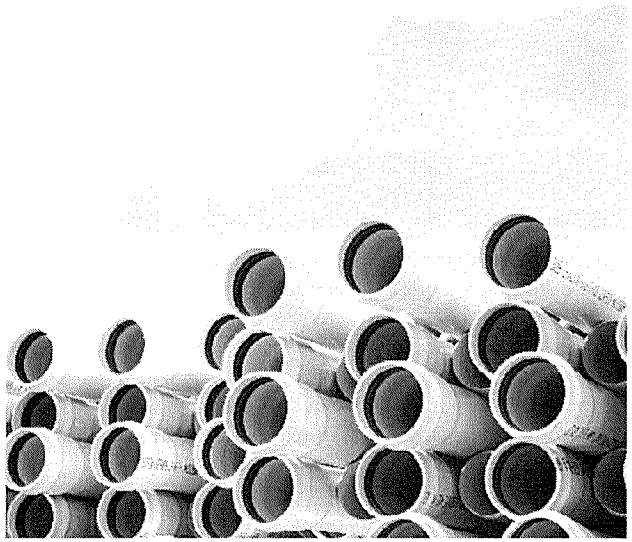
Efficiency vs. Conservation

Efficiency is a *means*, and conservation an *end*. In most cases, efficiency will allow for some conservation, but it may also serve as permission to consume. Take, for example, lawn watering: significant efficiency gains are possible with the use of low-flow sprinklers, but with more and more lawns to water, such measures simply amount to a "better way" of doing something we should not be doing in the first place. A water conservation approach questions the underlying assumption that turf-grass is the only good and desirable form of landscaping, and by doing so, opens the door to creating landscapes that require only minimal irrigation or none at all. A comprehensive approach then combines efficiency and conservation to initiate a shift in both practice and behaviour.

Efficiency is about doing things a better way. Conservation is about doing different things—such as Xeriscaping. Photo: Abkhazi Garden, Victoria, BC.

Source: Brandes, O.M. and D.B. Brooks. (2006). The Soft Path for Water: A Social Approach to the Physical Problem of Achieving Sustainable Water Management. *HORIZONS*, 9(1), p. 73.

The POLIS Top 10 — Ways communities can save water and money



Recognizing the local nature of water management challenges—that context is (almost) everything—the *Top 10* identifies critical components of any truly comprehensive water conservation program. The list is non-hierarchical—it is not in order of priority, but rather a top 10 where all the "hits" are winners.

The full potential of the *Top 10* lies in strategic integration of the many complementary and synergistic options. For example, as water prices increase and volume-based pricing encourages conservation, efficient fixtures, reuse technologies and rainwater harvesting become significantly more cost-effective and desirable. So, while specifics may vary from place to place, the general concepts of each strategy can be integrated to create an effective water conservation program for just about any community.

Each of the *Top 10* meets the following basic criteria:

- technically feasible;
- broadly applicable;
- socially acceptable; and,
- cost-effective compared to infrastructure expansion.

Presented in a quick-reference format, each *Top 10* "hit" includes a summary, key considerations and opportunities for implementation, at least one example where the practice has been put into action, and suggested first steps for utilities and local governments. Additional resources are also listed for each of the *Top 10* to assist communities as they adapt the approaches to suit local needs.

10. Fix the leaks! Reduce waste

PROBLEM:

Leaks result in significant water loss, often due to ageing infrastructure.

SOLUTION:

Detect and repair leaks by integrating regular water audits and maintenance programs.

CHALLENGES:

The financial strain on utilities of up-front costs for integrated metering programs, detection, maintenance and monitoring.

SAVINGS:

Fixing leaks can easily result in 5% to 10% water savings—upwards of 30% is possible in systems with older infrastructure.

Waste is the bane of any water utility. Leaks—or "real water losses"—are the most troubling element of what water efficiency experts call non-revenue water. Other elements of non-revenue water include "unbilled authorized consumption" for services like fire fighting, main flushing and street cleaning, and "apparent water losses" such as unauthorized consumption (i.e. theft) and metering and billing inaccuracies.[1]

According to Environment Canada, an average of 13% of municipal water is unaccounted for.[2] However, as a performance indicator, percentages are misleading because they are totally dependent on user consumption levels; percentages represent the portion of total water demand that is "non-revenue" but say nothing of the *actual volume*. The International Water Association (IWA) has developed a new approach based on their Standard Water Balance model and Infrastructure Leakage Index (ILI). The former categorizes water uses into standardized categories; the latter provides new, more representative, performance indicators. The ILI is a ratio of a community's current actual level of real water losses to the unavoidable level of real losses. In other words, it compares current real water losses to a technically achievable minimum (i.e. best practice).[3]

Wasted water also amounts to lost revenue, undermining a utility's financial viability. Leaks may also lead to infiltration of water into sewers, hampering performance and adding to operational costs for waste- and stormwater systems.

End-use leakage is also an issue—one that costs both customers and water purveyors. While many utilities use pamphlets and bill "stuffers" urging customers to check for and fix leaks, this does not mean they are actually dealt with. Indeed, leaking toilets and faucets are not uncommon occurrences in homes, office buildings and businesses.[4] All of this waste is literally money down the drain.

Leak detection & repair

In industry, leak detection and repair is common practice. Even considering the costs of repairs, it just makes sense; wasting inputs and losing output is simply bad for business. The same can be said for municipal water systems. Why pay for treatment and distribution only to let high quality water seep into the ground or trickle away?

Water audits are used to detect leaks in distribution systems and at the end of the pipe. In municipalities without water meters, system leaks are often only discovered and dealt with when water reaches the surface or property is damaged. This passive detection and reactive repair can amount to huge water losses and significant financial costs.

Environment Canada estimates that Canadian communities are losing an average of 13% of municipal water to leaks and various unmetered uses.

Metering, monitoring & maintenance

An integrated metering program that combines metering at water treatment plants with zone (i.e. neighbourhood, building complex, subdivision or campus) and end-use metering can greatly improve leak detection. More sophisticated sonic leak detection, which makes use of sound equipment to pinpoint the location of leaks, is increasingly common.

Home or end user water audits, along with preventative maintenance programs, save customers money and free-up municipal infrastructure capacity. Utilities can ensure that routine inspection and maintenance of water fixtures become everyday practices. For households, initial water savings of around 5% have been regularly reported as a result of audits.[5] For institutional, commercial and industrial (ICI) customers, audits may be more complex, but the pay-offs in both water and financial savings are also larger. To reap the long-term benefits of such pay-offs, either in home or industry, communities need to make an initial investment in implementation.

Long-term programs = long-term savings

At the system level, leak detection and repair programs may be designed and conducted by in-house staff or outsourced to a private partner. Implementation is relatively simple, requiring little or no involvement of end users. End-use leak detection is more challenging because it requires customer participation. The key to success is to make a strong public case and to provide leak detection and repair packages with information on financial savings, detection kits and repair tips. Social marketing can take this a step further, sending utility staff members door-to-door to help customers understand and fix problems. In either case, capitalizing on long-term savings requires utilities to commit staff and financial resources for ongoing programs that are built into annual budgets.

Fixing leaks in Halifax, Nova Scotia

The Halifax Regional Water Commission (HRWC) took a new approach to reducing leaks in its water distribution systems. The Commission adopted the International Water Association (IWA) methodology—the first North American utility to do so—that uses an integrated approach to water loss control. Using noise-mapping surveys and a computerized monitoring system to detect leaks allows the HRWC to pinpoint problems and immediately dispatch crews to the area. Between 1998 and 2004, the HRWC reduced water leakages in the Dartmouth and Halifax systems by 27 million litres of water a day, a cost saving of $500,000 annually.[6]

...and in Las Vegas, Nevada

The Las Vegas Valley Water District (LVVWD) monitors leaks with an underground sounding system that includes over 8000 detection units. Between January 2004 and December 2005, the system identified 540 leaks including a number of sub-surface leaks that may not have otherwise been found. The approach is estimated to save 353,224 cubic metres (93,312,000 gallons) of water per month. The total cost for replacing, treating and distributing the lost water was estimated at over US$2.2 million. The up-front cost of the equipment was US$2.15 million, with an annual operating cost of US$626,000. Comparing these figures to the cost of replacing, treating and distributing the same amount of water, the program paid for itself in less than three years.[7]

First Steps...

Utilities:

- Develop a comprehensive leak detection and system maintenance program.
- Develop a plan to implement integrated metering.

Local government:

- Require periodic water system efficiency reviews or audits.
- Revise budgets to earmark sufficient financial resources for ongoing leak detection and maintenance programs.

Resources:

AWWA Waterwiser Web site – Water Loss Control. Available at: www.awwa.org/WaterWiser/waterloss/.

AWWA Water Loss Control Committee. (2003). Applying worldwide BMPs in water loss control. AWWA Journal, 95(8) pp. 65-79.

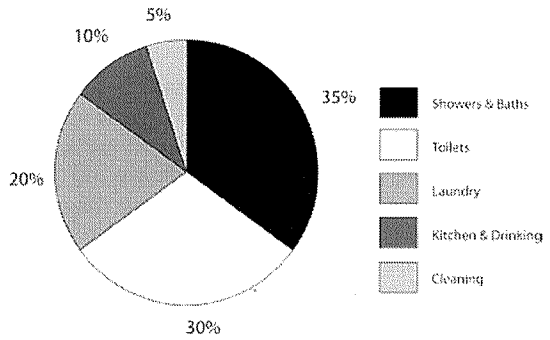
International Water Association (IWA). (2005). Leakage 2005: Water Loss Task Force Conference. Proceedings available at: www.leakage2005.com.

InfraGuide: National Guide to Sustainable Municipal Infrastructure. Available at: www.infraguide.ca.

9 • Stop flushing the future

Canadian urbanites are among the most profligate water users in the world. According to recent data, Canadians use 335 litres per capita per day[8] in and around the home, and trends suggest that because of increasing population and urbanization, total residential water use has been rising in Canada for many years.[9]

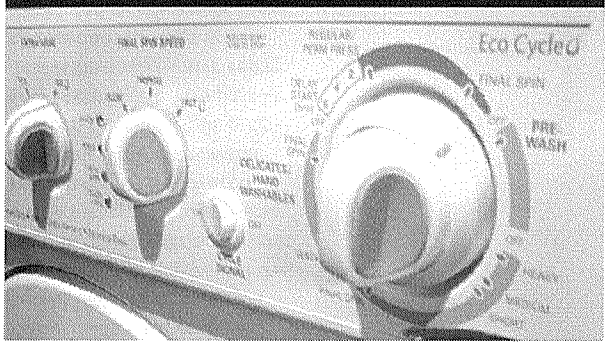
Residential indoor water use



Source: Environment Canada Freshwater Web site (Accessed August 2006). Available at: www.ec.gc.ca/water/images/manage/effic/a6f7e.htm.

Residential (or domestic) water use includes all water used within and around our homes—for everything from drinking and cooking to flushing toilets and hosing down driveways. One of the main reasons for high indoor water use is that most homes are equipped with inefficient fixtures and appliances.

Household appliances such as high-efficiency laundry machines also have the potential for big water and energy savings. Photo: R. Ruzzier



PROBLEM:

Inefficient fixtures and appliances are common in most homes.

SOLUTION:

Install efficient toilets, faucets and showerheads and water-saving dishwashers and washing machines that provide the same services using less water (and energy).

CHALLENGES:

Permissive building and plumbing codes, and a lack of incentives and resources to promote efficient technologies.

SAVINGS:

Efficient fixtures and appliances can result in indoor water savings of 33% to 50% with payback periods under two years in many cases.

Installing efficiency

Technological improvements over the past 20 years mean that we can now enjoy the same quality and reliability of service we are accustomed to, but using far less water. Table 1 outlines some of the water and energy savings associated with the "magic five" of indoor water savings—toilets, showers, faucets, laundry machines and dishwashers.

Table 1 - The 'magic five' of indoor water savings

End use	Model	Water use	Water & Energy Savings[1]
Toilet	Ultra-low-flow	6 litres per flush	Water: 30-80 lcd
	High Efficiency Toilets (HETs) use 20% less than ULFs and are usually dual flush or pressure assist models	Less than 4.8 litres per flush	Water: 24-64 lcd
	Composting	Negligible	Water: 60-110 lcd
Showerhead	Low-flow	9.5 litres per minute	Water: 10-40 lcd Energy: 0.4-1.8 kWh/cd
Faucet	Low-flow	9.5 litres per minute	Water 6-40 lcd Energy: 0.4-0.8 kWh/cd
Laundry Machine	High-efficiency	60-102 litres per load	Water: 17-40 lcd Energy: 0.5-1.0 kWh/cd
Dishwasher	High-efficiency	26.5 litres per load	Water: 1-3 lcd Energy: 0.4-1.4 kWh/cd

Source: Vickers, A. (2001). *Handbook of Water Use and Conservation: Homes, Landscapes, Businesses, Industries, Farms.* Amherst, Massachusetts: WaterPlow Press. pp. 115-126.

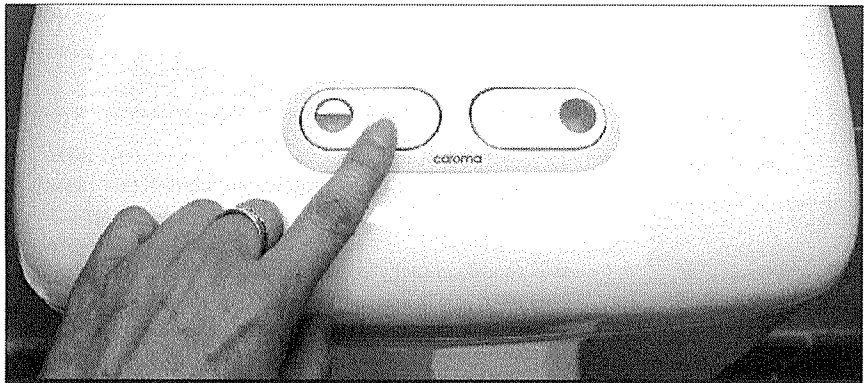
Toilets offer the greatest potential for indoor water savings. Conventional models use 13 litres per flush (lpf), with older models using 20 or more. By contrast, Ultra Low Flush (ULF) models use only 6 lpf, and newer High Efficiency Toilets (HETs) have average flush volumes of less than 4.8 litres and provide similar (and in some cases better) performance at comparable prices.[10]

Older showers and faucets are also big water wasters. Efficient models of both have proven performance records and are readily available at costs comparable to conventional models. Efficient showerheads also save energy and reduce heating costs. So, a new $10 showerhead can save a household around $10 to $15 in water and $20 to $50 in energy costs per year.[11]

Combined impacts are where the real savings become apparent. Installing a 6 lpf toilet, an efficient showerhead and a faucet aerator is estimated to reduce indoor water use by about 35%, representing a potential 30% total reduction of in- and outdoor water use in a typical household.[12]

Household appliances such as laundry machines and dishwashers also have the potential for big efficiency gains. Replacing conventional laundry machines with high efficiency models, such as front loaders, can reduce water demand per load from a range of 148 to 212 litres down to 60 to 102 litres (i.e. using less than half the amount of water). Front loaders work more efficiently by tumbling clothes on a horizontal axis through a smaller pool of water than more common top loading machines. Similar efficiency gains are

[1] Lcd = litres per capita per day; kWh/cd = kilowatt-hours per capita per day.



Dual flush models are considered High Efficiency Toilets (HETs) and typically use 6 litres per flush for the full flush and 4.2 litres or less for the reduced flush (on average less than 4.8 litres per flush). Photo: E. Reynolds.

possible with water-saving dishwashers, which are competitively priced compared to less efficient models, but use only a fraction of the water.

Incentives for end users

Getting these water-, energy- and money-saving technologies off the shelf and into use is often the greatest challenge. In some cases, this happens naturally as older, inefficient models break down or fall out of fashion. However, for most of the technologies discussed above, brand new inefficient models are still readily available, so the trick is to get the most efficient ones—not just any new ones—into action.

Fixture give-aways can be economically feasible. Low-flow showerheads are the best example of a relatively inexpensive fixture that results in significant water savings. Showerheads and faucet aerators are often included in free water efficiency kits offered by municipalities.

For more expensive technologies such as toilets and washing machines, financial incentives may be required to encourage replacement of water wasting models. Rebates, which typically range from $40 to $150 per unit, shorten the payback period and increase the penetration of water-efficient models. In the same way, pricing changes—discussed in depth later—are also powerful financial incentives to get water-efficient technologies off the shelf and into use.

Making it law

Other more direct options help ensure that only water-saving technologies are used, including legal tools such as by-laws and building and plumbing codes to restrict the use of inefficient models. Ontario's building code, for example, stipulates that toilets in all new housing must use 6 litres or less per flush to pass inspection.

Innovative legal tools have been introduced in some areas requiring homes to undergo water fixture inspections and replacement on resale. Before a real estate deal can be finalized in parts of the United States, sellers must have their properties inspected to ensure that fixtures—toilets, showerheads and faucets—meet water efficiency standards.

Installing efficiency in Alberta & British Columbia

Many successful examples of fixture replacements exist, some encompassing entire communities. For example, Cochrane, Alberta, reduced water consumption by 15% and deferred a multi-million dollar pipeline by giving away toilet dams, low-flow showerheads and faucet aerators.[13] Others like the Sylvia Hotel, in Vancouver, BC, target high-use sectors or customers. This 90-year-old, 120-room hotel replaced toilets, showers, urinals and installed aerators. The result was a 47% reduction in water use, not to mention the added benefit of increased customer satisfaction.[14]

Recently, the Sunshine Coast Regional District (SCRD) in BC began an aggressive Bathroom Fixture Replacement Program in partnership with the fixture manufacturer Caroma. Residents of Sechelt, Gibsons and other SCRD communities can swap up to two of their 13+ litre toilets for dual flush toilets and receive low-flow showerheads and faucet aerators all professionally installed free of charge (a $500 value). By the end of 2006, 1400 households in the district will have fixture replacements in up to two bathrooms per household.[15]

First steps...
Utilities:

- Develop and implement cost-effective fixture replacement programs, such as shower and faucet giveaways, and toilet and appliance rebates.

Local government:

- Enact by-laws that require tested and approved high performance water-saving technologies in new buildings or renovations requiring a permit.
- Enact by-laws requiring home water audits and retrofits with every house resale.

Resources:

Canada Mortgage and Housing Corporation (CMHC). (2000). *Household Guide to Water Efficiency: Homes, Landscapes, Businesses, Industries, Farms.*

Canadian Mortgage and Housing Corporation (CMHC). *Dual flush Toilet Testing. Technical Series 02-124.* Available at: www.cmhc.ca.

Vickers, A. (2001). *Handbook of Water Use and Conservation.* Amherst, MA: WaterPlow Press.

Water Wiser – The Water Efficiency Clearinghouse Web site: www.waterwiser.org.

Veritec Consulting Inc. & Koeller and Company. (2006). *Maximum Performance (MaP) Testing of Popular Toilet Models. (7th Ed.).* Available at: www.cwwa.ca.

8. Make managing demand part of daily business

When planning water supply projects such as raising dams, expanding distribution systems and upgrading treatment facilities, municipalities turn to engineering and construction professionals—the right people for the job. In the same way, effective demand-side management (DSM) programs require staff with the right skills. What often happens, however, is that program design and administration gets tacked onto the responsibilities of municipal water engineers—not necessarily the right people for the job. As noted by Rob de Loë, Canadian Research Chair in Water Governance, "Venturing into the institutional and educational realm is often difficult for managers who have been trained exclusively in engineering aspects of municipal water supply."[16]

To realize the full potential of water efficiency and conservation, managing demand must become part of daily business. Yet despite growing popularity, in most municipalities demand management programs are still viewed and treated as stop-gap measures designed to buy the time needed to increase supply. This often results in ad hoc programs that are understaffed and under-funded, and that eventually under perform.

Advantages of dedicated DSM staff

Conservation staff can:

- reduce water use more effectively through improved planning and implementation of long-term DSM programs;
- design, implement and enforce water rationing programs in periods of drought, or when water demands threaten to exceed available supply;
- build relationships with the community and help guide the planning and implementation of DSM programs that require citizen participation;
- monitor and adapt DSM programs over the long term;
- gather and analyze information about local patterns of water use.

Source: Brandes, O.M. and K. Ferguson (2004). *The Future in Every Drop: The benefits, barriers, and practice of urban water demand management in Canada.* Victoria, BC: The POLIS Project on Ecological Governance at the University of Victoria. p. 25. Available at: www.waterdsm.org

PROBLEM:

Current approaches to demand management are often not comprehensive enough, and are rarely part of daily business in most communities.

SOLUTION:

Implement permanent water conservation programs and hire permanent staff with technical skills and understanding in fields such as economics, psychology and education.

CHALLENGES:

For utilities to commit the financial and institutional resources to hire demand management professionals and create long-term (10 years or more) water conservation programs.

SAVINGS:

The sky is the limit, based on the aggressiveness and creativity of the programs.

DSM programs & professionals

Making demand management part of everyday business means developing the capacity to design and implement long-term, comprehensive programs. In the modern information and knowledge economy, good water infrastructure is as much about the tangible as the intangible. Pipes, pumps, concrete and steel are critical parts of our urban water system, but so are the programs and initiatives that manage water demand.

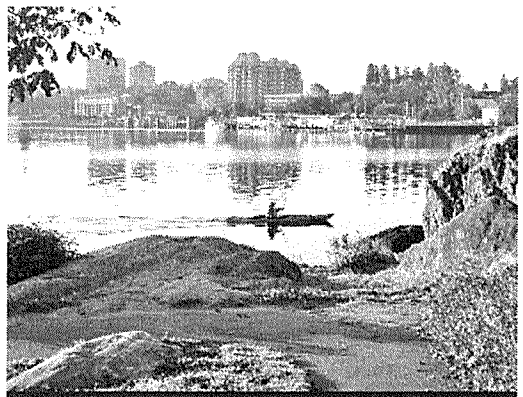
Managing water demand involves a complexity that differs from supply-side management and projects, and requires professionals with specific training, skills and resources. Traditional disciplines of water management—primarily engineering and the natural sciences—are important to maintain safe, reliable urban water infrastructure. However, to effectively manage the demand on infrastructure requires an expanded disciplinary perspective. Demand management professionals draw heavily on the social sciences, integrating expertise from economics, psychology, sociology and education.

Investing in such professionals is critical to effective urban water management in the 21st century. Programs that promote water conservation and begin to instil a lasting water ethic require dedicated human and financial resources to develop.

Money, resources & commitment

Finding the financial resources to hire staff and maintain such programs is often the biggest challenge, particularly for smaller communities. Many innovative financing opportunities exist—from taxes on water use to changes in water fee structures and special levies on developers or industrial users. For smaller communities, creating regional DSM staff positions supported by the provincial or federal government may also be an option.

Despite the initial cost, it is important to remember that creating dedicated demand management positions will translate into significant financial benefits. Hiring people to cut demand now reduces future operating costs and the expense of infrastructure expansion. Over the longer term, municipalities could finance such positions through the cost savings they achieve. For example, the campus sustainability office at the University of British Columbia (UBC) is operated on money saved through energy and water savings—an approach that could be adapted to municipalities to support water conservation positions.



The Capital Regional District in Victoria, BC, is emerging as a regional water conservation leader with its efforts to make demand management part of everyday business.

Dedicated DSM professionals in Calgary, Alberta

Responding to a booming population and a limited water supply, water managers in the city of Calgary have developed one of Canada's most elaborate water efficiency programs that includes six staff members supported by communication and customer service personnel. Initiatives target residential, commercial and civic water use and range from educational campaigns to technology rebate programs to repairing leaks in city water mains. The program takes a broad-based approach, with elements designed to foster change both in the water system and in social behaviour. Programs fall under seven theme areas: leading by example; aligning policy with conservation objectives; source substitution; technology retrofit and incentives; providing technical assistance; developing a water ethic; and community outreach.[17]

First steps...

Utilities:

- Create permanent DSM staff positions that are integrated with utility operations, finance and planning departments, and strategic decision making.

Local government:

- Promote the benefits of managing demand as a core part of day-to-day water management.
- Provide financial and staff support to utilities to encourage a long-term commitment to water conservation programs at the community level.

Resources

W.O. Maddaus and L.A. Maddaus. (2006). *Water Conservation Programs – A Planning Manual.* AWWA Manual of Water Supply Practice – M52. Denver, CO: American Water Works Association.

Brandes, O.M. and K. Ferguson (2004). *The Future in Every Drop: The benefits, barriers, and practice of urban water demand management in Canada.* Victoria, BC: The POLIS Project on Ecological Governance at the University of Victoria.

The POLIS Project on Ecological Governance – Water Sustainability Project Web site: www.waterdsm.org.

InfraGuide: National Guide to Sustainable Municipal Infrastructure. Available at: www.infraguide.ca.

7. Link conservation to development

"What we do on the land shows up in the water" is a common adage in watershed planning. Threats to water quality come immediately to mind, such as agricultural chemicals running off the land or urban pollutants finding their way into the water system. Equally concerning are the impacts of development on the water cycle—on how much water is used, and on the size and capacity of urban water infrastructure. Yet the connection between urban design and water use receives little attention in development and infrastructure planning. As a result, few financial incentives exist to ensure that water conservation is considered as *part of* urban development or infrastructure upgrade and repair.

Linking conservation to funding & permits

Linking funding for development to demand management is a sure-fire way to encourage conservation. Communities can apply innovative "water offset" by-laws to building permits, requiring proof that any additional water demand resulting from new development is off-set by reducing water use in existing homes (or businesses) with water efficiency measures. This helps to ensure that all "new" water is tapped from conservation and that growing communities stabilize their "water footprint" and acknowledge that limits to growth do exist.

Infrastructure funding provides another opportunity to promote conservation. Availability of capital, in the form of funding transfers from senior governments to municipalities, is a driving force in all infrastructure investment decisions. The process for assessing grants, along with contingencies placed on their approval, can provide strong incentives for conservation—and can simultaneously eliminate current disincentives or perverse supply-side subsidies. Federal and provincial grants for upgrading water and sewage treatment infrastructure represent substantial sums of money. The motivation for communities to conserve water would increase significantly if these funds were allocated only when applicants show proof of an acceptable level of action on demand management. This is currently the practice in British Columbia.

Implementing & enforcing incentives

The main challenge in levering infrastructure funding to promote water conservation is to ensure that senior governments consistently implement and enforce conditions. Agencies that provide and administer funding for major infrastructure projects could

PROBLEM:

The current process for funding urban water infrastructure does not promote conservation and innovation.

SOLUTION:

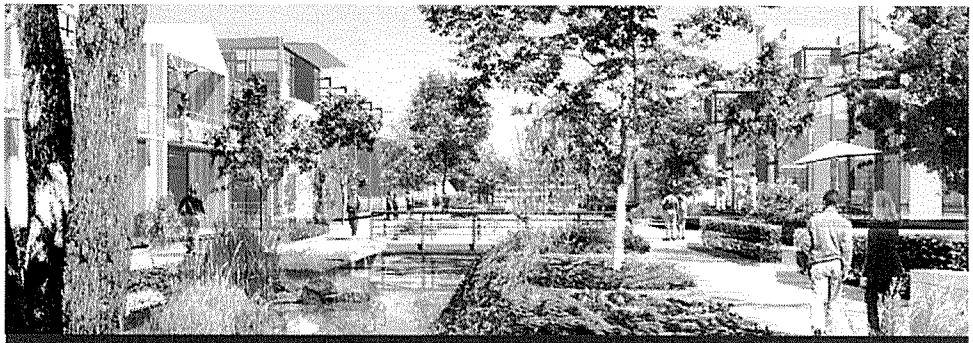
Link conservation to development by making water infrastructure funding and development permits contingent on demand management planning and action.

CHALLENGES:

Local resistance to conditional funds or permits; enforcement and follow-up on conditional funding agreements to ensure implementation.

SAVINGS:

Water savings of 20% to 30% can be readily achieved in many communities using off-the-shelf technologies and modest water pricing reforms.



Dockside Green development in Victoria, BC, is becoming a global showcase for large-scale sustainable development. Illustration: Dockside Green Ltd.

enforce conditional water conservation plans by withholding future funds until conservation efforts are demonstrated. In response, municipalities can offer regulatory support and incentives such as tax benefits or administrative streamlining for cutting-edge developments that result in conservation activities in other parts of the community.

Taking this approach a step further, rather than making infrastructure funding *contingent on* demand management, senior governments could earmark funding or offer low-interest loans *specifically for* demand management programs. A revenue-neutral approach for provincial and territorial governments is to simultaneously reduce grants for infrastructure expansion while increasing grants for demand management programs.

Conservation incentives in California

In Morro Bay, California, builders are required either to pay a standard hook-up fee for new developments, or to retrofit existing houses to the point that the reduction in water use matches the water requirements of the new development.[18]

First Steps...
Local government:

- Require that all new developments and retrofits of existing buildings and homes make use of the best available water conservation technologies.

Senior government:

- Change the eligibility requirements for infrastructure funding to make it contingent on achieving specific water conservation goals.
- Establish funding specifically for comprehensive and integrated demand management programs.

Resources:

POLIS Project and Friends of the Earth Canada. (2004). *Federal Fiscal Policies to Link Infrastructure Funds to Water Demand Management Programs.* Briefing note to the Prime Minister of Canada, March 2004. Available at: www.waterdsm.org

Environmental Protection Agency (EPA) – Water Conservation Plan Guidelines. Available at: www.epa.gov

6. Price it right

Canadians rank among the world's highest per capita water users, which is not surprising given that municipal water rates rank among the lowest of all developed countries.[19] Low water prices encourage wasteful use, artificially increase demand and provide little incentive for efficiency improvements. This pricing problem also leads to overcapitalization of water systems—an inefficient use of scarce public funds.

In almost all cases, Canadian water rates fail to reflect environmental costs, and in many cases, rates do not even reflect the full financial costs of providing the service. Although "full costs" are ultimately paid one way or another—most commonly through property and business taxes—shifting the full costs into water prices encourages conservation by revealing the cost to customers. An easy way to better reflect the full costs in water pricing—and to promote conservation—is to include sewage fees in water bills.

Better water pricing

The problem is not only with the price of water, but also with pricing structures. Recent research suggests that water demand is equally sensitive to changes in pricing structures and changes to water prices.[20] A set price or flat rate—common in approximately 40% of Canadian communities[21] —is considered to be the least effective pricing structure for reducing demand. Think of an all-you-can-eat buffet; once you pay your fee, you tend to over indulge. Flat-rate water pricing has a similar effect.

Under flat-rate structures—where the fee is independent of water use—end users consume significantly more than if they pay by the volume they use. This relationship is supported by compelling evidence: on average, those Canadians paying flat rates use 74% more water than those under volume-based structures.[22] Volume-based pricing can be made even more effective by increasing the price as the volume used increases.

Many experts believe that without correct price signals little chance exists to change behaviour.[23] Together, *the carrot* (water pricing that better reflects the full cost to the utility and society of providing the service) and *the stick* (price structures that penalize consumptive behaviour) are a foundation

PROBLEM:

Canada's current water prices and predominant pricing structures promote wasteful use and reduce cost effectiveness of water-efficient technologies.

SOLUTION:

Implement "full cost" prices with volume-based pricing structures that reflect the importance and value of water to promote conservation, and that ensure equitable access.

CHALLENGES:

To implement metering and gain political support to increase water prices and change pricing structures while ensuring full access to basic water needs.

SAVINGS:

Effective water pricing can result in upwards of 20% water savings over the long term and can create incentives for development of innovative conservation technologies and practices.

Table 2 - Conservation-oriented pricing

Approach	Description	Impact
Uniform rates	Price per unit is constant	Reduces average demand
Increasing block rates	Price per block increases as consumption increases	Reduces both average and peak demand by providing increasing incentive to reduce waste
Seasonal rates (for drought periods)	Prices during peak periods (e.g. summer) are higher	Sends stronger signal during period of peak demand or low water availability
Excess-use rates	Prices significantly higher for above-average use	Can target excessive users thus reducing peak demand
Indoor/outdoor rates	Prices for indoor uses are lower than are prices for outdoor uses	Reduces seasonal peak demand which is mainly from outdoor use and is considered more responsive to price changes
Feebates	High water users pay a premium that is distributed to those who use less	Promotes revenue neutrality and provides incentives by penalizing heavy users and rewarding low users

of any conservation program. Table 2 outlines a range of conservation-oriented pricing approaches and their impacts on managing water demand.

Installing meters, implementing change

Metering is essential for the adoption of any volume-based pricing structure. Some analysts report that metering alone, without any changes to pricing, can result in water use reductions of 10% to 40%.[24] However, without a corresponding shift to volume-based pricing, metering may not sustain this initial level of savings as water use often rebounds to varying degrees after the installation of meters.

The primary driver for creating a conservation-based rate system is to encourage efficiency and reduce water use. The goal need not be limited to recovering costs. Conservation-based pricing implies that prices should be high enough to promote behaviour change and the uptake of new technology. However, the importance of equitable access to water and revenue neutrality to secure political support for changes cannot be overstated. Equity can be addressed through *lifelines*—a structure that provides the first block of water at low or no cost to all consumers to ensure basic human water needs are met. Dealing with revenue neutrality requires a strategic plan, and the support of community leaders to put it into action.

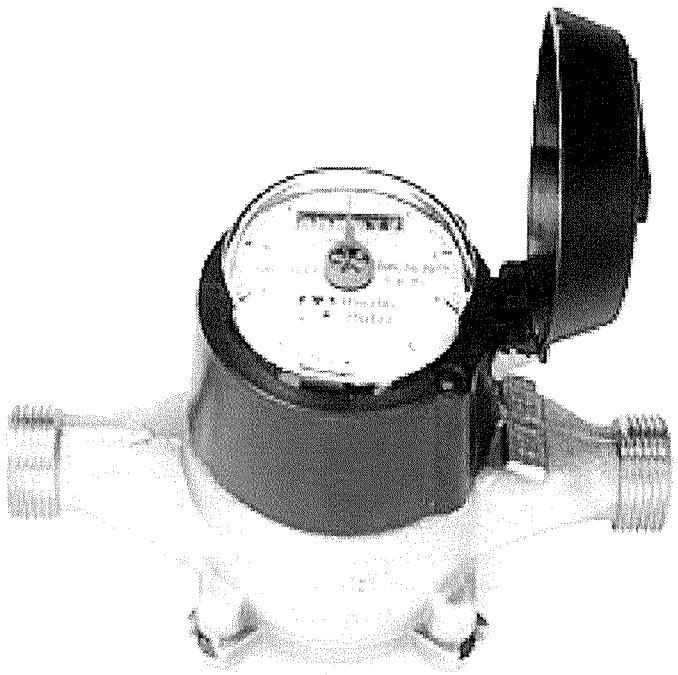
Politics - The BIG challenge

Although managing a volume-based pricing system requires more administration, the biggest challenge is generating political support. Making the move to conservation-based pricing takes strong political leadership—a challenge because the benefits of cheap water are generally taken for granted, and the consequences of not changing pricing are easily ignored. The key is to achieve broad community support through education and available water conservation opportunities. For example, if water prices doubled, with volume-based pricing, implementing new technologies could cut demand in half and the customer's water bill would remain the same.

Volume- or conservation-based pricing may also result in less stable revenue streams for municipalities. While this is understandably unpopular, a variety of strategies can be used to compensate for the increased revenue uncertainty. Examples include regular rate reviews (i.e. fine tuning), contingency funds, and legal instruments requiring that excess revenue be invested in customer conservation technologies, or to offset future revenue shortfalls and reduce future rates.

Price drives innovation

Conservation-based pricing strategies also foster innovation and market transformation. Increasing the market for water-efficient technologies promotes further research and development and stimulates new industries to provide technological solutions. Indeed, it has been suggested that much of the technology required to achieve an "optimum state of conservation" may not be discovered unless the correct signals are provided through social institutions such as appropriate pricing.[25]



Metering is essential for the adoption of any volume-based pricing structure. Some analysts report that metering alone can result in water use reductions of 10% to 40%.

Changing water pricing is not a silver bullet solution. In fact, changing pricing without providing customers with guidance on how they can decrease their water use, and education about why such changes are needed, will likely be met by stiff opposition. That said, pricing measures are critical to comprehensive and integrated demand management programs.

Finding a better price

...**around the world:** The OECD found that metering combined with volume-based pricing was one of the most effective measures for water conservation, with water use reductions ranging from 20% in Copenhagen, Denmark and 33% in Gottenberg, Sweden, to 41% in Toowoomba, Australia, and 45% in Philadelphia, USA.[26]

...**in the United States:** Irvine Ranch Water District (IRWD) in California replaced its flat rate-per-unit charge with an increasing block-rate structure in 1991. IRWD's rate structure represents an aggressive approach to promoting conservation and has formed the foundation of a larger water conservation program linked with an existing water recycling and reuse program. In the six years following implementation of the rate structure, a 12% reduction in water use was observed for the residential water use customer group.[27]

...**and in Canada:** The SEKID (South East Kelowna Irrigation District) project near Kelowna in the Okanagan Basin, British Columbia, reduced agricultural water allotments by 27% per year over a five-year period through an increasing-block pricing system.[28]

First steps... Utilities and local government:

- Work together to secure the political and financial support for universal metering and appropriate volume-based and equitable pricing structures suited to local conditions.

Senior government:

- Provide funding for universal metering.
- Provide research data and support to communities seeking to customize pricing structures to local conditions.

Resources:

InfraGuide: National Guide to Sustainable Municipal Infrastructure (2006). *Water and Sewer Rates: Full Cost Recovery.* Available at www.infraguide.ca/lib/db2file.asp?fileid=4903

Canadian Water and Wastewater Association. (1994). *Municipal Water and Wastewater Rate Manual.* Ottawa: CWWA. Available at: www.cwwa.ca.

Canadian Water and Wastewater Association. (1997). *Municipal Water and Wastewater Rates Primer.* Ottawa: CWWA. Available at: www.cwwa.ca.

Want, Y.D., W.J. Smith Jr. and J. Byrne. (2005). *Water Conservation-Oriented Rates: Strategies to Extend Supply, Promote Equity, and Meet Minimum Flow Levels.* American Water Works Association (AWWA).

The California Urban Water Conservation Council. (1997). *Designing, Evaluating and Implementing Conservation Rate Structures.*

5. Plan for sustainability

In most communities, demand management programs are developed on an incremental basis with little regard for long-term planning. The tendency is to start with low-cost and politically acceptable measures such as public information and watering restrictions. This short-term and ad hoc approach is the result of narrow planning time frames—usually 2 to 3 years—aligned with electoral cycles and established to develop political capital by demonstrating concrete results in a short period.

Reaching the full potential of water conservation requires comprehensive and long-term strategic planning. Indeed, in many cases, supply-side infrastructure expansion can be avoided through long-term demand management planning and strategic implementation.

Planning for sustainability

Planning for sustainability ensures that ecosystem health and water conservation are foundations of planning processes and outputs. Taking a comprehensive approach to planning can help water providers catalogue existing efforts, refine them to ensure maximum benefits, and identify new opportunities to reduce water use. Ultimately, planning can help utilities and local jurisdictions manage competing water-related goals, including implementing stringent water quality standards; meeting infrastructure needs; and mitigating the impacts of climate change, population growth, and the increasing demand for water.

Conventional water planning processes tend to isolate water managers—those who carry out the planning—from others such as industry representatives, homeowners and facility operators. But the tools of demand management—education, legal instruments, pricing and small-scale, decentralized technologies—require more interaction with end users than supply-side approaches. This makes demand management a prime candidate for collaboration. Stakeholder participation in both planning and implementation is critical to a successful demand management program. As Wallace et al. suggest, "The hope for achieving sustainability in water management lies in the establishment of interdependent, community-based partnerships and increased stakeholder involvement."[29]

PROBLEM:

Most water conservation programs are viewed as short-term efforts to buy time until the next water source can be found and developed.

SOLUTION:

Initiate strategic water planning that looks 10 to 50 years into a community's future, involves all stakeholders, and places ecological health at its core.

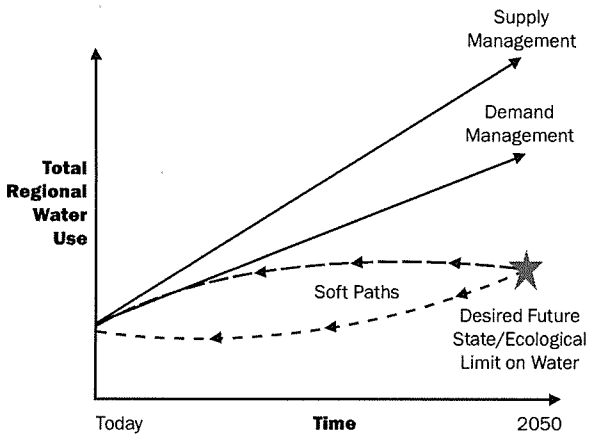
CHALLENGES:

To look beyond the electoral cycle and invest in programs that may take years before significant returns are achieved; to engage the community in planning and implementation.

SAVINGS:

Planning for sustainability may avoid many unnecessary costs; an effective water conservation program can result in water savings of 20% to 50%.

Planning for the Future with a Soft Path Approach



'Backcasting' to a sustainable future

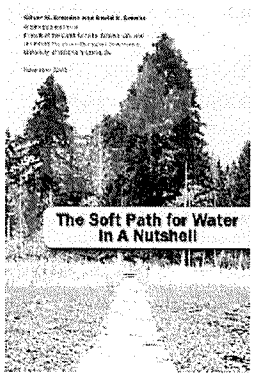
Rather than forecasting into an uncertain future by extrapolating from the past, the soft path relies on backcasting. This approach to planning starts by envisioning a desired future that reflects human needs and ecological limits. After determining what water might be available—considering the ecologically and socially acceptable limit on withdrawals—planners work backward to find feasible paths to meet long-term social and economic needs.

Source: Brandes, O.M. and D.B. Brooks. (2005). *The Soft Path for Water in a Nutshell.* Victoria, BC: The POLIS Project on Ecological Governance and Friends of the Earth Canada. Available at: www.waterdsm.org.

The 'soft path' for water

The "soft path" for water is a holistic approach to water management that takes demand management to the next level by planning *for* sustainability. The soft path differs fundamentally from conventional, supply-focused water planning beginning with its conception of water. Conventional planning treats water as an end product; by contrast, the soft path views water as a means to accomplish certain tasks. This liberates water planners to explore innovative solutions to *manage* demand rather than simply delivering more water to *satisfy* demand.

Developing scenarios that demonstrate the water saving potential of different management approaches—or packages of demand management measures—is central to soft path planning. Scenario planning can also promote wider community engagement and dialogue around water sustainability.



Core principles of the soft path approach

- Nest human water demands within local eco-hydrological limits
- Focus on providing services rather than water per se
- Maximize productivity of water withdrawals
- Match the quality of water supplied to quality required by end use
- Strive for open, democratic, participatory planning
- Backcast—planning backward to connect a desired future state to present conditions

For most communities, a straightforward starting point may be "no new water until 2050." This allows the utility, with community involvement, to envision what programs can be initiated today to defer additional infrastructure needs for at least a generation.

As with any strategic planning, this type is not a one-off event; plans must be regularly revisited through an iterative cycle of implementation, monitoring and assessment.

First steps... Utilities and local government:

- Make an official commitment to long-term (10 to 50 years into the future) strategic planning that focuses on water conservation, community participation, and living within the local water budget.

Resources:

Brandes, O.M. and D.B. Brooks. (2005). *The Soft Path for Water in a Nutshell.* Victoria, BC: The POLIS Project on Ecological Governance and Friends of the Earth Canada. Available at: www.waterdsm.org.

Brooks, D.B. (2005). Beyond Greater Efficiency: The Concept of Water Soft Paths. *Canadian Water Resources Journal,* 30(1), pp. 83-92.

Gleick, P.H. (2003). Global Freshwater Resources: Soft-Path Solutions for the 21st Century. *Science,* 302, pp. 524-528.

Gleick, P. et al. (2003). *Waste Not, Want Not: The Potential for Urban Water Conservation in California.* Oakland, California: Pacific Institute for Studies in Development, Environment, and Security. Available at: www.pacinst.org.

4. Look to the sky – Rainwater as the source

PROBLEM:

Communities are missing out on using rainwater as a valuable water source.

SOLUTION:

Promote decentralized infrastructure to harvest rainfall and create outdoor (Xeriscaped) spaces that rely primarily on precipitation for irrigation.

CHALLENGES:

Building and plumbing code restrictions; the financial burden of rainwater harvesting infrastructure for homeowners and builders; the enduring legacy of sprawling lawns that exists in most Canadian communities.

SAVINGS:

Rainwater harvesting and Xeriscaping can result in 50% savings in outdoor water, and rainwater harvesting can save up to 40% of water indoors (for toilet flushing and washing clothes).

The prevailing landscape aesthetic in North America, and perhaps the most influential factor affecting outdoor residential water use, is the lush green lawn.

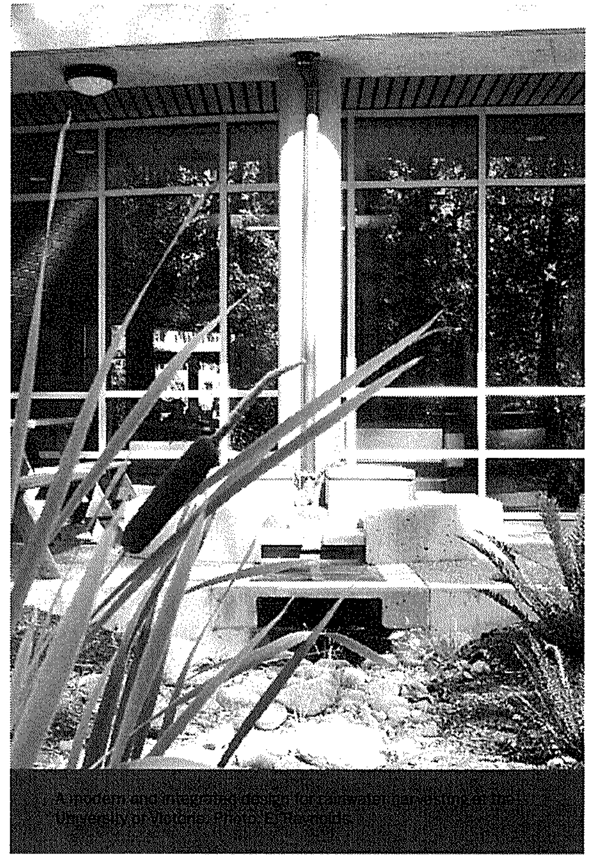
A typical suburban lawn requires up to 100,000 litres of water—over and above rainfall—during the summer season. Depending on season, location and climate, this represents anywhere from 30% to 75% of total residential water demand—about 20% of the total for the average household.[30] Also, overuse of fertilizers and pesticides (often associated with standard lawn care) can lead to surface- and groundwater contamination, threatening drinking water supplies and ecosystem health.

In most communities, outdoor water use is the primary factor contributing to peak demand, and consequently putting pressure on infrastructure capacity. In some regions, total municipal water use may double or more during the summer months because of outdoor watering.[31] For this reason, outdoor water demand during the summer should be one of the main targets of water conservation programs.

Looking to the sky

In some countries, rainwater collected from roofs or other impermeable surfaces is a viable source of water for outdoor irrigation, and for many indoor uses such as laundry washing or toilet flushing.[32] Yet in Canadian cities, with average precipitation rates ranging from about 260 to 1500 millimetres per year,[33] rainwater harvesting is vastly underused, resulting in missed opportunities to save 40% to 50% of the water currently used around the home.

Rainwater harvesting systems for residential use are gaining acceptance in North America, and are already well-established in Australia, Europe and throughout the Middle East. In Hong Kong, skyscrapers collect and store rainwater to supply the buildings' water requirements, and the island of Bermuda has relied on rainwater cistern systems as the primary source of residential water supply for some 300 years.[34]



A modern and integrated design for rainwater harvesting at the University of Victoria. Photo: E. Reynolds

Technologically, rainwater harvesting systems are relatively simple and can often be assembled by homeowners or builders with readily available materials and a basic understanding of plumbing and construction.[35] A typical system consists of a collection system (i.e. roof, gutters and downspouts), a cistern or storage tank, a delivery mechanism (i.e. gravity or pump) and filters to treat the water. They can range in size from rain barrels to larger systems with cisterns or storage containers constructed of polyethylene, galvanized steel or concrete. A typical 45,400-litre system, installed and winterized on Canada's West Coast, would cost approximately $13,000 in polyethylene, $17,000 in galvanized steel and up to $25,000 in concrete.[36]

This relatively simple technology can result in significant water savings. For example, with as little as 20 to 30 millimetres of monthly rainfall (a dry climate), a typical roof could still collect enough water to irrigate 25 to 40 square metres of lawn or garden area or flush an efficient toilet for a month—saving approximately 121 litres per capita per day.[37]

Benefits of rainwater harvesting

Rainwater harvesting is more reliable and cost-effective than many centralized options. Beyond enhancing local water security and potentially reducing costs, benefits include:

- reduced environmental impacts associated with reduced demands on centralized water systems and water sources;
- improved urban stormwater quality;
- reduced erosion and flooding associated with high rainfall; and,
- deferred or reduced requirements for centralized infrastructure and operations for water, wastewater and stormwater.[38]

The economic argument for rainwater harvesting is particularly compelling. Researchers

in Australia found that using rainwater tanks in dryer regions such as the Lower Hunter and Central Coast deferred infrastructure needs by 28 to 100 years—with savings of $78 million in Lower Hunter and $47 million in the Central Coast. Wetter areas like Sydney or Brisbane yield even greater water savings.[39] The key to success in these examples is not just to provide water for outdoor uses such as garden watering, but also to make rainwater available for toilet flushing, laundry and hot water—thus constantly drawing down the rainwater tanks.

Xeriscaping: The new urban landscape

Xeriscaping, a trademark term used to describe a form of *dry landscaping*, is another water conservation option that looks to the sky for its water source. While most outdoor demand management measures seek to improve irrigation efficiency, Xeriscaping actually conserves water by landscaping with drought-resistant plants to reduce water use and loss to evaporation and run-off (see Table 3).

Plants are grouped by *hydrozones* (i.e. plants with similar water requirements), allowing for more efficient watering according to plant needs. The most drought-tolerant plants are used as wind breaks to shelter less hardy plants. *Natural landscaping* is a similar approach which relies only on drought-resistant *native* plants to virtually eliminate supplemental watering (i.e. beyond precipitation) except in extreme drought. Experience indicates that Xeriscaping can reduce outdoor residential water use by over 50% while maintaining the visual appeal and seasonal change of standard landscaping.

Table 3 - Typical outdoor irrigation water use savings

Method	Savings in outdoor irrigation water use
Improved irrigation technology: Automatic shutoff nozzle on hose Rainfall shutoff device on automatic irrigation systems Drip irrigation system	 5-10% 5-10% 25-75% (of non-lawn irrigation)
Water-wise landscape planning and design (e.g. Xeriscaping)	20-50% (potentially to 100%)
Reduced lawn area	15-50%
Use of native and low-water-use plants	20-30%
Comprehensive audit	10-15%

Source: Vickers, A. (2001). *Handbook of Water Use and Conservation: Homes, Landscapes, Businesses, Industries, Farms*. Amherst, Massachusetts: WaterPlow Press. pp. 152-200.

Code restrictions & up-front costs

The primary barriers associated with rainwater harvesting are building and plumbing code restrictions, high initial costs, and misperceptions about water quality. Currently, most provincial plumbing codes do not allow non-potable, non-municipal water supplies into dwellings. Additional meters would also be required for appropriate sewage billing where wastewater charges are based on metered municipal water supply.

Overcoming the barriers and promoting this "off the grid" water supply option requires municipalities to take an active role. Using financial incentives to overcome the short-term financial barriers is critical for success.

Demonstration projects can begin to change community perspectives on what constitutes beauty in our urban landscape. Photo: Xeriscaping in the Region of Durham, Ontario.

The City of Austin, Texas, offers a 30% rebate of up to US$500 to promote rainwater harvesting, and in Germany, widespread subsidies and technical support helped homeowners with the costs and technical challenges of implementation.[40]

Rainwater harvesting and Xeriscaping demonstration projects in highly visible locations such as city halls, government buildings, parks and recreation areas, effectively promote conservation. Coupled with aggressive education programs, demonstration projects can begin to change community perspectives on what constitutes beauty in our urban landscapes. Municipalities can create incentives to ensure developers of new buildings, subdivisions and residential units include water-efficient landscaping from the start. Not only does this avoid future water challenges, it is more cost effective than attempting to "retrofit" the landscape after the fact.

Xeriscaping and natural landscaping may require additional time and money for planning and replanting in the short term to reap the benefits of reduced maintenance time and costs over the medium and long term. Helping people overcome this short-term barrier may require fairly aggressive financial incentives such as "cash for grass," where residents are rewarded with rebates for not growing water-guzzling lawns.

Xeriscaping in Practice

Between 1990 and 2003, a study by the US National Xeriscape Demonstration Program compared the financial costs and water demand of Xeriscaping to standard landscaping with the following results:

- Phoenix realized water saving of 53% on properties with Xeriscaping;
- southern Nevada maintained a 39% summer water savings compared to properties not converted to Xeriscape;
- homes in Austin used 31% less water than those with conventional landscapes;
- cities along Colorado's Front Range used 18% to 63% less water than popular Kentucky bluegrass landscapes;

- in Colorado, surveys revealed that Xeriscape participants were generally satisfied with their new landscapes and would recommend them to others; and,
- Denver Water found an 11% increase in the number of Xeriscaped yards in Denver over the three-year study period.[41]

A study by the North Marin Water District in California found that water-conserving landscapes featuring about half as much turf as traditional yards required 54% less water, 25% less labour, 61% less fertilizer, 22% less herbicide, and 44% less fuel (for mowing) to maintain.[42]

Rainwater harvesting in Australia

Figtree Place, near Newcastle, New South Wales, Australia, is a water sensitive urban re-development consisting of 27 residential units. The site uses rainwater stored in tanks to supply hot water and toilet flushing demand. Water use was reduced by around 45% with noticeable cost savings. A two-year program to monitor roof water, tanks and hot water systems revealed that water quality improved in the roof to tank to hot water system treatment chain—and the quality complied with the Australian Drinking Water Guidelines.[43]

First steps...

Utilities:

- Provide funding and technical support to the public to set up rainwater harvesting systems.
- Create incentives to promote Xeriscaping, including pilot projects and highly visible demonstration sights.

Local government:

- Require all existing government buildings and lands to rely on rainwater as a primary water source—then advertise it to the public.
- Work with senior government to reduce legal and regulatory impediments to rainwater harvesting.

Resources:

Canadian Mortgage and Housing Corporation (CMHC). (2005). *Rainwater Harvesting Workshop Proceedings.* Toronto, Ontario: CMHC. May 24, 2005.

Konig, K. (2001). *The Rainwater Technology Handbook – Rain harvesting in building.* Dortmund, Germany: Wilo-Brain.

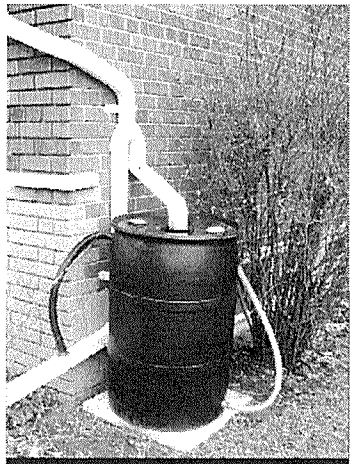
Bennett, J. (1998). *Dry-Land Gardening: A Xeriscape guide for dry-summer, cold-winter climates.* Toronto, Ontario: Firefly Books Ltd.

Weinstein, G. (1999). *Xeriscape Handbook: A How-to Guide to Natural Resource-Wise Gardening.* 2nd Ed. American Water Works Association (AWWA).

Xeriscaping-Colorado Water Wise Council. Available at: www.xeriscape.org/index.html.

Making rainwater harvesting common practice in Germany

A brief chronology of legal and institutional development illustrates how Germany addressed the barriers and created opportunities to become a leader in rainwater harvesting.



Small-scale rainwater harvesting. Photo: UBC Design Centre for Sustainability.

1980 – Previous legislation for "general mandatory connection to and utilization of the public water supply" was changed, providing the legal basis for domestic rainwater harvesting systems, including private water supplies from cisterns.

1988 – Hamburg was the first German federal state (similar to Canadian provinces) to introduce a grant program for installing rainwater systems in buildings. Approximately 1500 systems for private homeowners were financed over the course of seven years; 94% of users reported that they were generally happy and had no reservation about recommending rainwater use to others.

1992 – The Hessen state government introduced a tax on groundwater intended to maintain both the quality and quantity of available supply. Revenue collected from this tax was put toward financial incentives for implementing water-saving measures. Specifically, the funds assisted in the construction of rainwater and process water systems and associated education and training programs.

1993 – In Hessen, the government amended its building regulations, giving municipalities and local communities the power to make rainwater use mandatory. The states of Baden-Württemberg, Saarland, Bremen, Thuringen, and Hamburg followed. These code changes catalyzed a new era in municipal planning, and ushered in a process of technical innovation to improve performance and reduce costs associated with rainwater harvesting systems.

1996 – Industrial and professional associations published a water quality evaluation study showing no health risk for domestic use of rainwater for toilets and laundry, thus increasing acceptability of rainwater as a viable source.

2002 – Senior government published technical codes for construction to make rainwater harvesting part of standard building construction.

Sources: Konig, K.W. (2001). *The Rainwater Technology Handbook: Rainharvesting in Building.* Dortmund, Germany: Wilo-Brain. pp. 100-101; and, Konig, K.W. (May 24, 2005). Presentation at *The Rainwater Harvesting Workshop.* Toronto, Ontario: CMHC.

3. Close the urban water loop

Water withdrawn for municipal use typically follows a cycle from the source to the drinking water plant, off to the user, onward to the sewage treatment plant and back to the environment to then become someone else's source. Each year, municipalities and utilities pay more and more for this system, with much of the cost spent on bringing source water to a standard of quality suitable for drinking.

Yet, within our households we flush up to 30% of that drinking water right down the toilet. In summer months, we use high quality water to irrigate lawns, golf courses and other landscaping. Very little of the water treated to drinking water standards is actually used for purposes that require such high quality. According to Environment Canada, drinking and cooking consumes only about 5% of indoor residential water use.

Filtered reclaimed water can be reused without health risks for laundry washing cycles, toilet flushing and irrigation.

PROBLEM:

All municipal water is treated to drinking water standards, yet, more than two-thirds of that water is for end uses that do not require drinking water quality.

SOLUTION:

Use reclamation, reuse and recycling to better match water quality to end uses.

CHALLENGES:

Low water prices that reduce the cost effectiveness of reuse and recycling; negative perceptions about dual plumbing and the risks associated with reused and recycled water.

SAVINGS:

Reusing or recycling water for toilets and outdoor irrigation alone results in "double use" of existing water supplies—equating to a 50% water savings.

In this era of frequent water shortages, strained infrastructure capacity and growing environmental concern, the questions are obvious: Why treat all water to drinking water standards? Why use it only once? Why not match water quality to the requirements of end use? Why not turn wastewater into a resource?

Reclamation, Reuse & Recycling – The 3 R's

Reclamation, reuse and recycling are increasingly common practices in the world of water management. Reclamation refers to treatment of previously-used water (i.e. wastewater, greywater or stormwater) to a desired water quality. Reuse typically refers to the use of reclaimed water for a purpose different from that of the initial use. Recycling refers to use for the same purpose, and is commonly found in industrial applications such as cooling.[44] All of these processes reduce both the amount of water withdrawn from sources and the discharge of wastewater to the environment.

Together with rainwater harvesting, reuse and recycling are the next big trends in the realm of water efficiency. Indeed, any application for which water of potable quality is *not* required represents an opportunity to use reclaimed water.

It's only "waste" water if it's wasted.

The 3 R's on many scales

Reclaimed water has the potential to be used across sectors and on many different scales. It can be used in the residential sector to flush toilets and water lawns; on public lands to irrigate parks and playing fields; in agriculture to support non-food crop irrigation; and in the institutional, commercial and industrial (ICI) sector to cool water and irrigate golf courses.

Opportunities range from small-scale integrated household fixtures and on-site systems to large municipality-wide projects. Table 4 provides some examples.

Table 4 - Opportunities for reclamation, reuse and recycling

Scale	Application	Examples
	Fixtures with built-in reuse	Japanese toilets with built-in hand basins drain water directly to tanks for flushing.[45]
	On-site reuse or recycling within single family home, multi-family complex, or ICI building	Toronto's Healthy House relies on precipitation as source water, and uses reclaimed and reused wastewater (up to five times). This reduces water demand by 90% while maintaining the same quality and reliability of service as a conventional home.[46] Greywater from the University of British Columbia's C.K. Choi building is treated onsite in a Phragmite (tall grass) system and reused for irrigation.[47] In Vancouver's Quayside Village, a 19-unit residential complex, water from sinks and showers is reused in toilet flushing, reducing water demand and wastewater flows by 40%.[48]
	Neighbourhood or campus reuse of domestic wastewater for local reuse	Since 1926, Grand Canyon Village in Arizona has employed a dual distribution system to distribute reclaimed water for irrigating playing fields, toilet flushing, vehicle washing and construction uses.[49] A system under development for Iqaluit, Nunavut, will reclaim wastewater from a cluster of homes for use in flushing toilets and washing clothes. It is expected to reduce water demand by almost half.[50]
	Municipality-wide direct reuse	Vernon, British Columbia, has been reusing municipal wastewater since 1977 and now reclaims 100% of it to irrigate agricultural, forestry and recreational lands.[51] In River Hebert, Nova Scotia, a Ducks Unlimited Canada project reuses effluent from a wastewater treatment lagoon for wetland creation and replenishment.[52] In Phoenix, Arizona, secondary effluent is supplied to a reclamation plant at the Palo Verde Nuclear Power Plant to provide cooling tower water.[53]
	Municipality-wide planned indirect recycling	San Diego, California, is planning to augment the city's source water reservoir with advanced treated wastewater, which will supplement other stored water. This blended water then undergoes the usual water treatment before distribution.[54]

Hurdles: Real & perceived

While the potential for use of reclaimed water in Canada's urban areas is significant, the practice of water reuse and recycling is limited. In the past, technological hurdles were seen as the key challenge; Canadian experts now agree that technological issues related to water reuse have for the most part been resolved.[55]

In most regions of the country, regulatory frameworks do not support recycling and reuse. British Columbia is one exception. The province's Municipal Sewage Regulation (1999) and Code of Practice for the Use of Reclaimed Water (2001) have been described as "far ahead of the rest of Canada," permitting large-scale water reclamation projects and providing guidelines for water reuse.[56] As for provinces that are lagging behind, things may be about to change. The Canadian Mortgage and Housing Corporation (CMHC) in collaboration with Health Canada and Environment Canada is currently developing a guideline for using household water from showers and baths for toilet flushing. The Canadian Standards Association has developed a dual plumbing standard to be used in conjunction with this guideline.

Stormwater reuse for public art at the Olympic Park in Sydney, Australia. Photo: www.wsud.org

The widespread lack of financial incentives is a bigger issue. In particular, Canada's subsidized, rock-bottom water prices make it difficult for reclaimed water to compete economically. For recycled water to become mainstream, pricing regimes must take fuller account of the economic and environmental costs of water services. Environmental taxes, such as volume-based withdrawal fees and effluent discharge pricing based on contaminant loading would also significantly increase the economic appeal of the three R's.

Social barriers also exist. Top among these are public health concerns. Yet sources suggest that, from a health perspective, filtered reclaimed water can be reused without health risks for laundry washing cycles (but not rinse cycles), toilet flushing, and irrigation.[57] According to Eric Jackson, former Director of Water Reclamation for the City of Vernon, "no documented public health issues have arisen in Vernon's water reuse program since its inception over 25 years ago."[58]

The real problem is public perception. Education—of citizens, public servants and elected officials—must go beyond brochures and testimonials. Demonstrations and pilot studies that let the public and decision makers observe and participate are the best ways to win over doubters.

Closing the loop in Florida

St. Petersburg, Florida, completely closed its urban water cycle by reusing all wastewater, resulting in zero discharge to the surrounding environment. The city has two water distribution systems: one that delivers fresh water for drinking and most household uses, and another that distributes treated wastewater for irrigating parks, road medians, residential lawns, and other end uses that do not require drinking water quality. The reclaimed water costs about 70% less than the drinkable supply. And given the nutrients in reclaimed water, using it can reduce or eliminate use of synthetic lawn fertilizers.[59]

First steps...
Utilities:

- Identify local partners (e.g. NGOs, community groups and businesses) and develop high profile pilot projects and demonstration sites that highlight the potential of the 3Rs and build community support.

Local government:

- Work with senior governments to change legislation and regulations to permit water reuse and recycling.
- Enact by-laws that require dual plumbing in all new developments to reduce future retrofit costs and create demand for water reuse and recycling.

Resources:

Canadian Council of Ministers of the Environment. (2002). *Linking Water Science to Policy: Water Reuse and Recycling. Proceedings of the Water Science and Policy Workshop - May 30-31, 2002.* Calgary, Alberta: CCME. Available at: www.ccme.ca.

Hellebust, A. (2006). *Wastewater Reuse in Residential, Institutional and Commercial Buildings in Canada: Current Motivations, Future Scenarios and Initiatives.* EcoWerks Technologies Corporation. Prepared for Friends of the Earth Canada.

Purple Pipes – California Reuse and Recycling Web site: www.srcsd.com/purplepipes/index.htm.

Waller, D.H. et al. (1998). *Innovative Residential Water and Wastewater Management.* Canadian Mortgage and Housing Corporation (CMHC). Available at: www.cmhc-schl.gc.ca.

Canadian Mortgage and Housing Corporation. (1998). *Regulatory Barriers to On-Site Water Reuse.* Technical Series 98-101. CMHC. Available at: www.cmhc-schl.gc.ca.

2. Design communities for conservation

Land use decisions determine water use and watershed health now and in the future, and many current patterns of development are problematic. Standard subdivision design is a classic example of how "urban sprawl" inevitably leads to more and bigger water pipes. This type of land use decision—often divorced from local water use considerations—has negative impacts that may not be evident until years later. Examples include:

- startlingly high water demands associated with excessive outdoor water use;
- reduced groundwater recharge resulting from widespread impermeable surfaces; and,
- erosion and flooding associated with inadequate stormwater management.

Such land use decisions have cumulative effects that complicate policy making. To appease increasing water demands, water managers and municipal councils are forced to find new water sources or increase demand on existing sources. This in turn contributes to the cycle of over-built infrastructure for water delivery, wastewater treatment and stormwater management.

Australia is a leader in Water Sensitive Urban Design (WSUD) as demonstrated here with a green roof in Sydney. Photo: www.wsud.org.

PROBLEM:

Current municipal development decisions often negatively impact local watersheds.

SOLUTION:

Promote water sensitive urban design by limiting sprawling lawns, promoting "green" infrastructure, and requiring that all land use decisions be assessed for watershed impacts.

CHALLENGES:

The misconception that water sensitive urban design must be more expensive than standard approaches.

SAVINGS:

Compact water sensitive urban design can save 50% of outdoor water use.

A sprawl of a problem

Over the last decade, studies have linked suburban sprawl to increased traffic and air pollution and to the rapid loss of farmland and open space. Sprawl also threatens water quality. Rain that runs off roads and parking lots carries pollutants that poison rivers, lakes, streams and oceans. But sprawl not only pollutes our water, it also reduces water supplies. As impervious surfaces—roads, parking lots, driveways, and roofs—replace meadows and forests, rain can no longer seep into the ground to replenish aquifers. Instead, water is swept away by gutters and sewer systems.

Source: Otto, B., K. Ransel, J. Todd, D. Lovaas, H. Stutzman and J. Bailey. (2002). *Paving our Way to Water Shortages: How Sprawl Aggravates the Effects of Drought.* American Rivers, Natural Resources Defense Council.

Water sensitive urban design (WSUD)

Water sensitive urban design (or re-design) is closely related to *Smart Growth*—a concept in land use and development that promotes livable communities, environmental protection, and efficient use of tax dollars.[60] WSUD specifically aims to improve urban stormwater quality and encourage water conservation by optimizing planning and water cycle management. This approach to urban planning and design focuses on water management at the level of individual lots and considers how water, wastewater and stormwater services can be provided in ways that secure and enhance watershed health. Growth can be managed in a variety of ways, including comprehensive provincial growth management legislation, smart growth incentives, and urban growth boundaries. The key to facilitating WSUD is governments coordinating with water resource agencies during planning processes. In California, for example, state legal amendments link land use planning to water sustainability by requiring proof of the reliability of water supply for new municipal developments (e.g. 20-year supply demands for the equivalent of at least 500 residential homes).[61]

The real cost of WSUD

A primary stumbling block is the misconception that WSUD is more expensive than conventional urban development approaches. In some cases additional up-front costs are required (although not always—as the examples below demonstrate), but certainly from a community or even a homeowner's perspective, the long-term benefits of ecologically friendly design will outweigh the costs.

Smart Growth reducing costs and conserving water

Applying smart growth principles can significantly reduce the cost of water provided by communities and the quantity of water demanded by their residents. More compact development allows for shorter transmission systems, making them more efficient to operate and less susceptible to water loss through leakage. Encouraging compact neighbourhood design on smaller lots reduces water demand for landscaping. Directing development to areas served by existing infrastructure and maintaining that infrastructure can make systems more efficient.

Source: EPA. (2006). *Growing Toward More Efficient Water Use: Linking Development, Infrastructure, and Drinking Water Policies.* Washington, DC: US Environmental Protection Agency. p. 7. Available at www.epa.gov/smartgrowth.

Design for conservation in Australia and Canada

Research from Australia demonstrates the potential for significant savings. Figtree Place, an inner suburb of Newcastle, New South Wales, was constructed using a WSUD approach, resulting in savings of $25,900 in construction costs—almost $1000 per dwelling. Greenfield Subdivisions, also in Newcastle, produced a 53% savings in stormwater drainage construction costs using a WSUD approach, and is expected to considerably reduce environmental impacts.[62] Dockside Green, discussed in the final section of this handbook, is an excellent Canadian example of the economic, environmental and social benefits of holistic and integrated design.

First steps...

Local government:

- Make an official commitment to integrate land use decisions with water planning, with specific attention to integrating stormwater management and subdivision design that complements and enhances the existing "green" infrastructure.
- Set performance standards in by-laws for permeability, infiltration, tree cover, ecological function, buffering and zoning.

Senior governments:

- Help establish urban containment boundaries and require regional growth strategies and official community plans that are consistent with local water budgets.

Resources:

Smart By-laws Guide. Available at West Coast Environmental Law Web site: www.wcel.org. And for smart growth and sustainability legal support and strategies see Curran and Co. Web site: www.dcurranandco.ca.

Environmental Law Clinic, University of Victoria, Faculty of Law. (2006). *Green Infrastructure Model By-law Package.* Environmental Law Clinic Web site: www.elc.uvic.ca (forthcoming fall 2006).

Stephens, K., P. Graham and D. Reid. (2002). *Stormwater Planning – A Guidebook for British Columbia.* Victoria, BC: BC Ministry of Water, Land and Air Protection. This publication is complemented by the Water Balance Model Web site, an interactive and scenario-based tool available at: www.waterbalance.ca.

Argue, J. (2004). *Water Sensitive Urban Design: Basic Procedures for 'Source Control' of Stormwater – A Handbook of Australian Practice.* University of South Australia. See also, Water Sensitive Urban Design in Australia Web site: www.urbanwater.info/engineering/wsud.cfm.

US Environmental Protection Agency. (2004). *Protecting Water Resources with Smart Growth* (2004). Washington, DC: EPA. Available at: www.epa.gov/smartgrowth/publications.htm#water.

1. Educate, educate, educate

Canadians are among the highest water users in the world, using twice as much per capita as the average European. Despite emerging threats to water security such as climate change, pollution and increasing urbanization, most Canadians do not consider water quantity an issue. Because of our relative abundance of water, conservation is seen as a well-intentioned activity, but not a necessity.

Outreach and education

Outreach and education that inform water users about water conservation initiatives are a must for any successful demand management program. Even mandatory programs such as watering restrictions are rarely successful without promotion and publicity. The most effective education programs will also increase public knowledge about the need for water conservation, the potential benefits of demand management, and how to participate in local action.

A varied and multi-faceted approach is needed—one that engages individuals in community-based solutions to water security problems. To achieve this, education programs must be developed for different groups of end users, such as homeowners, renters, businesses and industry. Programs must also be developed to address water professionals, community and political leaders, and children.

The main benefits of a good education program include:

- instilling conservation habits in water users;
- heightened public awareness of the need to conserve to the point where other measures, such as volume-based pricing and regulation, become acceptable and can be implemented;
- enhanced public demand for elected officials to address water issues as a policy priority before a crisis is reached;
- continued awareness through regular public reminders of the need for conservation;
- changed values toward a lasting "water ethic."

PROBLEM:

Lack of understanding about the need for, and potential benefits of, water conservation, and how to effectively put it into action.

SOLUTION:

Implement outreach and education programs that go beyond information dissemination to engage and inspire citizens to permanently change behaviours.

CHALLENGES:

To engage community members in meaningful education programs that will help replace perceptions of Canada's "water wealth" with an enduring "water ethic."

SAVINGS:

The sky is the limit—most experts believe that, even in developed countries, only 50 to 80 litres per capita per day of high quality water is needed to maintain a good standard of living.

Education about water conservation exists in many forms and makes use of every imaginable teaching aid—from preschool programs to university seminars, from fridge magnets to interactive on-line games. Whether through information campaigns, media advertising, school curricula or other methods, the purpose of education on water conservation is not only to inform, but to influence behaviour. Motivation follows engagement—and motivation is what is needed to create lasting changes in behaviour.

Victoria Compost Education Centre demonstration project of a green roof and "bathtub ponds" fed by rainwater. Photo: E. Reynolds.

Social marketing

According to Doug McKenzie-Mohr, environmental psychologist and promoter of *community based social marketing*, information campaigns alone will not foster sustainable behaviours. Conventional education programs focused on disseminating information often reflect an inadequate understanding of the barriers to behavioural change.

Social marketing differs from conventional approaches because more time and effort is invested up-front to understand barriers prior to program design and implementation.[63] Using focus groups of stakeholders to identify barriers and recommend incentives creates the direct, interactive contact with end users that encourages a high level of "buy in" needed to inspire action.

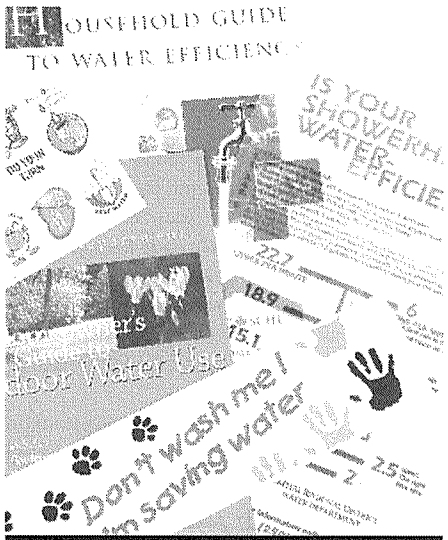
For end users, saving money is an effective motivator for changing behaviour. Others are also motivated by saving energy and being good environmental citizens. But, even with sufficient motivation, programs must also make it easy for end users to participate, especially early on.

Steps to community-based social marketing

Community-based social marketing involves four steps:

1. Identify the barriers and benefits to an activity by reviewing existing research, and conducting focus groups and randomized surveys;
2. Develop a strategy that uses "tools" such as communications and marketing techniques and incentives that have been proven effective in changing behaviour;
3. Pilot the strategy using community test groups; and,
4. Evaluate the strategy once it has been implemented across a community.

Source: McKenzie-Mohr, D. (2006). *Quick Reference: Community-Based Social Marketing.* Available at: www.cbsm.com.



Education materials are only the start. The purpose of education on water conservation is not only to inform, but to influence behaviours. Photo: E. Reynolds.

Tailoring programs

To be effective, education programs must be tailored to local needs, and must involve key constituent groups, such as homeowner associations, landscapers or plumbers. The Massachusetts Water Resources Authority, for example, sponsored workshops and provided information at professional trade shows, such as performance details on ultra-low-flow toilets. Tours of demonstration projects can be offered to professional and industry groups, allowing for more detailed technical discussions.

Programs can also be targeted at the customers who use more water than average. In Palo Alto, California, for example, the City hired college students to make personal visits, distribute information and give advice on conservation to residents with the highest water use.[64]

Children: Targeting education campaigns at children is highly effective. In addition to the potential of promoting life-long water conservation habits, a study in Vernon, BC concluded that children in primary school can teach parents more about water conservation than a utility representative ever could.[65] Before embarking on a school campaign, educating teachers first will improve the campaign's effectiveness. In British Columbia, "teach the teacher" guides have been developed for this purpose.[66]

Decision makers and government employees: Elected decision makers and government employees also need attention to build support for conservation. A recent survey in British Columbia found that only 10% of respondent municipalities were actively educating elected officials on water issues such as conservation. The result is that decision makers may be largely unaware of the potential benefits of demand management.[67] Municipal employees can also be targeted, since they not only represent a large group of water users, but are also involved in water supply and management, and are potential conservation ambassadors.[68]

Instilling a 'water ethic'

Although education and marketing campaigns are generally politically and publicly acceptable, NGOs have an important role in raising public awareness and engaging the public to the point where governments and water utilities will themselves undertake such campaigns. Government funding and training for NGOs will help ensure that a diverse community is involved in the process. The shared goal of balancing the water budget for a region encourages many disparate organizations and individuals to work together to develop more sustainable behaviours and practices—the first step toward a lasting water ethic.

Social marketing in Ontario

The Region of Durham in Ontario adopted this approach for its outdoor water efficiency program with notable success. The program started in 1997 with the Region employing summer students in a community-based social marketing program to work with homeowners to reduce residential lawn watering. The result was a 32% reduction in peak water demand over a three-year period.[69]

First steps...

Utilities:

- Identify high water use groups and target them in social marketing and education campaigns to reduce water consumption patterns.
- Expand education programs beyond brochures to include opportunities for community engagement to instill behavioural change.

Local Government:

- Make an official political commitment and provide financial and human resources to support ongoing education programs.

Resources

McKenzie-Mohr, D. (2006). *Quick Reference: Community Based Social Marketing.* Available at: www.cbsm.com.

Environment Canada. PowerPoint presentation (graphics and notes). Available at: www.ec.gc.ca/water/en/info/pubs/speak/e_slides.htm. Also from Environment Canada, a series of printer-ready utility bill "stuffers" that can be personalized by municipalities. Available at: www.ec.gc.ca/water/en/info/pubs/brochure/e_broch.htm.

Grant, T. (2003). Educating for the Environment. *Electronic Green Journal*, Issue 19. See also *Green Teacher Magazine*, Toronto, Ontario, and the Web site: www.greenteacher.com.

Australian Sustainable Schools Initiative Web site: www.deh.gov.au/education/sustainable-schools/index.html.

Making the Case – Conservation as the best source of 'new' water

Over the past decade, large municipalities across Canada have begun to integrate water efficiency into daily business, especially short-term initiatives such as fixture replacements, basic education programs and watering restrictions. Smaller and mid-sized municipalities are now following this lead. Driving the progress are threats such as drought and pollution, profligate water use and large-scale water diversions, which draw increasing attention to water's vital role in the health of communities. While these initiatives are a good start, as our *Top 10* demonstrates, much more is possible.

Benefits of demand management

Shifting the focus of urban water management from the standard supply-side approach toward a demand management paradigm has many benefits. Perhaps the most obvious over the long term is that the overall benefits to society—financial and environmental—far outweigh the costs. Maintaining healthy aquatic ecosystems cannot be underestimated as a long-term benefit. And avoiding or deferring infrastructure costs such as harmful and costly diversion projects is a huge benefit. Also, saving water saves energy and other resources that go into operating urban water infrastructure—another compelling argument for change. All of these benefits free up public funds that could then be applied to upgrade or replace ageing infrastructure, improve drinking water quality, wastewater and stormwater treatment, or to support other community programs such as policing, social services or recreation.

BIG MONEY SAVINGS

In the Regional Municipality of Durham, Ontario, estimates indicate that it would cost approximately $125 million for new infrastructure to provide the equivalent supply of water as will be made available by implementing a 10-year water efficiency plan, costing only about $17.2 million.

Source: Veritec Consulting. (2004). *Regional Municipality of Durham Water Efficiency Plan – Final Report.*

The business case

Urban water and wastewater systems are capital intensive. By maximizing the efficiency of existing built infrastructure and minimizing the need for future expansions, Canadian municipalities can reduce the strain on tight budgets. Because reductions in energy and chemical costs go hand-in-hand with reduced water use, reducing demand can also influence the costs of treating and distributing water, and of collecting and treating wastewater.

In the water conservation field, much of the "low-hanging fruit," such as water-efficient toilets, showers and appliances, often have payback periods of less than five years. Lower water and sewage bills for homeowners also create incentives to conserve.

Consider replacing toilets in single-family homes. In an average community, with approximately 40,000 participating homes, that single measure would reduce water use by about 6.6 million litres per day. At a value of $4.37 per litre of water saved, this equates to $29 million in avoided infrastructure costs. The total cost of the toilet replacement program is approximately $5 million, including administrative support and a toilet rebate—much less than the cost of providing that water through infrastructure expansion. And the savings could be even greater if existing toilets are replaced with HETs rather than standard 6-litre toilets.[70]

Low prices + high use = major infrastructure deficits

Most Canadian municipalities face pressing problems related to water and wastewater services. Yet Canadian municipal water prices rank second lowest among OECD nations. Not surprisingly, per capita water use is among the highest, with the OECD going so far as calling Canadian water "cheaper than dirt."[71]

The influence of these low prices is reflected in our profligate water use, and the over-capitalization of infrastructure that has in part led to the infrastructure deficit observed in many communities across the country. Excessively low water prices challenge community efforts to promote conservation, as many conservation options are easily dismissed as simply not cost-effective.

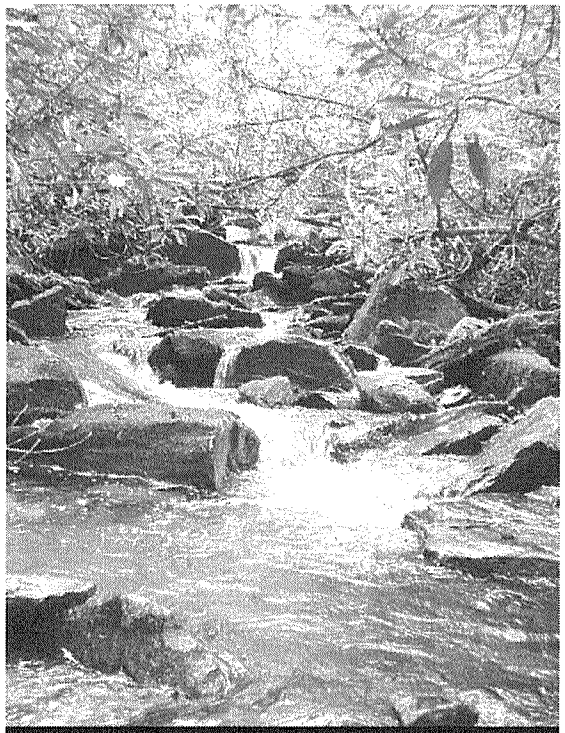
Conservation makes good fiscal sense. In Ontario's Regional Municipality of Durham, for example, the Region has determined that a long-term commitment to conservation could save the municipality approximately $125 million over the next 10 years.

Making the water & energy link

Energy and water resources are interrelated—conserving water conserves energy, which in turn conserves more water and vice versa. Yet, while energy conservation has been gaining momentum since the 1970s, the need for water conservation is only beginning to enter Canadians' collective consciousness.

California provides an example of the potential benefits of linking water and energy conservation. Regulated utilities in California are on track to meet their energy efficiency goals at a greatly reduced cost over the next two years simply by focusing on water conservation. "Water-related energy use consumes 19% of the state's electricity." This

includes storage, delivery and treatment of water, as well as energy used by customers to heat water and to supply water for landscape irrigation. Consequently, regulators in California recently agreed to divert some of the ample funding earmarked for energy conservation to water conservation in recognition that saving water means saving energy, and it all means saving money.[72]



To create long-term water security, a community must live within its ecological water budget.

The ecological case

Urban development and high water use alter the hydrological cycle and place increasing demands on Nature's infrastructure and services. Municipal water withdrawals and the associated wastewater discharges result in geographically concentrated impacts on the local environment. The most obvious impacts are associated with dams, diversions and surface- and groundwater taking. Such hydraulic infrastructure places pressure on the structure and function of aquatic ecosystems—with impacts reverberating up- and downstream of the actual infrastructure.

Groundwater management also impacts environmental health. Aquifer overdraft can affect the health of surface water systems—particularly in dry seasons when base stream flows are fed largely by groundwater sources such as springs and aquifers. Over pumping of groundwater reduces the volume available for these fragile ecosystems, which in turn impacts other ecological variables, such as temperature and nutrient balance, that sustain aquatic ecosystems and the fish populations within them.

To create long-term water security, a community must live within its ecological water budget—one that includes a precautionary buffer to safeguard ecosystem water needs. This will ensure future generations have access to the same benefits and quality of life we currently enjoy.

"Hydraulic infrastructure is literally killing the aquatic world."

Source: Postel, S. (2000). Entering an Era of Water Scarcity: The Challenges Ahead. *Ecological Applications*, 10(4), pp. 941-948.

Cumulative impacts

More than 20% of all freshwater fish species are now threatened or endangered because dams and water withdrawals have destroyed the free-flowing river ecosystems that sustain them. The American Fisheries Society estimate that 354 species of fish in North America are at risk, primarily due to habitat destruction through the excessive use and mismanagement of water.

Swedish scientists Mats Dynesius and Christer Nilsson report that 77% of the large river systems in the United States, Canada, Europe and the former Soviet Union are altered by dams, reservoirs, diversions, and irrigation projects. They warn that, because of the extent of river modification, key habitats such as waterfalls, rapids, and floodplain wetlands could disappear entirely from some regions, extinguishing many plant and animal species that depend on running water habitats. Perhaps the most startling finding is that the weight of impounded waters at high latitudes in the northern hemisphere has slightly altered the tilt of the earth's axis and increased the speed of the earth's rotation.

Sources: Gleick, P. (2002). *Water Facts, Trends, Threats, Solutions*. Oakland, California: Pacific Institute for Studies in Development, Environment, and Security. Available at www.pacinst.org; Postel, S. (1994). *A Global Perspective on Water Conservation*. In Shrubsole, D. and D. Tate (Eds.). *Every Drop Counts* (p. 13). Canadian Water Resources Association; Postel, S. and B. Richter. (2003). *Rivers for Life: Managing Water for People and Nature* (p. 14). Washington DC: Island Press.

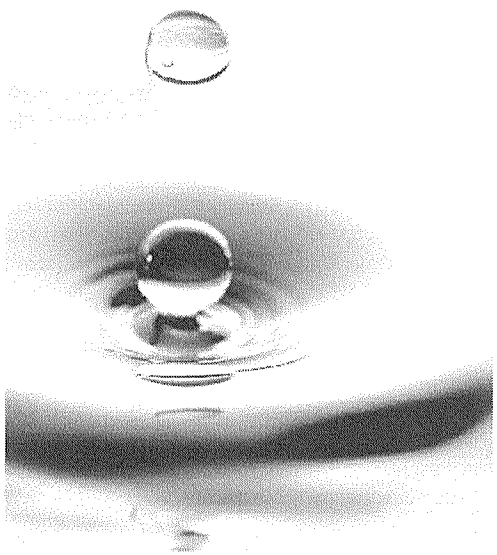
A word about climate change

Climate and the water cycle are intimately linked. As temperatures increase and the weather changes, so too does the amount and timing of precipitation. For Canada, the general prognosis is for more precipitation falling as rain rather than snow, and the snow that does fall will melt and run off the land faster and sooner. In non-winter months, predictions are for more frequent severe storms and droughts—not necessarily less precipitation overall, but fewer rain days with larger volumes of rainfall per day. Such changes will significantly impact groundwater recharge and influence surface water flows. Add to this the water loss from land through evaporation from the soil and increased plant transpiration that result from rising temperatures, and we can see a very different context for water management emerging every day.

Time for a name change? "In 1850, there were 150 glaciers in Glacier National Park; now, there are only 35 left...There is a prediction that by 2030 there will not be any glaciers left (in Glacier National Park)."

Source: Dr. Hester Jiskoot, Assistant Professor, University of Lethbridge. Proceedings of the Standing Committee on Energy, the Environment and Natural Resources, March 8, 2005. Photo: Glacier National Park Web site.

Toward Solutions – The power of managing demand



Demand-side management has been used extensively in Canada over the years to alleviate transportation congestion and reduce energy consumption. Measures include conservation-based pricing, smart technologies, public education, and regulations that force innovation by promoting efficiency, conservation and alternative sources. In the water context, these same measures can be used to conserve water and dramatically increase water productivity to meet human needs and desires for services such as sanitation, landscaping and personal hygiene.

Comprehensive water demand management programs are multi-faceted efforts aimed at simultaneously changing water provision, waste disposal, energy demand and land use, to redirect social development onto a new path. Relying less on pipes and pumps, this new path focuses instead on changing behaviour, attitudes and values. It requires water planners to satisfy demands for water-based *services* such as sanitation and irrigation rather than simply delivering more and more water to meet ever increasing demand.

The California potential

A recent state-wide study in California profiles a compelling example of the potential savings of a demand management approach. The Pacific Institute reports that the total of commercial, industrial, residential and institutional water use could be cost-effectively cut by at least 30% using off-the-shelf technologies. Further, this dramatic efficiency improvement can be achieved more quickly and cleanly than any new supply project under consideration. They emphasize that "the potential for conservation and efficiency improvement in California is so large that even when the expected growth in the state's population and economy is taken into account, no new water-supply dams or reservoirs are needed in the coming decades."

Source: Gleick, P., D. Haasz, C. Henges-Jeck, V. Srinivassan, G. Wolff, K. Cushing, and A. Mann. (2003). *Waste Not, Want Not: The Potential for Urban Water Conservation in California.* Oakland, California: Pacific Institute for Studies in Development, Environment, and Security. Available at: www.pacinst.org.

Reasons to conserve water in Canada

- **High and rising urban water use** – Canadians are among the highest municipal water users in the world. The average total municipal water consumption (including residential, ICI and unaccounted for water) is 622 litres per capita per day.[73] This tradition of overuse is deeply entrenched in our culture, water use habits and urban designs. Despite water conservation efforts, and a decrease in per capita water use, urbanization and population growth are driving up total water use.
- **Supply limits** – Scarcity of freshwater resources—both ground and surface water—is common in most urban areas where the geographic concentration of human activity imposes a significant strain on limited water supplies.
- **Costs** – Efficient use of existing capital-intensive infrastructure can be cost effective, especially if municipalities consider the savings in energy and chemical costs from reduced pumping, treatment and distribution.
- **Environmental impacts** – Urban development and high water use alter the hydrological cycle and place increasing demands on natural infrastructure. Urban water impacts add to other cumulative factors, such as point and non-point source pollutants, that damage the aquatic and riparian environment.
- **Quality and quantity concerns** – High urban water use places increasing stress on water treatment systems. The increased wastewater volumes can result in less effective treatment, potentially threatening the quality of receiving waters and undermining the integrity of the entire system.

The great Canadian water myth

Looking at Canada as a whole, renewable water supplies exceed water demands, leading many to conclude that water scarcity cannot possibly be a problem. However, at a community level, other factors such as water quality and local availability must also be considered to get an accurate picture of our water "wealth." Population distribution is another important consideration. While 60% of our renewable water resources flows north, the majority of Canadians (85%) live along the southern border. After factoring in the water needs of aquatic ecosystems, the reality is that in most places—especially where most Canadians live—communities usually have just enough water, not extra.

A commitment to 'no new water'

As this handbook demonstrates, opportunities to improve water productivity abound. These gains are, however, just the beginning of the water saving story. Some communities are exploring the potential of meeting all new water demands through efficient use of existing supplies and conservation. In Calgary, Alberta, this "no new water" approach is a driving force behind one of Canada's most comprehensive water demand management strategies. In Victoria, British Columbia, and the surrounding capital region, local leaders and water managers are also exploring the potential of a regional commitment to "no new water."

Looking to the Future – Water management in the 21st century

In Canada, long-term water security in the face of growing populations and a changing climate is a social dilemma that will not be resolved with technical solutions alone. Lasting solutions require a focus on the broader social and cultural contexts that shape attitudes and behaviours—a focus not just on managing watersheds, but managing the people within watersheds. Instead of assuming an endless water supply or dreaming up large-scale technologies to harness water, this paradigm seeks to manage demand, increase water productivity and instil a conservation ethic.

The future of water management

Comprehensive and long-term water conservation programs are the new water infrastructure. In many places, they also represent the best option for meeting growing water demands. These programs, built around innovative efficiency-based technologies, pricing that promotes conservation, interactive education and engaged citizens, are the foundations of 21st century urban water management.

Comprehensive and long-term water conservation programs are the new water infrastructure.

Creating sustainable communities requires the right programs and techniques to conserve water resources. A conservation-based approach to land use decisions, development and design will ensure that society begins to develop a secure and prosperous future. Witness the potential at Dockside Green in British Columbia's capital city (see box). Today this example is considered to be on the cutting edge of sustainable development. If sustainability is truly the goal, this type of project must become tomorrow's standard practice.

The potential for water conservation stems from a fundamentally different concept of water in our human environment. This does not mean doing without. Instead it is about taking a long-term approach with a focus on holistic water resource management and a water ethic that permeates much of what we do. Not only is this approach better for the environment, it is cheaper in the long run—and in this way becomes the only sustainable option.

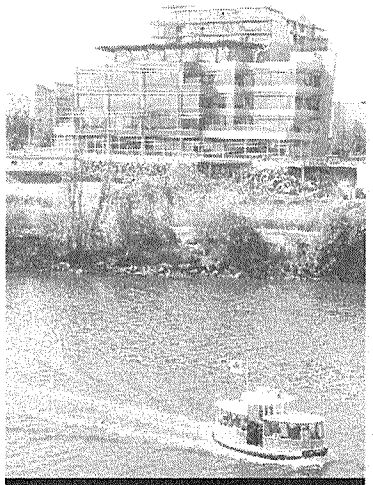
Solutions exist. The urgency increases daily. Changing the world one watershed at a time is the goal. Your community is the place to start.

Dockside Green — At the vanguard of 21st century urban planning

Dockside Green in Victoria, British Columbia, is being developed on 15 acres of former industrial land near the downtown core. Dockside Green will house approximately 700 residential units in the planned total of 1.3 million square feet of mixed residential, office, retail and industrial space. This model of modern urbanization brings together many of the Top 10 water savings options outlined in this handbook.

The developer is aiming for the Leadership in Energy and Environmental Design (LEED) Platinum rating for each building on the site, establishing the project as a global showcase for large-scale sustainable development. It is a model for holistic, closed-loop design, functioning as a total environmental system in which form, structure, materials, mechanical and electrical systems will be interdependent—a largely self-sufficient, sustainable community where waste from one area will provide fuel for another.

One hundred percent of Dockside Green's sewage will be treated on site and reused primarily to flush toilets and for irrigation, reducing the demand for potable water. Excess treated water will be exported for sale to off-site customers, such as industrial users.



Dockside Green integrates many of the Top 10 into its design. If sustainability is truly the goal, this type of project must become tomorrow's standard practice. Photo: E. Reynolds.

Using a "triple bottom line" approach, this development integrates a closed-loop water system featuring cutting-edge conservation technologies, alternative sources, drought-resistant landscaping, and water reuse and recycling to minimize municipal water demands and water impacts. Dockside Green's innovative approach to conserving and reusing water will save approximately 70 million gallons of water per year—the same amount used in all of the Greater Victoria area on the year's driest day. Potable water use in residential and commercial/office buildings will be approximately 60% to 65% lower than standard developments.

For more information see the Dockside Green Web site: www.docksidegreen.com/index.

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POLIS PROJECT ON ECOLOGICAL GOVERNANCE

Created in 2000, the POLIS Project on Ecological Governance is a research-based organization housed at the University of Victoria in British Columbia. Researchers who are also community activists work together at POLIS to dismantle the notion of the environment as merely another sector, and to make ecological thinking and practice a core value in all aspects of society. Among the many research centres investigating and promoting sustainability worldwide, POLIS represents a unique blend of multidisciplinary academic research and community action.

POLIS Project on Ecological Governance
University of Victoria

www.polisproject.org

WATER SUSTAINABILITY PROJECT

Created in January of 2003 at the POLIS Project, the Water Sustainability Project seeks to understand the structure and dynamics of urban water use, and to provide mechanisms to help reorient water management in Canada from supply to demand-side approaches. The WSP team has developed a comprehensive legal and policy framework for urban water management and detailed action plans for federal, provincial and municipal governments. The Project is also investigating the emerging field of watershed governance to test its practical implementation and explore its potential for "developing sustainability" in Canada.

The Water Sustainability Project

www.waterdsm.org

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Drought-Ready Communities

A Guide to Community Drought Preparedness

National Drought Mitigation Center | Oklahoma Climatological Survey | Lower Platte River Corridor Alliance | NIDIS | NOAA

Contact Us

The Drought Ready Communities research team is seeking additional resources to work with organizations and communities to make community-level drought planning more widespread. One of our goals is to expand the collection of case studies detailing different communities' experiences with different parts of the process.

For more information on how your community can become involved, to share your experiences in drought planning, or for any other questions, please contact one of the research team members:

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Sponsorship and Partners

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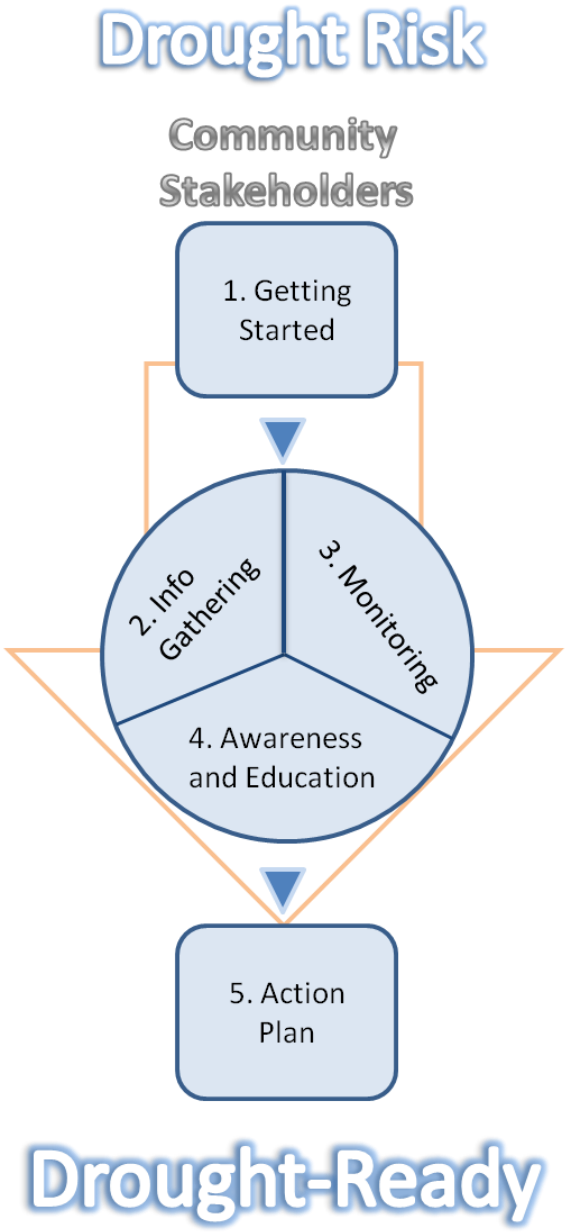
Project partners included the National Drought Mitigation Center, the Oklahoma Climatological Survey, the Illinois State Water Survey, and the Lower Platte River Corridor Alliance.

Updated May 2011



Outcomes:

- Understand past droughts and impacts on community
- Implement system to monitor drought and impacts
- Establish regular communication about drought conditions and impacts
- Know what actions to take before and during a drought

Benefits:

- Increased community awareness of water, climate, and drought
- Reduce dollar losses during next drought
- Reduce stress during next drought
- Protect animals and plants from drought impacts
- Increase community resilience

Table of Contents

Introduction to Drought-Ready Communities

What is Drought?

Drought is a period of excessive dryness long or intense enough to affect agriculture, habitats, or people. It is difficult to define because it often develops slowly over months or years, and has different impacts depending on the location, time of year, and sector of the community you are focusing on. Although drought can and does cause severe and far-reaching impacts, it is not as tangible as other disasters, such as hurricanes and tornadoes.

What is a Drought-Ready Community?

A Drought-Ready Community has taken steps to:

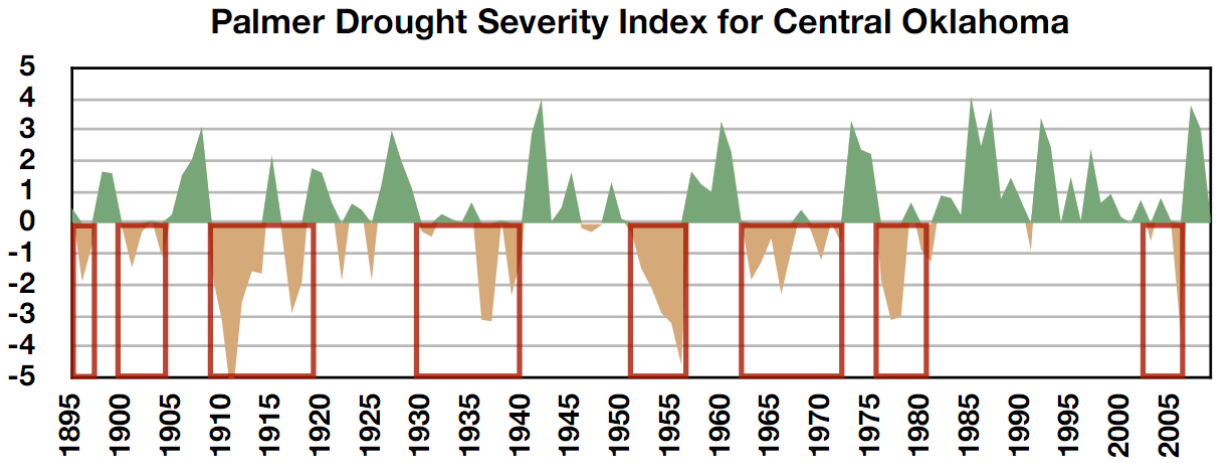
1) Involve a representative cross section of the community;
2) Learn how drought has affected them in the past and how it would likely affect them in the future;
3) Set up a system to **monitor** and communicate about drought conditions in the community;
4) Prepare and document a set of actions to take before and in response to a drought;
5) Educate the public about water, drought, and the community's **drought plan**.

It should be noted that "Drought-Ready" is not "Drought Proof." The drought monitoring, communications, and response plan developed during the process may help reduce the effects of drought.

Why be a Drought-Ready Community?

Droughts can occur anywhere.
Between 1980 and 2009, droughts affected nearly every major region of the United States. For example, as of July 2010, Hawaii, one of the wettest states in the United States, had been experiencing severe drought since June 2008.

Droughts are a periodic phenomenon and will happen again.



The graph above shows the Palmer Drought Severity Index (PDSI), one commonly-used measure of dryness, which rates dry and wet conditions on a scale from -5 to +5. This particular plot, for Central Oklahoma, has red boxes drawn to represent drought periods. As you can see, multi-year droughts are the norm, rather than the exception, for the area.

Droughts have a variety of impacts.
Drought can result in many negative impacts to a community, including:

- Loss of lawns and cracked foundations;
- Property damage or depreciation;
- Losses to businesses such as marinas and landscapers;
- Losses to industrial businesses using processed or non-potable water;
- Partial or complete shutdown of utilities relying on water for cooling;
- Crop, pasture, livestock, and forest damage;
- Increased fire hazard, including wildfires;
- Loss of wildlife and threats to habitat;
- Increased water demand;
- Reduced water supplies;
- Reduced water quality;
- Reduced population due to migration;
- Health effects from airborne particles.

Droughts are costly, in terms of both lives and property.
Out of ninety-six billion-dollar weather disasters since 1980, fifteen were droughts, and ten were fires, which frequently occur in drought conditions. The 1980 heat wave and drought in the central and eastern United States alone caused $55.4 billion in damage (2007 dollars) and an estimated 10,000 deaths. Two out of the three disasters causing more than $50 billion in damage (2007 dollars) during this period were droughts.
[http://www.ncdc.noaa.gov/oa/reports/billionz.html]

Research by the Multi-Hazard Mitigation Council in 2005 found that for every $1 spent on hazard mitigation, $4 was saved. Although the study focused on earthquake, flood, and wind hazards, it is likely that similar benefits would come from becoming Drought-Ready.

The Path to Drought Readiness

To complete the DRC process, a community should use this document and accompanying resources to guide them through a number of tasks. A summary of expected accomplishments to be completed in each section is described below.

Getting Started (Section 1)

This section takes a community through the initial steps of becoming Drought-Ready. Communities will form a leadership team, identify specific community benefits of drought planning, start a drought contact list, and gather community drought perceptions.

Information Gathering (Section 2)

This section will guide the community in assembling the best available information for decision making. The community will learn how to record information about its water sources and users, gather information about past drought events and impacts, and identify factors that could serve to reduce or intensify the local effects of drought.

Establish Monitoring (Section 3)

This section takes a community through the process of developing a monitoring system to assess its current drought status. In this step a community will identify pertinent drought indicators to monitor real-time conditions, designate one or more people to regularly monitor drought conditions, identify the types of impacts to be monitored, and develop a "Drought Monitoring Report" to be disseminated on a regular basis to interested people or groups.

Public Awareness and Education (Section 4)

This section details the development of a public awareness and education campaign to encourage public support of the Drought-Ready Community process. Specifically, it guides communities through the process of developing a strategy, gathering educational materials, and assigning an implementation schedule.

Planning Responses (Section 5)

This section synthesizes the materials developed in all the other sections. In Section 5, the community will create a list of strategies and actions that should be undertaken before and during a drought to reduce negative impacts, and identify specific thresholds to help decide when to implement the pre-defined actions during a drought.

Section 1. Getting Started: Invite the Community to Participate, Commit to the Process

Communities don't just become Drought-Ready. They require sustained leadership, energy, focus, and the ability to share a vision and coordinate action. Leadership on municipal drought planning typically comes from the city agency that is responsible for keeping the water flowing, but, particularly in smaller communities, a grassroots effort might provide the spark or even the ongoing focus and energy required to become a Drought-Ready Community. Regardless of whether the effort is initiated by officials or others within the community, it will eventually need buy-in from authorities, residents, and specific interests within the community.

1.1. Establish a leadership team that includes individuals with responsibility for monitoring, communication, and implementation.

Action Items

1. Commit to becoming a Drought-Ready Community today. It's not a question of if, but when, the next drought will happen. The sooner your community starts preparing for drought the better off you will be.
2. Identify stakeholders. Use Worksheet 1: The Benefits of Drought Planning to create a preliminary list of businesses and groups who would be most affected by drought. Let stakeholders know about the Drought-Ready Communities process and invite them to participate. Stakeholders may welcome the chance to work with others to reduce or eliminate the effects of drought.
3. Reach out to media leaders in the community. Getting buy-in from them early on contributes to publicity and positive PR throughout the Drought Ready process. In addition, focusing on educating media about drought before it happens may allow you to minimize that effort later.
4. Determine what level of public participation would be beneficial and feasible. Consider holding a town hall meeting to share basics about drought and how the community can benefit from being Drought-Ready. People may be very aware of how drought has affected their community in the past, and welcome the chance to prevent serious impacts in the future. A town hall meeting may be a good way to recruit citizen volunteers for a Drought-Ready Community task force or leadership team. Ask people to provide email addresses if they would like to receive regular updates. See Section 4 (Plan a Public Awareness and Education Campaign**)**.
5. **Form a leadership team** with the collective ability to monitor drought and water supply, communicate with residents, and take action. This could include city officials, water officials, stakeholders, business and industry leaders, labor organizations, or people from non-profit organizations who are active in community-building activities.
6. Start a Drought-Ready Communities binder to keep a record of valuable information and decisions. It should ideally be publicly available and be regularly updated with meeting notices, minutes, reports, and other information. The binder, or documents from the binder, could be electronic and available on a website so the whole community can browse the materials.

📖 Start a Drought-Ready Communities binder and add the completed copy of Worksheet 1: Benefits of Drought Planning to it.

Resources

1. Appendix A, Worksheet 1: The Benefits of Drought Planning

1.2. Identify stakeholders or groups in the community that may need additional resources to participate in the Drought-Ready Communities process

This step helps ensure an inclusive process that can accommodate people from all walks of life who may be affected by drought. When working with a broad range of stakeholders, keep in mind:

- The timing of meetings is often a key determinant in who participates. For city officials and others who are paid to be part of the process, daytime meetings during regular working hours may seem convenient. For others, such as farmers and ranchers, meetings may need to be in the evening.
- The time of year may matter, too. In an agricultural community, meetings may need to be at times other than planting or harvest.
- Individuals with personal or professional care-giving responsibilities may require special allowances. For example, getting parents of young children to participate may require scheduling meetings around school schedules, holding a meeting near a park or other play area, or providing child care.
- People vulnerable to stress from extremes of temperature, humidity, or air pollution (for example, the elderly) may prefer meetings in certain venues or at certain times of day.
- Community members with a poor command of spoken and/or written English, or the hearing impaired, may require special accommodations, such as translators or interpreters, to participate. These may include the deaf and hard-of-hearing, immigrants, migrant workers, and non-native English speakers. Remember, immigrants, particularly undocumented workers, may be distrustful of any official process.
- Some cultural, ethnic, or religious groups, such as Native American tribes, may need special outreach in order to see the value in the process, or to want to contribute.
- Those struggling to meet physical or emotional needs may not see a planning meeting as a good use of time and energy. Remember, drought can exacerbate food insecurity and compound existing stresses.

Action Items

1. Find demographic data for the community. The U.S. Census is a good starting point. A local school district may have more up-to-date information.
2. Check with social service providers, both government and non-profit, about what have been the most successful accommodations for working with non-mainstream groups within the community. Meeting times, places, and formats could be considerations, as well as the presence of translators, advocates, or specific individuals.
3. Identify representatives of any minority or special-needs groups within the community that may be affected by drought, such as leaders of cultural centers, or advocates for farm workers or older people.

1.3. Include government agencies and regulators

Communities across the country are affected by federal, state, and local regulations. Federal regulations generally mandate standards and broad programs, which are implemented with certain variations by both state and local governments. Each state has differing requirements regarding how most of these regulations are implemented. It is essential that your community understand the regulations at all levels regardless of the type of water supply you have and any individual monitoring systems you have in place. Communities should have a list of resources for contact persons regarding regulations and programs. Although regulations can place demands on communities, having a thorough understanding of those regulations as well as responsible agencies and individuals can also provide insight into funding opportunities to update infrastructure, educate community members, and safeguard your water resources.

Action Items

1. Identify appropriate contacts at all levels of government who have regulatory duties for both surface and groundwater quality and quantity.
2. Review relevant regulations to ensure that you fully understand and can meet all requirements.
3. Contact the appropriate agencies as you work toward becoming Drought-Ready. Can the agencies assist you with any aspect of the Drought-Ready Communities process? Can they attend a meeting with the leadership team or the community? Can they provide resource material to assist your public awareness and education campaign? Can they help you find funding to place safeguards on your water supply or the development of your drought plan?
4. Keep in contact with agencies as you go through the Drought-Ready Communities process and after you have developed your community's drought plan.

Resources

1. Appendix B, Background on Jurisdiction

1.4. Develop a contact list

A master contact list will help maintain continuity and reduce the learning curve if new community members become involved in drought planning. The process of developing this list and defining roles may also reveal what resources are available to the community before, during, and after a drought, as well as highlighting any resources that might be missing.

Action Items

1. Use Worksheet 2: Contact List to begin developing a comprehensive list of drought contacts. Include the members of the **Leadership Team**.
2. Include a broad spectrum of **water users**, particularly those who can provide regular updates and serve as a communication conduit for a sector or group. Some examples of these groups include, but are not limited to, industrial water users, irrigators, labor groups, media outlets, non-profit organizations, landscapers, recreational and tourist businesses, neighborhood groups, and local politicians. Be sure to include people who specifically ask to be updated about the process.

3. List **local, regional, state, and federal agencies** that have jurisdiction over or data about the community's water supply, public health, agriculture, environmental quality, and other relevant areas. Include each agency's area of responsibility to the community and a contact person.
4. Investigate the ways in which social media, such as Facebook, MySpace, and Twitter, can be used to construct or augment a contact list. Remember, millions of people are using these resources.

📖 Add the Contact List to your Drought-Ready Communities binder.

Resources

1. Appendix A, Worksheet 2: Contact List
2. Appendix B, Background on Jurisdiction

1.5. Gather community perceptions of drought

Now that you have gathered a diverse group of stakeholders that are interested in helping the community become Drought-Ready, it's time to survey their knowledge about drought in the community. This information will be useful in many respects. First, it will provide subjective impact information, which will serve as the starting point of Section 2. It will also inform the Drought-Ready Communities leadership team about the monitoring and communications systems currently in place, the subject of Section 3. In addition, this information can highlight community misperceptions that can be addressed by the public awareness and education campaign, discussed in Section 4. Finally, it can provide an understanding of the different ways that people in the community think about drought.

Action Items

1. Compare perceptions of drought from among the different contacts. Use Worksheet 3 as a guide. Compile the results to give a picture of how drought and its impacts are seen by members of your community.

📖 Add Worksheet 3: Perceptions of Drought to your Drought-Ready Communities binder.

Resources

1. Appendix A, Worksheet 3: Perceptions of Drought

Section 2. Information Gathering: Understand Water Sources and Uses, Develop a Drought History

Droughts are both natural and social phenomena. Droughts can directly and indirectly affect a community in many ways, depending on the characteristics of the drought (severity, spatial extent, and duration) and the unique social aspects of the community. The steps within this section will guide you through gathering information about water sources and uses as well as historical climate and drought information for your area. Combined, this information will give you an accurate picture of past conditions, and it will serve as the foundation for developing effective drought monitoring and planning strategies tailored to the community.

2.1. Identify water sources and uses

This section will help you assess what water sources (supplies) and uses (demands) currently exist within the community. Droughts typically have noticeable effects on water supply and demand. Having baseline knowledge about water will help the community identify potential future impacts and provide a basis for comparison when a drought occurs. Note that "uses" and "users" may be very different. For example, the largest residential "user" might be a small fraction of the total water demand, although residential "use" constitutes the majority delivery type.

Action Items

1. Make a list of all available water supplies by source (e.g., reservoir, groundwater, river) with as many numerical measurements as possible. Use Worksheet 4: Available Water Supplies as a guide. Include:
    a. The amount that comes from reservoirs, wells, rivers, etc.
    b. Costs associated with different sources of water, including seasonal variations.
    c. For each water source, note the typical proven capacity, maximum pumping rates, and minimum usable level (if applicable).
    d. How drought affects water quality. Municipalities may need to filter sediment from water drawn from lower reservoirs. Well owners may need to test wells more frequently when there is less water to dilute contaminants.
2. Learn what proportion of water supply goes to various uses, such as residential, industrial, commercial/business, water deliveries (to surrounding areas), etc. Note major seasonal variations. If you do not have information on use by sector, refer to Action Item 3, below.
3. As a double-check that you've included all the "uses" in Item 2, make a record of the top water "users". Use Worksheet 5: Top Water Users as a guide. If there are any concerns about the confidentiality of water use information, consider redacting this portion of the document in some fashion. Also, be sure to state how the top water users are defined (i.e., what the cut-off is). Include:
    a. Their maximum, minimum, and average water use.
    b. Peak usage time or month if there is significant variation throughout the year.

📖 Add Worksheets 4 and 5 to your Drought-Ready Communities binder.

Resources

1. Appendix A, Worksheet 4: Available Water Supplies
2. Appendix A, Worksheet 5: Top Water Users
3. Nebraska's Health and Human Services community water supply vulnerability document at http://carc.agr.ne.gov/pdf_files/MunicipalSubCommittee.pdf

2.2. Learn how drought has affected the community in the past

Droughts can result in a variety of impacts, such as changes in water availability, income declines for businesses, increased fire risk, health problems, environmental issues, and more. Gathering specific information about drought impacts in different sectors within the community can help ensure that responses to drought address actual rather than perceived needs, as well as include special needs or less visible groups (see Section 1.2). Taking time to examine impacts from as many droughts as possible over a long period of time may help a community judge the many and varied ways in which a drought can impact the community.

Action Items

1. Learn how each of the water sources and uses identified in 2.1 has been affected by drought in the past. Remember that drought can affect water quality and characteristics as well as supply. Drought impact information is available through a variety of sources. See the Resources section below for help getting started.
2. Develop a comprehensive list of impacts that have affected the community in the past or that would affect it in the future. It is recommended that impacts be grouped by affected sector.
3. Refer to the list of contacts developed in Section 1.4. At this point, having reviewed potential impacts in depth, are there other groups that also need special attention? For instance, rural communities with a lot of farm families and communities with a lot of agricultural workers will need to pay special attention to the economic and social needs of these populations.

📖 Add the list of historic impacts to your Drought-Ready Communities binder. Update Worksheet 1: Benefits of Drought Planning if needed to reflect benefits to other stakeholder groups you may have identified in this section.

Resources

1. Where to find information on drought impacts:
    a. Local history, which could come from newspaper records, library clipping files and other holdings, the historical society, and residents' recent experiences and past memories. Remember to view this history in light of changes over time in climate, water supply, population, and industry.
    b. The local water utility. Be sure to ask about how drought has affected or could affect water quality, too. Make sure the utility is keeping key records, such as when auxiliary

supplies are used to augment the main supply. Also, remember that corporate memory within an organization rarely extends much beyond 20 or 30 years because of position turnover.

c. Worksheet 1: Benefits of Drought Planning, which provides a detailed list of impacts, broken down by environmental, social, and economic impacts. It can serve as a reminder or provide ideas about impacts to look for.
d. The Drought Impact Reporter (DIR), http://droughtreporter.unl.edu/, on-line since 2005, archives drought impacts from across the country, based on ways impacts are commonly reported in media and other sources. Note that, in some cases, historical drought information has been collected from newspaper archives and entered into the Drought Impact Reporter.

2. The National Drought Mitigation Center (NDMC) provides a detailed discussion about drought impacts at:
    a. http://drought.unl.edu/risk/impacts.htm

2.3. Gather data on water and climate

Droughts are a normal part of climate in most areas. It is likely that your community has experienced more than one drought in the past, and they will certainly experience another drought sometime in the future. Identifying the occurrence of past droughts is another important step toward being able to better cope with future droughts.

In this section your community will gather and analyze water and climate data to gain a better understanding of your location's climate and drought history. Throughout this process you will answer the following questions:

- How much precipitation normally occurs and what time of year is it most abundant?
- How often does drought occur in this region?
- How severe have the droughts been?
- How widespread have the droughts been?
- How long have the droughts lasted?

As you conduct this exercise, remember that the relationship between precipitation, stream flow, and water supply can be quite complex. It is strongly recommended that you complete this step with some outside assistance, possibly from a hydrologist or engineer. If resources are limited or outside assistance cannot be obtained, complete this exercise to the best of your ability.

Action Items

1. Inventory all available records and monitoring systems concerning the community's water system. Remember to survey community-maintained, state, and federal networks, to find out what data are available. As you do this, answer the following questions:
    a. How close are the nearest monitoring stations (well, stream gauge, reservoir intake, etc.)?

   b. How frequently are data gathered?
   c. How far back do records go?
   d. Do other stations, even if more distant, provide more complete and better quality data, while still being representative of your region? These may be used in place of your records; however, there's no substitute for local data. Collection of any missing data should begin immediately.
2. Find out what climate data are available from national, state, or regional sources that can help you understand your community's drought and climate history. Sometimes climate and weather observations may be combined from multiple sites to provide a more complete, longer climate record; these may be substituted in some cases for single-station observations in or near the community. You will likely want to answer many of the same questions as in Item 1, above.
3. Possibly with outside assistance from a NOAA Regional Climate Center, a state climatologist, a state hydrologist, or the water survey, interpret the data you have gathered. Also see Appendix B, Case Study: Norman, Oklahoma – Drought History for an example of a community's climate and water history.
   a. Obtain or compute the average monthly, seasonal, and annual precipitation and temperature.
   b. Define periods when a drought occurred. Take note of the severity, duration, and spatial extent of each drought. You might find the U.S. Drought Monitor, the Standardized Precipitation Index (SPI), and the Palmer Drought Severity Index to be great resources for identifying drought periods.
   c. Compare data about water sources and uses with the periods of significant drought that you identify, to further understand the connection between drought and your community's hydrology.

📖 Include the analysis of past droughts in your binder.

Resources

1. Appendix B, Case Study: Norman, Oklahoma – Drought History, provides a detailed climate and water history for the city of Norman.

2. The community's state climatologist (SC): http://www.stateclimate.org/

3. A NOAA regional climate center (RCC): http://www.ncdc.noaa.gov/oa/climate/regionalclimatecenters.html

4. The National Drought Mitigation Center (NDMC)
   a. Homepage: http://drought.unl.edu
   b. How to create a local drought history: http://drought.unl.edu/monitor/localdroughthistory.htm
   c. Climographs – graphs showing average monthly precipitation and temperature – for various locations across the United States: http://drought.unl.edu/whatis/climographsdomesticenglish.htm
   d. Maps of Palmer Drought Severity Index 1895-1995: http://drought.unl.edu/whatis/palmer/pdsihist.htm
   e. Archive of Standardized Precipitation Index: http://drought.unl.edu/monitor/archivedspi.htm

f. Comparison of major drought indices: http://drought.unl.edu/whatis/indices.htm

5. U.S. Drought Monitor archive: http://drought.unl.edu/dm/archive.html

6. The National Climatic Data Center (NCDC) provides graphs showing time series of precipitation, temperature, and SPI and PDSI at the climate division level: http://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp#

7. Climate trend information for temperature and precipitation is available by state climate division at http://cig.mesonet.org/~derek/public/timetraces/, or at http://www.southernclimate.org/products/trends.php .

8. NOAA Climate Services provides a wealth of information to help with understanding climate and finding climate data: http://www.climate.gov/

9. The American Water Resources Association (AWRA): http://www.awra.org/

10. The American Water Works Association (AWWA): http://www.awwa.org

2.4. List factors that affect the severity of drought impacts

A direct relationship seldom exists between the degree of drought severity and the degree of impacts experienced by a community. This is because natural and social factors, both of which tend to change over time, can play a role in how the drought affects society, the economy, and the environment. These factors include, but are not limited to, the timing of a precipitation deficit, temperature, population growth, the development of new technologies or water supplies, and land use patterns.

For example, suppose a city experiences a precipitation deficit in the middle of an abnormally cool summer. The impacts of the drought on water supply and demand and water-sensitive activities could be quite different from the impacts in a year when normal or above-average temperatures were occurring. Also, consider a severe drought from 20 or 30 years ago. Would impacts be the same today, considering changes in water demand due to population changes, per capita water use trends, or new industry? In this section you will explore the circumstances that influence how drought affects your community.

Action Items

1. The community's water supply and demand have probably fluctuated over time, creating situations of water strain and plenty. With this in mind, gather any available information on long-lasting changes to the water supply and demand. Examples might include the development of a reservoir, a change in irrigation technique, or the opening of a new industrial plant.
2. List any natural and social factors that tend to increase or decrease the impact a drought can have on the community. Some of these factors affect water supply, and others affect demand.

Keep in mind that factors can be sector-specific. For example, temperature may influence impacts in agriculture but not tourism.

3. Pick at least two different droughts – one that was particularly severe according to the climate record, and another that was the most recent -- and compare their impacts. Consider this exercise an opportunity to identify any additional natural or social factors that may have been overlooked above.

📖 Include the list of factors that moderate or intensify the effects of drought in your binder, including background information on major changes to the community's water supply and demand.

Resources

1. Appendix B, Case Study: Norman, Oklahoma – Drought History, discusses how natural and social factors can result in severe impacts during relatively minor droughts.

Section 3. Establish Monitoring: How You Will Recognize and Communicate About Drought

As described in Section 2, many resources are available to evaluate past drought conditions and impacts. Many of these same resources, such as the U.S. Drought Monitor, can also be used in real-time to detect an emerging drought. Drought monitoring includes defining what to monitor and at what intervals, how information will be accessed and distributed, assigning individuals with the responsibility for routinely monitoring conditions and impacts, and informing others in the community based upon a defined schedule.

3.1. Identify drought indicators that will be used by the community

Drought reveals itself in many different ways. Consequently, you could choose from a multitude of drought indicators. For example, what are your primary sources of water? If you rely on groundwater, stream flow or reservoir levels may not be as important. How quickly do water shortages appear? If they appear quickly, more rapidly responding indicators may be more appropriate. The purpose of this section is to evaluate various drought indicators and determine what is most relevant to your community.

Action Items

1. Review the water, drought, and climate indicators identified in Section 2. Decide which indicators your community should regularly monitor, keeping in mind that some indicators may be historical while others may be current. You may wish to include at least one regional indicator that can provide broad information about the surrounding area and at least one local indicator directly tied to the community's water supply.
2. Assign responsibility for monitoring drought indicators to one or more people. Establish a regular schedule to monitor and report conditions to the Drought-Ready Communities team and others who are interested. Make sure that conditions are monitored at least monthly, even on groundwater systems.

📖 Add the water, drought, and climate indicators you chose, and the names of those responsible for monitoring them, to your binder.

Resources

1. The NIDIS Drought Portal has a section related to drought indicators that may be helpful: http://www.drought.gov/portal/server.pt/community/drought_indicators/223. Also keep in mind that some indicators are regional (for example, many reservoir-based indices are only produced in western states) and may not be available in your state. Ask the NIDIS Portal team (http://www.drought.gov/portal/server.pt/community/drought.gov/202//contact_us) for help. If an indicator of importance to you is not available on the NIDIS Portal, you can request that your indicator be added to their list.

2. Commonly used large-scale indicators:
    a. U.S. Drought Monitor: http://drought.unl.edu/dm/monitor.html

   b. Standardized Precipitation Index: http://www.wrcc.dri.edu/spi/spi.html
   c. Palmer Drought Severity Index: http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/palmer.gif
   d. Crop Moisture Index: http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/cmi.gif
   e. USDA/NASS Crop Reports: http://www.nass.usda.gov/Statistics_by_State/index.asp
   f. Surface Water Supply Index: http://www.wcc.nrcs.usda.gov/wsf/swsi.html
   g. Keetch-Byrum Drought Index (fire potential): http://www.fs.fed.us/land/wfas/kbdi.png
   h. Mountain snowpack: http://www.wcc.nrcs.usda.gov/cgibin/westsnow.pl

3. General list of common local indicators (locally maintained data may also be available although it is not listed below):
   a. The National Weather Service's Precipitation Analysis, showing current precipitation, as well as accumulated 7-, 14-, 30-, 60-day precipitation totals and amounts relative to normal : http://www.srh.noaa.gov/rfcshare/precip_analysis_new.php
   b. Soil moisture: http://www.emc.ncep.noaa.gov/mmb/nldas/drought/
   c. Stream flow measurements (U.S. Geological Survey): http://waterwatch.usgs.gov
   d. Reservoir levels (not an exhaustive list)
      i. http://www.usbr.gov/main/water/ (Contains hourly, daily, weekly water supply information, etc., for the Great Plains and Western United States)
      ii. http://www.pecad.fas.usda.gov/cropexplorer/global_reservoir/ (Satellite info on the largest lakes/crop coverage)
   e. Well or groundwater levels (U.S. Geological Survey): http://waterdata.usgs.gov/nwis/gw

4. The National Drought Mitigation Center maintains a list of state drought contacts. These people specialize in drought issues and would be an excellent resource. They may be able to provide advice based on what other nearby communities use to monitor drought: http://drought.unl.edu/plan/direct.htm

5. For a discussion about drought indices, see the "Comparison of Drought Indices" page on the NDMC website: http://drought.unl.edu/whatis/indices.htm

3.2. Identify drought impact indicators for your community

In Section 2.2, you learned how drought has affected the community in the past. In this section, you will see whether there are specific ways to measure the impacts of an emerging or ongoing drought. Detecting drought's impacts in the early stages, before they become a crisis, can help prevent some of the worst effects. Decision makers find drought impact information valuable since it can help them make informed decisions about water prioritizations, and it helps identify sectors in need of assistance. Unfortunately, information on drought impacts can be hard to find, particularly quantifiable data. Businesses, farm families, agricultural workers, and others are sometimes reluctant to share information about how drought is affecting them, either for competitive or personal reasons. In this section you will take steps that will help your community effectively monitor and communicate drought impacts.

Action Items

1. Review Section 2.2 and identify a representative or advocate for each group or sector that is likely to experience drought's impact. Ask this person to help detect and convey the impacts of drought, serving as a conduit of information between the Drought-Ready Communities team and the sector or group. Be sure there is a clear understanding whether, and at what point, submitted impact information will be made public. Also, don't forget to add this person to your Drought-Ready Communities contact list (Section 1.4).
2. Consult representatives for each group or sector (as determined in Action Item 1) to determine what impact information is most critical to track. Ideally, the information you track should include quantitative components such as number of businesses affected, number of people laid off from work, percent of water users experiencing restrictions, etc. Determine how this information will be collected and at what frequency. It is recommended that impact monitoring be done at least on a monthly basis.
3. Incorporate impact reporting into regular drought monitoring and communication, and submit impacts to the NDMC's Drought Impact Reporter database.

📖 Add the list of impact information to track to your binder, including sector contacts, data/information that will be tracked, and a URL (web link) to the Drought Impact Reporter.

Resources

1. NDMC's Drought Impact Reporter
    a. Homepage: http://droughtreporter.unl.edu/
    b. Submit a Drought Impact: http://droughtreporter.unl.edu/add.jsp

Section 3.3. Develop a drought monitoring communication plan

A drought communication plan allows a community to organize much of the information that must be shared internally, with partner agencies, and with the general public during a disaster. As such, it is a vital part of being "Drought-Ready." The drought monitoring communication plan meets the following objectives:

1) It outlines when, how, what, and to whom drought status information will be disseminated.
2) It includes inter-agency communication, so that local decision makers and emergency managers are in the information loop.
3) It has provisions for updating state and national authorities, as needed.
4) It outlines provisions for alerting and communicating with the general public, including a method for handling information inquiries, which multiply rapidly during a disaster.
5) Information is disseminated on a timely basis, using appropriate language for the target audience(s).

Having a communication plan in place before drought occurs will increase the likelihood of timely communication of relevant information to officials, decision makers and emergency

managers, and the general public. Communication between those with specific roles and responsibilities to safeguard the public will increase efficiency and transparency in water management. Also, keeping the public well informed as drought intensifies may help people react more favorably when officials request steps such as reduced lawn watering, eliminating car washing, and shorter showers.

Action Items

1. Assess how information about drought was disseminated in the past. Who reported the information, and how was it released to the public? You may want to consult the drought impact history compiled in Section 2.2 as well as Worksheet 3: Perceptions of Drought.
2. Create a template for a regular drought information report. This report should include drought indicators identified in Section 3.1, and any impacts being reported, ideally using quantitative indicators identified in Section 3.2. The resources section below contains several examples of how various government agencies have chosen to communicate about drought to help you get started. Be sure to communicate about drought status in terms that people can relate to easily. For example, instead of talking about capacity in absolute terms, such as millions of gallons per day, use relative terms such as the equivalent in number of showers, the percentage of total water storage capacity of the municipal water supply available, or the water use compared with that of previous years.
3. Prepare and distribute the drought information report to a core group of people responsible for safeguarding the public, even when there is no drought. Include local media and any others who indicate interest. Having a regular publication, even in times of plentiful rain, will assure that those receiving the document are familiar with its content and format and the indices used so they will not have to overcome a learning curve when a drought strikes.
4. Identify any groups that need longer lead time or earlier warning, and incorporate more frequent or more detailed updates for those groups into the plan, if possible. For example, farmers may be able to make use of any available forecast information.
5. If you believe conditions in your area are not reflected properly in the U.S. Drought Monitor, contact your state climatologist or the local National Weather Service Forecast Office. You may also contact the Drought Monitor authors directly at DroughtMonitor@unl.edu.
6. Increase the frequency and scope of communication as drought develops. One great resource to utilize as you do so is a public information officer or other media specialist. Expand communication to a broader audience by:
    a. Designating an individual to be responsible for communicating with the public. This person should be available by telephone or email to answer questions that arise during a drought situation. If a staff position is unavailable, consider seeking volunteers from the community to answer basic questions.
    b. Identifying means of distributing information that you will use for timely communication during drought, such as bulletin boards, cable access channels, notes on water bills, websites, social networking sites (Facebook,Twitter, RSS feeds) , etc.
    c. Developing press releases and other education and outreach materials to keep the public informed and to request or encourage behavior changes, such as voluntary conservation. Be sure to emphasize responses based on the triggering thresholds outlined in Section 5.2.

📖 Add the drought information report template, the distribution list, and the schedule to your binder.

Resources

1. *National Weather Service (NWS) Drought Impact Statements* demonstrate how drought is communicated between NWS officials and the public.
   Current statements: http://www.weather.gov/ahps/hic/current/drought/

2. The Arizona Department of Water Resources Drought Program does an excellent job disseminating drought status information to the public. Below is a link to the Arizona "Drought Status" webpage. It contains links to past and current monthly status documents and annual reports.
   http://www.azwater.gov/AzDWR/StatewidePlanning/Drought/DroughtStatus.htm

3. The *Denver Water Drought Response Plan* discusses their Drought Communication Program, which contains three major components: public involvement, customer information, and media relations (p. 42). The plan also addresses internal communication.
   http://www.denverwater.org/docs/assets/DD1F807E-BCDF-1B42-D5B4FD4EB681A7B3/drought_response_plan1.pdf

4. The City of San Diego maintains a website that uses a four-tiered, color-coded scale for communicating drought conditions to the public.
   http://www.sandiego.gov/water/

5. The New Jersey Drought Department of Environmental Protection's Drought Information website provides an example of how the Internet can be used to regularly update stakeholders about drought status and other drought-related information.
   http://www.njdrought.org/

6. The Maryland Department of the Environment drought website provides another an example of how the Internet can be used to communicate drought status and other drought-related information to stakeholders.
   http://www.mde.state.md.us/Water/Drought/home/index.asp

Section 4. Plan a Public Awareness and Education Campaign

Design a public awareness and education campaign that will help community members understand the benefits of planning for drought, the community's water supply and use, the local drought history, and water conservation techniques. Greater understanding is likely to lead to greater compliance when people need to conserve water in response to drought. It's also likely that people will begin to place more value on some of the long-term steps the community can take to be better prepared for the next drought, and to consider drought, climate, and water related issues in planning and decision making. To make a difference, information needs to be delivered consistently.

Key messages will vary, depending on the intent and the audience. Possibilities include:

- Where does the community's water come from and who uses it?
- What is drought and how has it affected the community in the past? How would it affect the community in the future?
- Benefits of planning for drought
- Community drought indicators, triggers, and responses
- Current drought status
- Water conservation measures for drought and non-drought times
- Watershed planning and protection

Information can be shared or delivered in many ways. Consider:

- Educational materials, activities, or programs for elementary, secondary, and post-secondary schools, and for Scout troops, 4-H groups, or other youth groups
- A display for community functions, local libraries, or meeting places
- Speakers willing to give presentations to local businesses or groups
- Coffee shop meetings or town hall meetings
- Reports or feature stories by local media sources
- Programs coordinated with local museums or the park district
- Internet sources, including a RSS Feed, blog, Twitter, and Facebook.

Action Items

1. Identify people interested in public awareness and education to create informational materials that will convey key messages to your community. Be sure to review these materials to see whether they need to be modified or translated for specific groups within your community – children, adults, cultural or ethnic groups, etc. It may help to consult Section 1.2 for special needs groups.
    a. Consider many ways to reach various groups – pamphlets, billboards, newspaper advertisements or inserts, website content, public access cable programming, etc.
    b. Consider the staff resources you have available to develop and distribute the materials, and find an option that works within your budget. Communities may find it useful to work with a marketing firm to develop and distribute information.
2. Identify community organizations or agencies that would be willing to collaborate by including Drought-Ready information in their publications or mailings. The local water utility is a likely collaborator. Other community organizations such as churches and any environmentally

oriented non-profit organizations may also be willing to include Drought-Ready information. Don't forget to include local media outlets. They are often a valuable resource for getting information out to the public.

3. Outline your strategy and gather educational materials, products, and activities. Refer to the resources below for guidance.
4. Devise an implementation schedule. Periodically update or refresh the materials and messages that you are distributing so the information does not become stale or overlooked.

📖 Add the strategy, schedule, and any materials you produce to your binder.

Resources

1. The Groundwater Foundation: http://www.groundwater.org/
2. Drought Central: Nebraska State Government – General Public Drought Management Tips: http://www.droughtcentral.nebraska.gov/
3. Maryland Department of the Environment: Water Conservation: http://www.mde.state.md.us/Programs/WaterPrograms/Water_Conservation/index.asp
4. *Oklahoma Water Resources Board Strategic Plan, FY 2008-2012;* Public Outreach and Education (p. 14): http://www.owrb.ok.gov/about/management/OWRBStrategicPlanFY2008.pdf
5. State of Arizona: Water Conservation Education and Outreach: http://www.adwr.state.az.us/azdwr/StatewidePlanning/Conservation2/Education/default.htm
6. Save Water NC (good information and links for homes, businesses, government, etc): http://savewaternc.org/
7. Redwood City, California, "10 Gallon Challenge" : http://www.redwoodcity.org/galloncount/

Children's Educational Materials and Websites

1. 42eXplore (eduScapes) – The Topic: Drought: http://www.42explore2.com/drought.htm

2. Environmental Protection Agency (EPA)
    a. Water Cycle: The EPA's animated "Thirstin's Water Cycle" shows how water moves through the hydrologic cycle. Concepts include precipitation, aquifers, vapor, and clouds. http://www.epa.gov/safewater/kids/flash/flash_watercycle.html
    b. Environmental Kids Club: The EPA's "Kids Page on Water" teaches kids how to care for this important resource. http://www.epa.gov/kids/water.htm
    c. EPA WaterSense Kids: Provides kids with games, trivia, and tips on how to save water. http://www.epa.gov/WaterSense/kids/
    d. *A Day in the Life of a Drop* is a set of activities designed to help students in grades 3–5 understand the connections between the source of the water they use and the ways their water use habits affect the environment and human health. http://www.epa.gov/watersense/resources/educational_materials.html

3. National Drought Mitigation Center: Drought for Kids: http://drought.unl.edu/kids/index.htm

Section 5. Taking Action: Planning Responses to Reduce Impacts

You have probably realized by now that your community can take steps ahead of time to reduce the anticipated effects of the next drought. Examples of steps that communities can take ahead of time include educating people about water conservation, encouraging alternatives to thirsty lawns, ensuring that new developments incorporate land-use practices that preserve watersheds and reduce paved area, interconnecting water sources, etc.

It's also helpful to plan responses to take during drought before the next one happens. Regularly consulting drought indicators makes it more likely that your community will be alerted to developing events in time to respond carefully and deliberately, before your community reaches a crisis stage. These response actions could include providing or accelerating distribution of awareness materials, voluntary or mandatory conservation measures, and notifying local social service or public health agencies of the potential for drought-related hardship. The key is to assess what steps your community should take to respond to the varying durations and intensities of drought. Remember to be inclusive – a good drought response plan includes more than just mandatory water conservation.

Equally important is the fact that a good drought response plan doesn't end when the drought does. A drought can be a powerful focusing event that increases community awareness and resolve. After a drought, be sure to capitalize on this attention and experience to improve the drought plan and possibly even employ additional strategies to further reduce drought impacts.

5.1. Determine and prioritize possible strategies to take before and in response to drought

Action Items

1. Review the lists of impacts and stakeholders from Section 2.2.
2. Review strategies used by other communities to respond to drought and reduce impacts. Appendix C provides a list of strategies that may apply to your community.
3. Brainstorm a list of any strategies, possibly including those discovered in Action Item 2, that could help with reducing or responding to the effects of drought in your community. Be sure to include strategies that can be taken both before and during a drought.
4. Evaluate each strategy according to its feasibility, equity, cost, and other considerations. Some actions will likely be termed a "worst-case scenario" for the community, but it may still be useful to include them for planning purposes. For each strategy, decide whether it requires action ahead of time or as a response to an emerging drought. For each item that requires action, assign a person or agency to be responsible, and decide or estimate the time and costs (if any) needed to complete the action. Worksheet 6 (Appendix A) can guide you through this process.

📖 Add the list of response strategies and the evaluation from Worksheet 6 to your binder.

Resources

1. Appendix A, Worksheet 6: Cost-Benefit Comparison
2. Appendix C, Examples of Drought Response Actions

5.2. Link response actions to drought indicators

Now that you have identified steps to take to reduce the impacts of drought and indicators to detect emerging drought, decide when to take action. Some strategies listed in Section 5.1, such as developing a new water source, will need to be carried out before a drought occurs. Others won't need to be implemented until a drought occurs. Keep in mind that different levels of response will probably depend on drought severity, in addition to the type of impact. The following action items will help you determine when to employ actions based on varying levels of drought severity.

It is nearly impossible to predict how severe or long-lasting a drought will be. As your indicators creep toward the values that trigger response actions, there will be a tendency to wait and see whether or not the dry spell will evolve into a full-fledged drought. There is a natural tension here, because triggering too early can induce complacency in the community; however, waiting too long to institute action may put you in more dire straits later. That is why the use of triggers linked to potential impacts is important. They provide an agreed-upon set of measures that can inform response decisions. Setting appropriate triggers might seem like an intimidating task, but your community's knowledge of past events and water system limitations gained from Section 2 will allow initial values to be determined. Depending on available resources, the process of defining trigger values may be subjective or objective. Regardless, be sure to revisit this exercise after a drought occurs to improve the connection between drought severity and community response.

Action Items

1. Refer to Worksheet 6, Cost-Benefit Comparison, and identify the strategies on that list that will be implemented during drought.
2. Some strategies will probably need to be implemented in stages as drought severity changes while others will only require one level of action. For all strategies requiring incremental implementation, determine 2-5 levels of action that can be taken as drought severity increases. For example, the strategy "implement water restrictions" might result in the actions "voluntary restrictions," "mandatory restrictions," and "water rationing" for moderate, severe, and extreme drought triggers, respectively.
3. Determine the values (thresholds) at which your indicators will trigger the response actions identified in Action Item 2. Remember that actions may be triggered by a combination of indicators, or ranges of values.
4. Combine Action Items 2 and 3 using Worksheet 7: Linking Thresholds to Actions. See the case study from Decatur, Illinois, in Appendix B for an example of how one community linked thresholds to actions.
5. After a drought occurs, be sure to revisit the threshold values used to trigger response actions. If adjustments are needed, remember to update Worksheet 7.

📖 Add your thresholds and actions from Worksheet 7 to the Drought-Ready Communities binder, make it available to the community, and publicize it at least annually.

Resources

1. Appendix A, Worksheet 7: Linking Thresholds to Actions

2. Appendix B, Case Study: Decatur, Illinois – Linking Indicators to Actions

3. Other drought response plans are available on the NDMC website at http://drought.unl.edu/plan/stateplans.htm

4. A few notable drought plans that link drought responses to drought indicators:
   a. *Denver Water Response Drought Plan* http://www.denverwater.org/docs/assets/DD1F807E-BCDF-1B42-D5B4FD4EB681A7B3/drought_response_plan1.pdf
   b. *Georgia Drought Management Plan* http://www.georgiaplanning.com/watertoolkit/Documents/WaterConservationDroughtManagement/DroughtMgtPlanFinal03.pdf

Wrapping Up

📖 When you have completed all five sections of the Drought-Ready Communities process, your binder should include the following:

From Section 1, Getting Started

1. Worksheet 1: Benefits of Drought Planning
2. Worksheet 2: Contact List. Hopefully you thought of ways to expand your initial list as you went along.
3. Worksheet 3: Perceptions of Drought summarized list (you may want to keep individual responses as an appendix)

From Section 2, Information Gathering

4. Details about the community's water sources and users, including Worksheet 4: Available Water Supplies and Worksheet 5: Top Water Uses.
5. A list of all the ways that drought has affected the community in the past.
6. An analysis of past droughts
7. A list of factors that moderate or intensify the effects of drought, including background information on major changes to the community's water supply and demand.

From Section 3, Establish Monitoring

8. A list of drought indicators that your community should monitor regularly, including at least one large-scale climate-based indicator, and one locally generated indicator that is directly related to your community's water supply.
9. The name(s) of one or more people who will check the chosen drought indicators and the schedule for checking.
10. A list of drought impact indicators that are relevant for your community and details about who is responsible for collecting this information.
11. A drought information report template and the distribution list and schedule.

From Section 4, Public Awareness and Education

12. A strategy and schedule for a public awareness and education campaign.
13. Any presentations, pamphlets, templates for press releases, or other materials you have developed to publicize drought and response actions in your community.

From Section 5, Drought Response Planning

14. Worksheet 6: Cost-Benefit Comparison, which is an evaluated list of strategies to prevent and respond to drought impacts
15. Worksheet 7: Linking thresholds to actions

Appendix A: Worksheets

Worksheet 1: Benefits of Drought Planning

Worksheet 2: Contact List

Worksheet 3: Perceptions of Drought

Worksheet 4: Available Water Supplies

Worksheet 5: Top Water Users

Worksheet 6: Cost-Benefit Comparison

Worksheet 7: Linking Thresholds to Actions

Worksheet 1: The Benefits of Drought Planning Date:	
General Benefit	**Specific Stakeholders, Groups, or Businesses**
Economic Benefits	
Reduce or eliminate costs and losses to agricultural and/or livestock producers	
Reduce or eliminate costs and losses to industries directly or indirectly related to agricultural production (seed, feed, and weed companies; equipment dealers; etc.)	
Reduce or eliminate costs and losses to timber production	
Reduce or eliminate costs and losses to fishery production	
Reduce or eliminate costs and losses to recreation and tourism	
Reduce or eliminate impacts on energy-related businesses/agencies	
Reduce or eliminate impacts on water suppliers	
Reduce or eliminate costs and losses to the transportation industry (barge transport/navigability; trucking; etc.)	
Reduce or eliminate decline in food production and/or disruption of food supply	
Mitigate decreased land prices	
Reduce drought-related unemployment	
Reduce or eliminate reduction of economic development	
Reduce rural population loss	
Environmental Benefits	
Plant and animal communities are safer when drought-related wildfire is minimized or eliminated	
Plant and animal communities are healthier when drought-related water quality issues (depletion, pollution, contamination, etc.) are minimized or eliminated	
Maintain environmental aesthetics (visual quality of the landscape, health-recreational benefits)	
Reduce damage to plant or animal species, or loss of plant animal species (disease; mortality; migration)	
Preserve biodiversity	
Preserve wetlands Mitigate reductions in stream flow / river flow	
Mitigate low-water levels in reservoirs / lakes	
Mitigate groundwater depletion	
Reduce or eliminate wind and water erosion	
Reduce or eliminate air quality impacts	
Societal Benefits	
Reduce or eliminate impacts to physical health such as issues related to water quality (which can be affected by depletion) or respiratory ailments from more dust and particles in the air	

Reduce or eliminate safety issues related to wildfire threat	
Reduce or eliminate impacts to mental health (anxiety; depression)	
Mitigate potential conflict (user conflict; political conflict)	
Reduce or eliminate potential quality of life issues (increased poverty; migrations; rural population loss; etc.)	
Preserve cultural belief systems / cultural sites	
Reduce or eliminate public dissatisfaction with government action / response	
Assure current and future residents and businesses that the community is forward-thinking on drought and climate issues	
Attract grant money – granting entities typically regard planning favorably and planning may lead to more community resources	
Community education about drought and natural hazards, and an awareness of community planning and mitigation efforts, provides a sense of security and peace of mind for citizens, public agencies, and businesses	
Communities, families, and individuals benefit when drought planning is incorporated into new development or re-development efforts. For example, smart growth development can reduce the human footprint on the land, conserve natural watershed function, and create walkable communities that are good for public health and that reduce energy consumption.	
Benefits Specific to Your Community	

Most Recent Update:

Worksheet 2: Contact List Date:						
Name	**Contact Number**	**Email**	**Mailing Address**	**Business/Sector**	**Preferred Area of Contribution**	**Notes**

Worksheet 3: Perceptions of Drought

Drought-Ready Town Hall Discussion Questions

When you hear the word “drought,” what comes to your mind?

How do you know when you are entering a drought?

How is your community/organization/etc. affected by drought?

When have you experienced impacts of drought? What were those impacts? When were you impacted the worst?

What information would you like to have about drought that is not presently available?

Drought-Ready Town Hall Survey Questions

Are there any particular groups, businesses, or geographical areas in your community that are especially susceptible to drought?

What concerns, if any, do you have about how drought may affect your own business, home, or recreational opportunities?

Do you monitor drought conditions directly, such as looking at weather or drought indices? If so, what do you use? (e.g., precipitation departures, lake levels, crop conditions, etc.) and how do you access that information? (website, direct measurements)

Do you receive any kind of notification from other individuals or agencies? If so, from whom and how is that provided? Is this a routine message you receive regardless of whether your community is in drought or not?

When you become aware of or are alerted to drought, what do you do with that information?

Do you communicate drought status to other individuals, organizations, or city or county agencies? If so, to what groups and how (forums, newspaper, website, etc.)?

Are you familiar with the Drought Monitor? If yes, do you provide any comments to authors or other officials involved in the process? Do you know state or local people who participate in Drought Monitor discussions?

What information would you like to have about drought that is not presently available?

If you wanted to learn more about drought, how would you go about doing that?

Worksheet 4: Available Water Supplies Date:									
Source	**10 years ago**	**5 years ago**	**Last Year**	**This Year**	**Cost**	**Capacity**	**Pumping Rates**	**Minimum Usable Level**	**Does drought affect water quality?**

Worksheet 5: Top Water Users Date:										
Rank	**Customer /User**	**Type**	**10 years ago**	**5 years ago**	**Last year**	**This year**	**Min Use**	**Avg. Use**	**Max Use**	**Date/Times of Peak Use**

Worksheet 6: Cost-Benefit Comparison Date:						
Potential Action	**Cost**	**Feasibility**	**Effectiveness**	**Before**	**In Response**	**Assigned to**

Worksheet 7: Linking Thresholds to Actions Date:			
Impact	**Indicator(s)**	**Threshold(s)**	**Actions**

Appendix B: Background Material and Case Studies

Background on Jurisdiction

Below is a list of some of the major federal regulations affecting community water supply. State and local regulations in general are summarized as well.

Federal Agencies:

The Environmental Protection Agency (EPA; http://www.epa.gov/regulations/) is responsible for administering regulations preventing pollution of water bodies and ensuring safe drinking water. They are the primary federal agency with responsibilities impacting communities and water supplies. Some of the primary laws they administer:

- Clean Water Act (CWA) of 1972 (with amendments) http://www.epa.gov/regulations/laws/cwa.html
    - The CWA focus is on protecting surface waters from pollution. The law controls wastewater discharge and point and non-point source pollution, and was the foundation for the development of the National Pollution Discharge Elimination System (NPDES). A NPDES permit is required for municipal systems that discharge wastewater into surface waters.
- Safe Drinking Water Act (SDWA) http://www.epa.gov/regulations/laws/sdwa.html
    - The SDWA focus is protecting waters that are utilized for drinking water. Unlike the CWA, which is primarily focused on surface water, the SDWA focuses on both groundwater and surface water protections. Under this law, public water supplies are expected to meet certain minimum standards for the quality of water provided to its customers. The law also sets minimum standards for the protection of groundwater resources from pollution caused primarily by liquid contaminants.
- Endangered Species Act (ESA) http://www.epa.gov/espp/
    - The EPA, together with the United States Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) Fisheries Division, implement regulations for the protection of endangered species habitat. EPA's primary responsibility under this act is to ensure that the quality of critical marine or surface waters is protected.

State Agencies:

States are charged with implementing the federal regulations. Certain regulations are set by the federal government and apply to all states. Other regulatory programs may be implemented on a state-by-state basis by a single agency or several agencies.

The EPA provides a state-by-state look at regulations and their implementations at http://www.epa.gov/lawsregs/states/index.html

Local level:

Certain regulations or programs are often implemented by local entities such as conservation districts, natural resources districts, and local health departments. These entities also can have

the authority to place further restrictions on surface and groundwater use and protection. Often they are responsible for single landowners, but they also work collaboratively with state agencies and other entities to monitor and enforce water regulations and standards. State contacts should be able to guide to you to local entities you may need contact.

Other organizations can assist your community with understanding and keeping up to date with regulations and opportunities for funding. Some of those organizations are listed below.

- The National Association of Conservation Districts: http://www.nacdnet.org/
- The National Water Resource Association: http://www.nwra.org/
- The National Ground Water Association: http://www.ngwa.org/

Case Study: Decatur, Illinois – Linking Indicators to Actions

Overview of Decatur

Decatur is the 11th most populous city in Illinois, with a population of 81,860 [1]. It has a heavy agricultural-industrial economic base, anchored by the headquarters of Archer-Daniels-Midland (ADM) and Tate & Lyle Incorporated. In addition, Caterpillar, Inc., has a manufacturing plant in town. Because of the large water use by these corporations (ADM alone uses approximately 18 mgd)[2,3] , Decatur has a vested economic interest in maintaining a water supply larger than one would expect from a community its size.

Lake Decatur

Decatur's primary water source, Lake Decatur, is an impounded reservoir built in 1922 and fed by the Sangamon River. The lake has a capacity of 22,000 acre-feet[2]. Although it is relatively large, with a surface area of approximately 3,093 acres, it is quite shallow, with an average depth of approximately 6.8 ft[4]. The drainage area of the reservoir is quite large, approximately 925 mi^2, so recharge can occur fairly quickly, even with moderate rainfall [4,5].

Lake Decatur serves the communities of Decatur, Harristown, Long Creek, and Mount Zion by means of a 36 mgd treatment plant. Another treatment plant, capable of providing 19 mgd, was sold to ADM in 1999[4,6]. The north treatment plant, which serves ADM, requires the water level to be at least 610 ft asl. The south treatment plant requires 605 ft asl.[7]

Decatur's Drought Plan

As a result of the circumstances above, Decatur has put particular emphasis on rapid response to decreasing lake levels. Decatur's drought plan focuses on the economic and social impact of a rapid decrease in the quality and availability of the primary water source. Because water demand, evaporation, precipitation, and lake level all tend to be lower in the winter months, and the lake level needs to be higher in the summer to dredge the shallow areas, the plan sets a target lake level of 614 ft asl between March 1 and December 15, and 612.5 ft asl between December 16 and February 28.

Decatur's drought plan is shown below. It provides an example of how drought impacts, indicators, and thresholds relate to community actions at differing levels of drought intensity.

Impact	Indicators	Thresholds	Action(s) - Mar 1 to Dec 15	Action(s) - Dec 16 to Feb 28
Availability of usable water for industry/community.	Lake Level; Calendar Date; Dredging	613.5 ft asl	(1) Start Vulcan Gravel Pit well; (2) Release water from sediment storage site; (3) Inspect and clear DeWitt wellfield oxidation basin and discharge ditches.	None

No dredging of the lake can occur below this level.	Lake Level; Calendar Date; Dredging	613.0 ft asl	(1) Implement voluntary water conservation; (2) Provide top 10 customers with lake level projections; (3) Issue media release; (4) Start 4 DeWitt wells; (5) Start ADM East Plant wells.	None
	Lake Level; Calendar Date; Dredging	612.5 ft asl	(1) Apply for emergency permits for Lake Toko water use and Reas Bridge low flow dams; (2) Obtain bids for Lake Toko pumps and pipe.	None
	Lake Level; Calendar Date; Dredging	612.0 ft asl	(1) Implement mandatory water conservation; (2) Provide top 10 customers with lake level projections; (3) Issue media release.	(1) Implement voluntary water conservation; (2) Provide top 10 customers with lake level projections; (3) Issue media release; (4) Start Vulcan Gravel Pit well; (5) Start ADM East Plant wells; (6) Inspect and clear DeWitt wellfield oxidation basin and discharge ditches.
	Lake Level; Calendar Date; Dredging	611.5 ft asl	Monitor mandatory water conservation effectiveness.	(1) Start 4 DeWitt wells; (2) Apply for emergency permits for Lake Toko water use and Reas Bridge low flow dams; (3) Obtain bids for Lake Toko pumps and pipe.
	Lake Level; Calendar Date; Dredging	611.0 ft asl	ADM install Reas Bridge low flow dams.	(1) Implement voluntary water conservation; (2) Provide top 10 customers with lake level projections; (3) Issue media release.
	Lake Level; Calendar Date; Dredging	610.5 ft asl	Prepare to install Lake Toko pumps and pipeline.	ADM install Reas Bridge low flow dams.
Minimum lake level required for ADM water plant intakes.	Lake Level; Calendar Date; Dredging	610.0 ft asl	Install Lake Toko pumps and pipeline.	Install Lake Toko pumps and pipeline.

Minimum lake level required for South water plant intakes.	Lake Level; Calendar Date; Dredging	605.0 ft asl		

Sources

[1] Illinois Cities by Population. http://www.maps-n-stats.com/us_il_population.html, accessed April 16, 2010.

[2] Alexander, K., 2010: Personal Communication, 20 April, 2010.

[3] Freeman, H., 2000: "Buried Resource. Decatur considers the vast Mahomet Aquifer a key part of its water strategy, but it's uncertain what effect drawing on the underground river will have." Decatur Herald & Review 12 March, 2000.

[4] Hecht, J. and V. Knapp, 2008: Data for assessing drought vulnerability of Illinois' community surface water systems. Contract Report 2008-02. Available at: http://www.isws.illinois.edu/pubdoc/CR/ISWSCR2008-02.pdf

[5] Knapp, V., 2009: Interview.

[6] Editorial Staff, 1999: "1999 Newsmakers." Decatur Herald & Review 31 December, 1999.

[7]City of Decatur Drought Plan. Obtained from Keith Alexander, Decatur City Water Management Director.

Case Study: Norman, Oklahoma – Drought History

As part of the Drought-Ready Communities development process, an applied meteorology and climatology class at the University of Oklahoma worked with officials in Norman, Oklahoma, to develop a climate history. Excerpts are below. The full report is also attached.

Has our city experienced drought?

Drought is a recurring condition in Norman and is part of our climate. Norman's climate history can provide us insight into what we may see in the future. Being a Drought-Ready Community means, in part, that we recognize how our climate has changed over time.

The Climate of Norman, Oklahoma

Temperature and precipitation are the two main elements of our climate. Because Norman is located in the middle latitudes, east of the Rocky Mountains and northwest of the Gulf of Mexico, its residents experience a wide range of weather conditions. Hence, our climate is highly variable, from year to year, season to season, and month to month.

Figure 1 shows the annual temperature (top) and annual precipitation (bottom) in central Oklahoma, including Norman, since 1895.The annual temperature for Norman averages 59.9 degrees Fahrenheit, while precipitation averages 34.5 inches. The warmest temperatures typically occur during July and August when there is a warm-season minimum in precipitation. Warmer-than-average periods have spanned the 1930s, the mid-1950s, and the late 1990s to recent years. Significant periods of drier-than-average conditions include the 1910s, 1930s, mid-1950s, and 1960s.

Drought in Norman, Oklahoma

Figure 3 displays the departure from normal precipitation and the Palmer Drought Severity Index for central Oklahoma from 1895 to 2009. It is evident from these drought indicators that Norman has experienced long and extreme droughts in its past. In addition, the most recent drought in 2006 pales in comparison to droughts of the past.

Climate, Water and Population in Historic Perspective

The past three decades have been significantly wetter than previous decades. Hence, the current generation of Norman residents have not experienced drought conditions as long or as intense as previous generations. While the 2006 drought was minor in terms of precipitation deficit, significant impacts occurred because of non-climate related factors. Population growth has increased Norman's demand for water, and per capita water usage is at an all-time high (Figures 9 and 10). As a result, even during years not suffering from drought, the City of Norman cannot supply enough water as demanded by users during part of the summer without accessing external supplies.

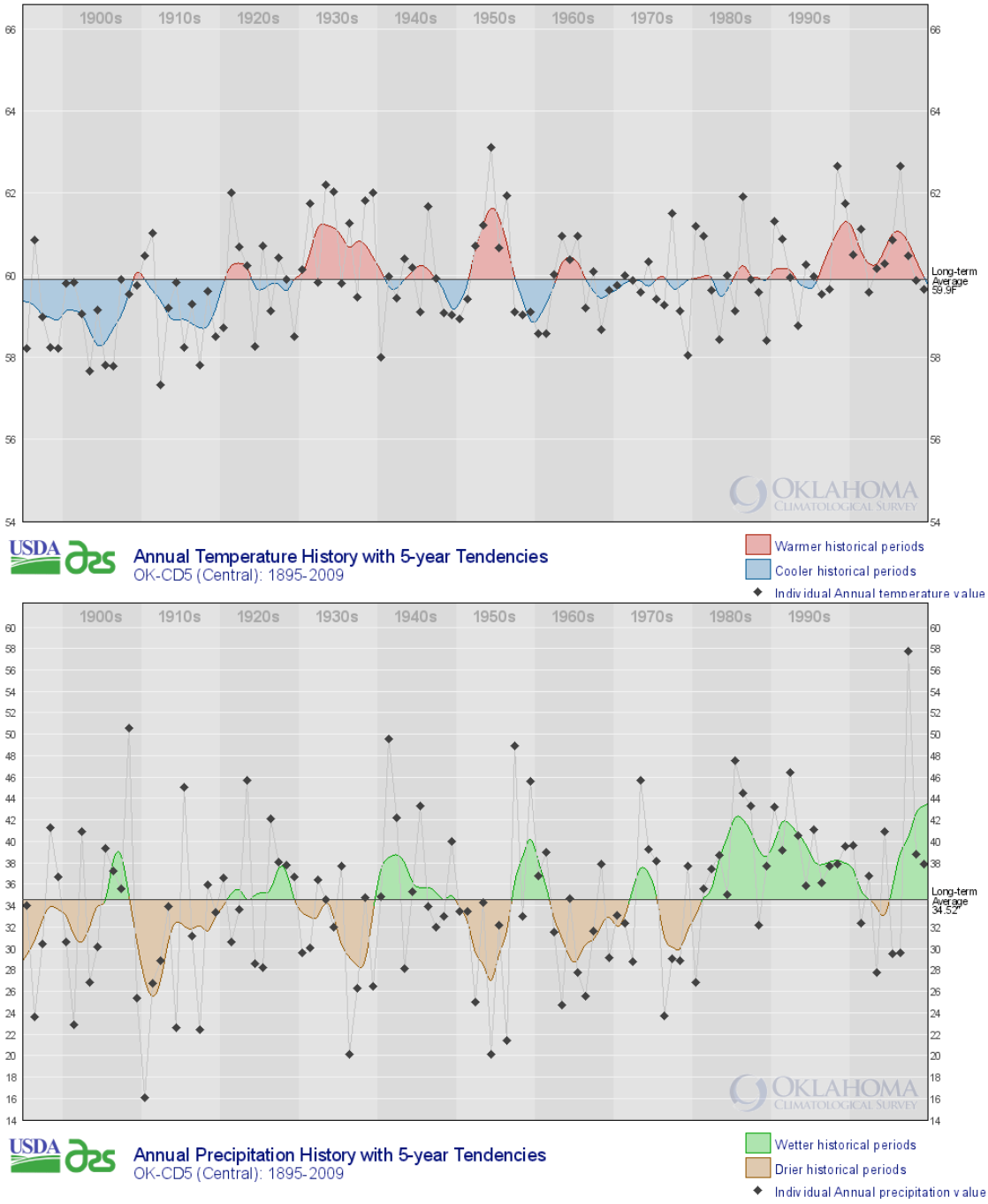


Figure 1. The average annual temperature (top graph) and total annual precipitation (bottom graph) in central Oklahoma from 1895 to 2009. To highlight warmer, cooler, wetter, or drier periods, 5-year moving averages are shaded. On the top graph, red shading (above the horizontal line) indicates warmer periods and blue shading (below the line) notes cooler periods than average. Similarly, on the bottom graph, green shading (above the horizontal line) highlights wetter periods and brown shading (below the line) highlights drier periods than average. Extended periods of relatively warm temperatures or low precipitation are outlined in red boxes.

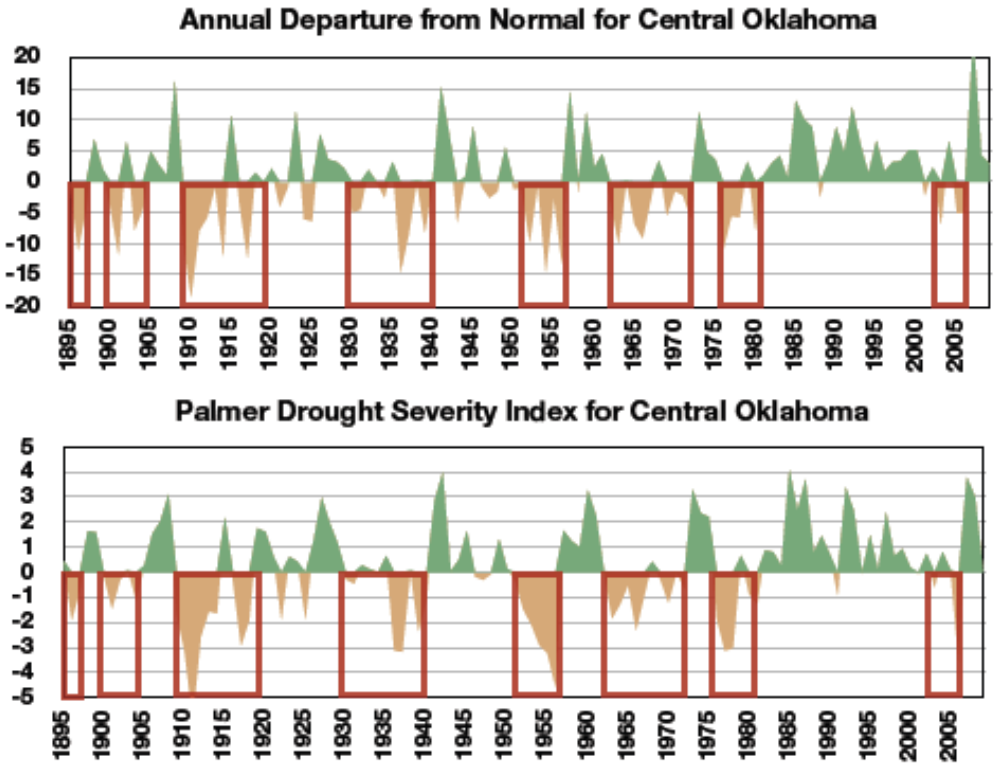


Figure 3. Top graph: Annual departure from normal precipitation (actual precipitation total for the year subtracted from the annual normal) for central Oklahoma from 1895 to 2009. Bottom graph: Palmer Drought Severity Index for central Oklahoma from 1895 to 2009. Red boxes outline the same drier-than-average periods highlighted in Figure 1.

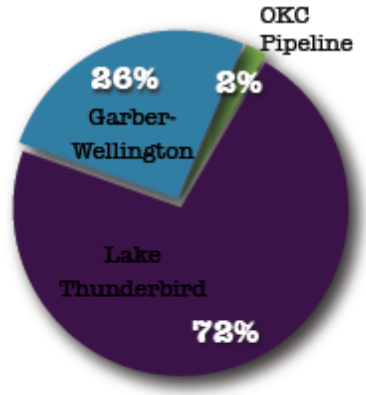


Figure 4. Sources of water for the City of Norman and its customers. On average, 72% of the water supply is from Lake Thunderbird (dark violet), 26% from the Garber-Wellington Aquifer, and 2% from the Oklahoma City pipelines.

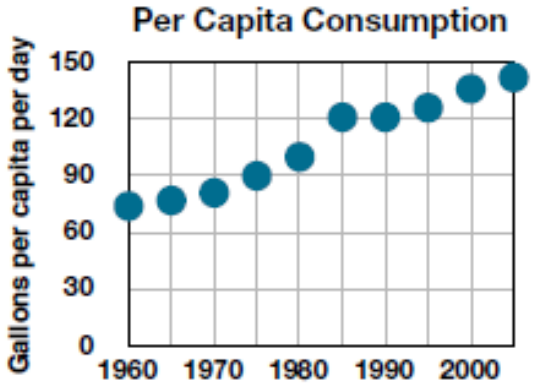


Figure 9. Daily water consumption per person from 1960 to present. Data courtesy of the City of Norman (Water Conservation Plan 2006).

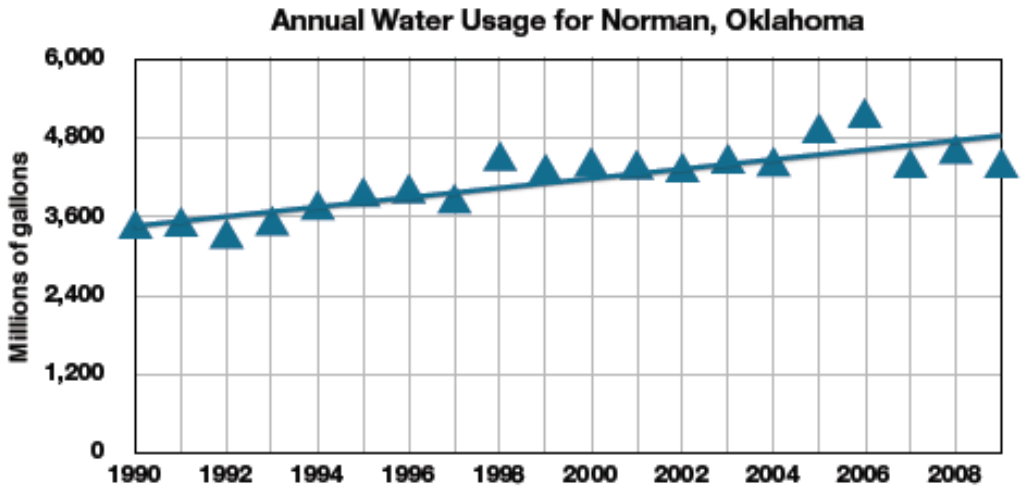


Figure 10. Annual water usage (in millions of gallons) for Norman from 1990 to present. Data courtesy of the City of Norman. The line depicts the average increase in water usage over the past two decades.

Appendix C. Examples of Drought Response Actions

Broad-spectrum Drought Resources

Drought Plans that Discuss Response Actions

1. The *Navajo Nation Drought Contingency* Plan has a section on Drought Mitigation (p. 50) that recommends short- and long-term actions for responding to drought and reducing impacts. Topics discussed include drought monitoring, domestic water hauling, public drinking water systems, irrigators and dryland farmers, ranchers (establishing a grazing policy, improving range management, reliability of livestock supplies), recreation, wildlife and forestry (fire prevention, forest restoration), and reuse of treated effluent.
    - http://drought.unl.edu/plan/Navajo_drought_pln2003.pdf

2. The *County Drought Mitigation Strategies* for all four counties in Hawaii provide examples of drought response actions implemented and being planned in relation to wildfire, agriculture and commerce, and water supply. Topics related to **wildfire** include conducting controlled burns, education programs, constructing firebreaks, modifying building codes, identifying helicopter-accessible water sources, closing forest areas, weather stations, and burn bans. Topics related to **agriculture and commerce** include repairing/upgrading ditch systems and water pumps, ag conservation programs, alternative irrigation techniques, crop selection, and developing a Green Business Program. Topics related to **water supply** include education programs, water restrictions, water metering, leak detection programs, rebate programs, water efficiency standards, supplementing water supplies, modified water rate structures, and system interconnections.
    - http://hawaii.gov/dlnr/drought/preparedness/KauaiDroughtMitigationStrategies.pdf
    - http://hawaii.gov/dlnr/drought/preparedness/OahuDroughtMitigationStrategies.pdf
    - http://hawaii.gov/dlnr/drought/preparedness/MauiDroughtMitigationStrategies.pdf
    - http://hawaii.gov/dlnr/drought/preparedness/HawaiiDroughtMitigationStrategies.pdf

3. The *Denver Water Drought Response Plan* discusses a Drought Communication Program, which contains three major components: public involvement, customer information, and media relations (p. 42). The plan also addresses internal communication.
    - http://www.denverwater.org/docs/assets/DD1F807E-BCDF-1B42-D5B4FD4EB681A7B3/drought_response_plan1.pdf

Drought Planning Guides

4. The *California Urban Drought Guidebook (2008)* provides specific examples of community supply augmentation and demand reduction strategies. Table 2 (p. 43) provides water augmentation methods and examples. Pages 42-64 focus on demand reduction options, including public information campaigns, landscape irrigation schedules, water restrictions and ordinances (for waste water, landscaping), modified water pricing, and tips for enforcement. Table 11 (p. 77) provides demand reduction measures by customer category (residential, commercial and institutional, industrial, new connections).
    - http://www.cuwcc.org/WorkArea/showcontent.aspx?id=9740

5. The *How to Reduce Drought Risk (1998)* document contains an appendix (p. E-1) with an at-a-glance list of potential drought risk reduction actions. Topics listed include assessment, legislation and public policy, water conservation/demand reduction, water supply augmentation, economic development, public education and participation, health and nutrition, media participation, conflict resolution, drought plans, technical assistance, and emergency response.
    - http://drought.unl.edu/plan/handbook/risk.pdf

6. *Dealing with Drought: A Handbook for Water Suppliers in British Columbia (Updated 2009)* discusses strategies to prepare for drought and minimize drought impacts primarily for water suppliers. Topics discussed include preparing drought management plans, improving water use efficiency, and communication and education. Also included is a matrix identifying appropriate responses for varying levels of drought (p. 14).
    - http://www.env.gov.bc.ca/wsd/public_safety/drought_info/cabinet/drought_handbook2009V2.pdf

7. Section 6 (p. 41) in *Managing Water for Drought: A National Study of Water Management During Drought (1994)* discusses long-term (strategic) and short-term (tactical) response measures adopted by communities to address water supply and demand impacts. Table IX (p. 49) shows a list of typical strategic and tactical measures.
    - http://www.iwr.usace.army.mil/docs/iwrreports/94nds8.pdf

8. The *Executive Summary of Lessons Learned From the California Drought (1987-1992)*, published by the U.S. Army Corps of Engineers in 1995, includes a thorough overview of the progression of the drought, indices used to measure it, impacts, and executive orders/responses and their effectiveness during the California drought from 1987 to 1992.
    - http://www.iwr.usace.army.mil/docs/iwrreports/94-NDS-6.pdf

9. In 2001, a group of water resources managers and other decision makers in the Puget Sound area attended a workshop focused on regional drought preparedness. The *Final Summary of Workshop* outlines the lessons learned from that event.
    - http://www.ecs.umass.edu/waterresources/projects/seattlevde2000/summary.htm

Focused Drought Resources

Monitoring Plans

1. Monitoring and communicating drought conditions is a critical part of drought preparedness. The Arizona Department of Water Resources Drought Program does an excellent job disseminating drought status information to the public. Below are links to their Drought Status webpage, an example of their monthly status document, and an example of their annual report.
    - http://www.azwater.gov/AzDWR/StatewidePlanning/Drought/DroughtStatus.htm
    - http://www.azwater.gov/AzDWR/StatewidePlanning/Drought/documents/aprildroughtstatusupdate.pdf
    - http://www.azwater.gov/azdwr/StatewidePlanning/Drought/documents/2009DroughtPreparednessAnnualReport.pdf

City Drought Ordinances

2. San Antonio, Texas – Drought-tolerant Grass Ordinance:
    - http://www.saws.org/conservation/ordinance/turfgrass/

3. City of San Marcos, Texas – Drought Response Ordinance:
    - http://www.ci.san-marcos.tx.us/departments/WWW/Docs/DroughtResponseOrdinance-Feb2009.pdf

4. Eastern Municipal Water District (western Riverside County, California) – Water Shortage Contingency Plan (Ordinance No. 117.2):
    - http://www.emwd.org/news/ordinances/Ord117.2.pdf

5. Redwood City, California – Recycled Water Use Ordinance 2335:

    - http://www.ci.redwood-city.ca.us/publicworks/pdf/Recycled_Water_Ordinance_Info_Sheet_6-20-08.pdf

    Ordinance information for the public:
    - http://www.ci.redwood-city.ca.us/publicworks/water/recycling/index.html

Agriculture

6. *Grazing Animal Performance Under Drought Conditions* is an article discussing stocking strategies and animal performance during a drought. Along with background information about the impact of reduced forage quality on animal performance, the article lists destocking strategies aimed at maintaining herd performance.
    - http://www.wyorange.net/Drought/anperf.html

7. Financial Drought Assistance - Numerous financial assistance programs are available to help farmers and ranchers affected by drought. Assistance can be in the form of loans, grants, technical assistance, and other disaster assistance programs. The resources below provide information related to federal assistance. State and local programs may be available in some areas too.
    - http://www.wyorange.net/Drought/droutaid.html
    - http://www.fsa.usda.gov/FSA/webapp?area=home&subject=diap&topic=landing

8. Grazing productivity - Forage production can be greatly affected by drought conditions, leading to decreased animal health and productivity. The following resources provide livestock management options and grazing techniques to help manage forage production during drought and after. Topics discussed include selecting appropriate herd size, grazing rotations, subdividing pastures, re-seeding, weed control, and more.
    - http://www.wyorange.net/Drought/mgthdrot.html
    - http://www.wyorange.net/Drought/offearly.html
    - http://www.ext.colostate.edu/pubs/natres/06112.html

9. *Drought Resistant Soil* discusses background information on soil quality and techniques for improving soil quality and reducing erosion.
    - http://attra.ncat.org/attra-pub/drought.html

10. The Drought Planning and Management website, maintained by the University of Wyoming Cooperative Extension Service, is a collection of publications, presentations, and links focused on helping agricultural producers cope with drought. Strategies related to plant management, crop selection, livestock management, and financial assistance during drought are provided.
    - http://www.wyorange.net/Drought/drought.html

11. Planning for Drought on the Ranch is a website developed by the NDMC and their partners to help ranchers prepare for, respond to, and recover from drought. Included in this website is guidance for developing a drought plan, background information about drought, and strategies to employ before, during, and after a drought.
    - http://drought.unl.edu/ranchplan/

Fire Control and Safety

12. The Federal Emergency Management Agency (FEMA) has prepared a number of resources related to wildfire preparedness and response. Below are links to two FEMA guides: *Prepare for a Wildfire* and *What to do Before a Wildfire*. Included are tips for creating a fire safety zone and clearing brush and debris from around the home along with evacuation preparation.
    - http://www.fema.gov/hazard/wildfire/wf_prepare.shtm
    - http://www.fema.gov/hazard/wildfire/wf_before.shtm

13. The Firewise Communities program is a national, multi-agency effort to help communities reduce fire risk and effectively plan fire responses. The Firewise Communities website includes a section called “Firewise You Can Use”, which includes interactive modules , how-to guides, and other resources that can help a community prepare for and respond to wildfire.
    - http://www.firewise.org/

14. DisasterSaftey.org: Wildfire is a website from The Institute for Business and Home Safety focused on providing resources to help homeowners, farmers and ranchers, and business owners reduce their risk of wildfire.
    - http://www.disastersafety.org/text.asp?id=wildfire_main

15. *Water Supply Sources For Berlin Township Fire Department* is a document highlighting the results of a research project that analyzed water supply source options for firefighting in Allenton, Michigan. Included in this study was a review of various water supply sources in use throughout the United States (p. 7-11). Sources include cisterns, ponds, static suction sources, pressurized systems, and others.
    - http://www.usfa.dhs.gov/pdf/efop/efo35785.pdf

16. A low-flow firetruck/hose is one example of maintaining firefighting ability while also conserving water resources.
    - http://www.ccs-cobra.com/en/utrustning_sprint_eng.asp

Landscaping/Irrigation

17. *Turf and Landscape Irrigation Best Management Practices (2005)* aims to help policy makers and professionals save water and protect water quality. Relevant topics include irrigation system design, installation, maintenance, and management. Also discussed are irrigation efficiency, deficit irrigation techniques, drought planning, and more.
    - http://www.irrigation.org/WorkArea/DownloadAsset.aspx?id=1142
18. *Drip Irrigation for Home Gardens (2005)* is a factsheet from Colorado State University Extension aimed at helping homeowners understand the benefits and uses of drip irrigation. Topics discussed include pros/cons of drip irrigation systems, design and installation, operation, and maintenance.
    - http://www.ext.colostate.edu/pubs/garden/04702.html

19. *Improving Drought Tolerance in Your Florida Lawn* is a short document to help homeowners prepare their lawn for a drought. Specific topics covered include irrigation techniques, mowing practices, pest control, fertilization, and selecting turfgrass species.
    - http://www.tbwg.org/water/improving%20lawn%20drought%20tolerance.pdf

Water Delivery

20. During drought situations, low pressure in a water system can lead to backflow. The American Backflow Prevention Association's FAQ discusses backflow, why it can be dangerous, and what can be done to prevent it.
    - http://abpa.org/faq.htm

Conservation

21. The *California Water Efficiency Plan (20x2020)* describes a variety of practices (pp. 15-25) that can be employed to help reduce residential/commercial water use and increase water use efficiency. These practices include but are not limited to setting efficiency standards, retrofitting appliances, efficient landscape irrigation practices, recycled water use, and other best management practices.
    - http://www.water.ca.gov/wateruseefficiency/sb7/docs/20x2020plan.pdf

22. Eartheasy: Solutions for Sustainable Living has developed a list of 25 ways to conserve water in the home and yard.
    - http://www.eartheasy.com/live_water_saving.htm

23. WaterSense is an EPA-sponsored program aimed at promoting water use efficiency. Their website contains numerous resources to help consumers decrease indoor and outdoor water use, including information on water efficient products and practices, rebate programs, a water use calculator, and more.
    - http://www.epa.gov/watersense/index.html

Greywater Use

24. Oasis Design has a website devoted to discussing greywater, with links to research, information about greywater, and designs for greywater systems.
    - http://www.oasisdesign.net/greywater/index.htm

25. The Cooperative Extension Service at New Mexico State University has a publication that discusses the safe use of greywater.
    - http://aces.nmsu.edu/pubs/_m/m-106.pdf

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Water Supply Conservation Ordinance

SECTION 1: DECLARATION OF POLICY, PURPOSE, AND INTENT

Purpose: To achieve the greatest public benefit from domestic water use, sanitation, and fire protection, and to provide water for other purposes in an equitable manner and to preserve water quality, _____ (the appropriate local government agency) (City, Village, County, etc.) adopts the following regulations and restrictions on the delivery and consumption of water.

This Ordinance is hereby declared necessary for the preservation of public health, safety, welfare, and to enhance water supply operational flexibility and shall take effect upon its adoption by the City.

Whenever, in the judgment of Illinois American Water Company (Company), it becomes necessary to conserve water in the service area, the Company will notify the City of the existence of a water supply conservation need, explain in general terms the reason for the need, the City is authorized to issue a Proclamation that a water supply conservation situation exists. The Proclamation is an attempt to prevent depleting the water supply to the extent that water use for human consumption, sanitation, fire protection and other needs becomes endangered.

Immediately upon the issuance of such a Proclamation, regulations and restrictions set forth under this Ordinance shall become effective and shall remain in effect until the water shortage is terminated and the Proclamation rescinded. The Company shall notify the City when the water supply emergency has ended and the City shall rescind the Proclamation.

Water uses regulated or prohibited under the Ordinance are considered to be non-essential and continuation of such uses during times of water shortage is deemed to constitute a waste of water, subjecting the offender(s) to penalties.

The provisions of this Ordinance shall apply to Company customers within the jurisdiction of the City.

SECTION II: DEFINITIONS

For the purposes of this Ordinance, the following definitions shall apply:

> Aesthetic water use: water use for ornamental or decorative purposes such as fountains, reflecting pools, and waterfalls
>
> Commercial and industrial water use: water use integral to the production of goods and/or services by any establishment having financial profit as their primary aim.
>
> Customer: any person, company, or organization using water supplied by Illinois American Water Company

Domestic water use: water use for personal needs or household purposes such as drinking, bathing, heating, cooking, sanitation, or for cleaning a residence, business, industry, or institution.

Essential water uses: water used specifically for fire fighting, and to satisfy federal, state, and local public health and safety requirements.

Even numbered address: street addresses, box numbers or rural numbers and rural route numbers ending in 0, 2, 4, 6, 8 or letters A-M; and locations without addresses.

Institutional water use: water use by government, public and private educational institutions, public medians and rights of way, churches and places of worship, water utilities, and other lands, buildings, and organizations within the public domain.

Landscape water use: water used to maintain gardens, trees, lawns, shrubs, flowers, athletic fields, rights of way and medians.

Odd numbered address: street addresses, box numbers or rural numbers and rural route numbers ending in 1, 3, 5, 7, 9 or letters N-Z.

Water supply emergency level:

1. Water Supply Advisory: To be used when the company believes voluntary conservation efforts will be adequate to prevent a supply shortage

2. Moderate Water Supply Restrictions: To be used when the company believes voluntary conservation efforts will not be adequate to prevent a supply shortage and preliminary mandatory measures are required

3. Severe Water Supply Restrictions: To be used when the company believes voluntary conservation efforts will not be adequate to prevent a supply shortage and extensive mandatory measures are required

Water shortage: lack of adequate available water to meet normal demands.

SECTION III: NON-ESSENTIAL WATER USE

All water use categories other than essential water use may be curtailed during a level 2 or 3 water supply emergency. Some examples of non-essential water uses follow:

A. Residential and Institutional:

1. Washing down sidewalks, walkways, driveways, parking lots, tennis courts, or other hard surface areas.

2. Washing down buildings or structures for purposes other than immediate fire protection.

3. Flushing gutters or permitting water to run or accumulate in any gutter or street.

4. Washing any motor bike, motor vehicle, boat, trailer, airplane or other vehicle in public or private garages or elsewhere.

5. Maintaining fountains, reflection ponds, and decorative water bodies for aesthetic or scenic purposes.

6. Filling or maintaining fill levels in public or private swimming and wading pools.

7. Sprinkling lawns, plants, trees, and other flora on private or public property, except as otherwise provided under the Ordinance.

8. Placing new sod, planting or landscaping after the Proclamation.

B. Commercial and Industrial:

1. Serving water routinely in restaurants.

2. Increasing water levels in scenic and recreational ponds and lakes.

3. Irrigating golf courses except greens, tees, and fairways.

4. Obtaining water from hydrants for any purpose other than firefighting.

5. Serving customers who have been given a 10 day notice to repair one or more leaks and have failed to comply.

6. Expanding commercial nursery facilities, placing new sod, planting or landscaping on commercial and/or residential sites after the Proclamation.

SECTION IV: RESPONSES TO LEVEL 1, 2, & 3 WATER SUPPLY EMERGENCY

Water supply emergency levels set forth in this ordinance are 1. Advisory, 2. Moderate, and 3. Severe. Proclamations issued by the City shall coordinate an appropriate response to the level of emergency that exists based on information provided to the City by the Company.

A. Level 1 – Advisory Water Supply Alert Phase: If the Company decides conditions warrant an advisory water supply alert, the Company shall notify municipal and county governments and issue press releases concerning the supply concerns to the news media. Large or key water users will be directly contacted by the Company.

1. Goal:

a) Public awareness and education of water saving procedures

b) A five percent voluntary water use reduction for all users for the duration of the supply alert

2. General Responses:

a) Issue a Public Notice stating the reason for the conservation advisory, water supply and demand figures, and a list of non-essential water uses to local media outlets within the affected community and region.

b) Institute an increased water supply system maintenance effort to identify and correct water leaks.

c) Encourage customers to comply with the Level 1 voluntary water use restrictions in all categories while the advisory is in effect.

3. Water Use Restrictions:

a) Residential:

Stop non-essential water use as listed in Section III.A. Water outdoor plants only in the early morning or late evening, not in the heat of the day. Wash dishes and clothes only when appliance is full. Consider replacing toilets and shower heads with low-flow fixtures. Do not fill swimming pools.

b) Commercial, Industrial, and Institutional

Stop non-essential water use as listed in Section III.B. Reduce aesthetic, domestic, landscaping, and water-based recreational activities such as swimming pools, water slides, and other related water activities.

c) Agricultural, Irrigation and Livestock

Implement conservation techniques, explore different water saving methods, and use alternative sources

d) Electric Power Generation

Implement conservation techniques, explore different water saving methods, and use alternative sources

B. Level 2 – Moderate Water Supply Emergency Phase: If the Company believes the Level 1 Advisory is not or will not be adequate to allow it to maintain appropriate supply to the system it shall notify municipal and county governments and issue press releases concerning the supply concerns and mandatory actions being implemented to the news media.

1. Goal:

   a) Generate a public response that helps alleviate the water supply concerns through mandatory water use restrictions.

   b) A ten percent water use reduction for all users for the duration of the supply alert.

2. General Responses:

   a) Issue a Public Notice stating the reason for the water use restrictions, water supply and demand figures, and a list of water use curtailment measures to local media outlets within the affected community and region.

   b) Institute (or continue) an increased water supply system maintenance effort to identify and correct water leaks.

   c) Require customers to comply with the listed Level 2 water use restrictions in all categories while the advisory is in effect.

3. Water Use Restrictions:

   a) Residential:

      - Stop non-essential water use as listed in Section III.A.

      - Lawn and garden watering allowed only on odd numbered dates for odd numbered addresses and even numbered dates for even numbered addresses. Use low-volume hand-held applications only and prohibit sprinklers, other remote broadcast devices and water runoff in landscape design maintenance.

      - Car washing (other than at commercial car washes) is prohibited.

      - Filling swimming pools, water slides that do not recycle, and other related recreational water consuming activities are prohibited.

   b) Commercial, Industrial, and Institutional

      - Stop non-essential water use as listed in Section III.B.

      - Lawn and garden watering allowed only on odd numbered dates for odd numbered addresses and even numbered dates for even numbered addresses. Use low-volume hand-held applications only and prohibit sprinklers, other remote broadcast devices and water runoff in landscape design maintenance.

      - Aesthetic water use, such as fountains, is prohibited.

c) Agricultural, Irrigation and Livestock

- Implement conservation techniques, explore different water saving methods, and use alternative sources

- Irrigate only between 7:00 p.m. and 7:00 a.m.

d) Electric Power Generation

Implement conservation techniques, explore different water saving methods, and use alternative sources

B. Level 3 – Severe Water Supply Emergency Phase: If the Company believes the Level 2 Restrictions are not or will not be adequate to allow it to maintain appropriate supply to the system it shall notify municipal and county governments and issue press releases concerning the supply concerns and mandatory actions being implemented to the news media.

1. Goal:

c) Generate a public response that helps alleviate the water supply concerns through mandatory water use restrictions.

d) A twenty percent water use reduction for all users for the duration of the supply alert.

2. General Responses:

d) Issue a Public Notice stating the reason for the water use restrictions, water supply and demand figures, and a list of water use curtailment measures to local media outlets within the affected community and region.

e) Institute (or continue) an increased water supply system maintenance effort to identify and correct water leaks.

f) Require customers to comply with the listed Level 3 water use restrictions in all categories while the advisory is in effect.

3. Water Use Restrictions:

e) Residential:

- Reduce domestic water use to minimum levels necessary to maintain health and safety

- Lawn and garden watering allowed only on Tuesday and Saturday for odd numbered addresses and Thursday and Sunday for even numbered addresses. Use

low-volume hand-held applications only and prohibit sprinklers, other remote broadcast devices and water runoff in landscape design maintenance.

- Car washing (other than at commercial car washes) is prohibited.

- Filling swimming pools, water slides that do not recycle, and other related recreational water consuming activities are prohibited.

f) Commercial, Industrial, and Institutional

- Lawn and garden watering allowed only on Tuesday and Saturday for odd numbered addresses and Thursday and Sunday for even numbered addresses. Use low-volume hand-held applications only and prohibit sprinklers, other remote broadcast devices and water runoff in landscape design maintenance.

- Aesthetic water use, such as fountains, is prohibited.

g) Agricultural, Irrigation and Livestock

- Implement conservation techniques, explore different water saving methods, and use alternative sources

- Irrigate only between 12:00 a.m. and 6:00 a.m.

h) Electric Power Generation

Implement conservation techniques, explore different water saving methods, and use alternative sources

4. Company Operational Procedures:

- Stop bulk water sales at automated water salesmen locations.

- Reduce hydraulic grade line where possible

- Send warning notices to users with unusually high consumption

Whereas, Illinois American Water Company owns and operates the domestic and fire service water supply system that serves _____ (the appropriate local government agency), and

Whereas, Illinois American Water Company does not possess police authority to enforce water use restrictions, and

Whereas, it is in the interest of _____ (the appropriate local government agency) to cooperate with Illinois American Water Company to assure that an adequate supply of domestic and fire service water is available to citizens during a water supply emergency, and

Whereas, _____ (the appropriate local government agency) has police authority to enforce water use restrictions,

Now, therefore, it is hereby agreed that Illinois American Water Company shall notify _____ (the appropriate local government agency) of the existence of a water supply emergency of the degree of severity listed below, and request the assistance of _____ (the appropriate local government agency) in enforcing water use restrictions, and that _____ (the appropriate local government agency) will use its police authority to enforce the water use restrictions listed below,

Also, Illinois American Water Company shall notify _____ (the appropriate local government agency) immediately when the water supply emergency has ended or when the level of emergency can be reduced and _____ (the appropriate local government agency) shall publish said termination of or reduction in restriction in a similar fashion as the emergency order was initially published.

Water Use Restriction Levels

Level 1 – Water Supply Advisory – To be used when the company believes voluntary conservation efforts will be adequate to prevent a supply shortage

Level 2 – Moderate Water Supply Restrictions – To be used when the company believes voluntary conservation efforts will not be adequate to prevent a supply shortage and preliminary mandatory measures are required

Level 3 – Severe Water Supply Restrictions – To be used when the company believes voluntary conservation efforts will not be adequate to prevent a supply shortage and extensive mandatory measures are required

Actions

Level 1 – The Company shall notify _____ (the appropriate local government agency) as soon as it determines the existence of a Level 1 Water Supply Advisory. _____ shall cooperate with the company by announcing the existence of a Level 1 Water Supply

Advisory on its normal media outlets (public access cable channel, news releases, etc.) and shall publish a list of recommended appropriate water conservation measures.

Level 2 – The Company shall notify _____ (the appropriate local government agency) as soon as it determines the existence of a Level 2 Water Supply Restriction. _____ shall cooperate with the company by announcing the existence of Level 2 Water Supply Restrictions on its normal media outlets (public access cable channel, news releases, etc.) and shall publish a list of required water conservation measures and the penalties to be enforced for non-compliance.

Level 3 – The Company shall notify _____ (the appropriate local government agency) as soon as it determines the existence of a Level 3 Water Supply Restriction. _____ shall cooperate with the company by announcing the existence of Level 3 Water Supply Restrictions on its normal media outlets (public access cable channel, news releases, etc.) and shall publish a list of required water conservation measures and the penalties to be enforced for non-compliance.

Conservation Measures

Level 1 – Use water wisely. Actions are recommended but not mandated. Water outdoor plants only in the early morning or late evening, not in the heat of the day. Wash dishes and clothes only when appliance is full. Consider replacing toilets and shower heads with low-flow fixtures. Do not fill swimming pools.

Level 2 – Cut back normal consumption. Lawn and garden watering allowed only on odd numbered dates for odd numbered addresses and even numbered dates for even numbered addresses. Car washing (other than at commercial car washes) is prohibited. Filling of swimming pools or bulk water tanks without obtaining permission first from the Water Company is prohibited. Restaurants shall serve water only upon customer request. Fines for violations are $100 first offense, $200 second offense, & $300 for third offense or more.

Level 3 – Major cutbacks of normal consumption. Lawn & garden watering is not allowed except by prior permission from the Water Company. Car washing (other than at commercial car washes) is prohibited. Filling of swimming pools or bulk water tanks without obtaining permission first from the Water Company is prohibited. Fines for violations are $200 first offense, $400 second offense, & $600 for third offense. After 3 offenses water service is subject to being shut off.