

# Water Loss Control in the Great Lakes States

*A Utility Survey Report*

**INSIDE COVER**

INTENTIONALLY LEFT BLANK

# Water Loss Control in the Great Lakes States

## A Utility Survey Report



**PREPARED BY  
THE CENTER FOR NEIGHBORHOOD TECHNOLOGY**

**JULY 2012**

**PROJECT PARTNERS:**



American Water Works  
Association



Alliance  
for Water  
Efficiency



Great Lakes  
Commission  
des Grands Lacs

COVER: GREAT LAKES STATES WATERSHED Rendering by Katrina Nygaard, CNT

# Acknowledgments

The Center for Neighborhood Technology (CNT) owes thanks to a variety of people and organizations instrumental in the development of this survey report. Including our project partners the American Water Works Association (AWWA), the Alliance for Water Efficiency (AWE) and the Great Lakes Commission (GLC) for their assistance and commitment to improved water loss control.

The following advisors shared their time and expertise in a variety of different ways including reviewing initial survey concepts and report drafts. They include Janice Beecher of the Institute of Public Utilities at Michigan State University, George Kunkel of the Philadelphia Water Department, Mary Ann Dickinson of the Alliance for Water Efficiency, Cynthia Lane of the American Water Works Association, Becky Pearson of the Great Lakes Commission, Josh Ellis of the Metropolitan Planning Council, Joel Brammeier of the Alliance for the Great Lakes, Cary McElhinney of the U.S. EPA Region Five, Tim Loftus of the Chicago Metropolitan Agency for Planning (CMAP), and Margaret Schneemann of CMAP and the Illinois-Indiana Sea Grant Program.

CNT is also grateful to all the utilities that took time to answer the survey and provided us with a wealth of useful data and information necessary to understand current water loss control practices within the Great Lakes states.

This research is part of CNT's **Smart Water for Smart Regions** initiative dedicated to new research, inventive solutions, and regional advocacy focused on water supply and stormwater in the Great Lakes states. Funding for this research was generously provided by The Joyce Foundation and State Farm.

Visit [www.cnt.org/water](http://www.cnt.org/water) for more information.

Project Team:

Danielle Gallet, Project Manager  
Ann Chen (Lijun Chen), Research  
Joanne Choi, Research  
Kathrine Nichols, Report Layout

# Executive Summary

Unchecked water loss within water supply systems is of public concern: it wastes public money, hinders the economy, and risks long-term water scarcity. Previous studies and surveys about water loss demonstrate the long-held belief that maintaining robust water service infrastructure is key to an efficient and sustainable water system. Multiple reports<sup>1,2</sup> by various national agencies have highlighted the risks and associated costs of underinvestment in our nation's infrastructure. We can no longer afford to ignore the infrastructure buried under our feet; it is too costly, damaging, and unsustainable to do so.

As part of our **Smart Water for Smart Regions** initiative, the Center for Neighborhood Technology (CNT) is working with communities across the eight Great Lakes states (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin) to help them tackle various challenges surrounding water resources. This survey report constitutes a first step, by providing a baseline of current water loss practices and policies among water supply utilities that can be used to support collaboration in developing strategies for improvement.

All together within the Great Lakes states, the 55 water service providers who responded to our survey serve almost 500 municipalities, a population of around 9.8 million people, and a water supply infrastructure system that includes over 63,000 miles of pipe. Our survey indentified a number of serious challenges. The average pipe within these systems is 50 years old, and these pipes leak an estimated 66.5 billion gallons of water per year.

Tackling these challenges is problematic in an environment of disinvestment. Although the intention is there—almost 62 percent of respondents, for example, regularly audit their systems—action has been harder to achieve. Almost three-quarters (71 percent) have no policy in place to control water loss and two-thirds (67.3 percent) do not publicly report on the condition of their infrastructure.

Given the widespread and prevalent nature of these challenges, the absence of universal standards makes action difficult. For example, only 34.5 percent of utilities used the term non-revenue water recommended by AWWA and industry leaders when describing water loss; the rest used a mix of definitions. Good housekeeping and transparent reporting are critical to effective management of our public services and assets, and they ultimately require consistency in method.

Perhaps most significantly, this survey demonstrates the desire for change. The survey's 68 percent response rate demonstrates the importance of this topic to water service providers. Most utilities (76.4 percent) are already engaging their customers on water efficiency, and 60 percent of survey respondents indicated they are interested in collaborating and participating in improved water loss audit practices and public reporting.

This survey highlights the need and opportunity for a transition in the way water infrastructure and services are managed. Uncovering the mystery of our buried water infrastructure and giving it the attention and support it deserves will ensure community vitality, economic stability, and resource reliability now and for future generations. CNT invites water service providers, partners, and investors to work together to support this transition.

1. American Water Works Association. *Buried No Longer: Confronting America's Water Infrastructure Challenge*. Denver: American Water Works Association, 2012.

2. American Society of Civil Engineers (ASCE). *Failure to Act: The Economic Impact of Current Investment Trends in Water and Wastewater Treatment Infrastructure*. Prepared by Economic Development Research Group, Inc., 2011.

# Introduction

Water loss control within water supply systems has been a topic of importance for utilities for quite some time. Previous studies and surveys about water loss demonstrate the long held belief that maintaining robust water service infrastructure is key to an efficient and sustainable water system. The American Water Works Association's recent report titled *Buried No Longer: Confronting America's Water Infrastructure Challenge* highlighted the need to "bring the conversation about water infrastructure above ground."<sup>3</sup> We can no longer afford to ignore the infrastructure buried under our feet; it is too costly, damaging and unsustainable to do so.

A 2011 report<sup>4</sup> by the American Society of Civil Engineers, for example, found that by 2020, the predicted deficit for sustaining water delivery and wastewater treatment infrastructure will be \$84 billion. "This may lead to \$206 billion in increased costs for businesses and households between now and 2020. In a worst case scenario, the U.S. will lose nearly 700,000 jobs by 2020. Unless the infrastructure deficit is addressed by 2040, 1.4 million jobs will be at risk..." Overall, if we do not begin to improve the state of our water infrastructure, there will be financial effects across the national economy.

Likewise, it is important to recognize the inter-dependent relationship between water and energy – water is required to generate energy, and energy is required to generate water services. A recent estimate by River Network indicates that about 13 percent of the nation's electricity is used to pump, treat, and heat water<sup>5</sup> and about 75 percent of the cost of municipal water processing and distribution is electricity.<sup>6</sup> In other words, reducing water waste reduces significant energy costs and can save communities money.

As part of our **Smart Water for Smart Regions** initiative, CNT is working with communities across the eight Great Lakes states (Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin) to help tackle the challenges facing water utilities. This survey report constitutes a first step in an effort to help bring these issues to light. The main goal of the survey was to understand how water supply utilities within the Great Lakes states are managing water loss control. By establishing a baseline of current practices and policies, collaboration in developing strategies for improved investment in infrastructure and services can be identified. The survey's 68% response rate demonstrates the importance of this topic to water service providers.

It is important to note that the focus of the survey was on the Great Lakes states, not just the Great Lakes basin. Given the policy implications at the state level it was critical that utilities throughout each state be included.

## What Is Water Loss Control?

Water loss control represents the efforts of water supply utilities in managing operations by auditing their infrastructure performance and implementing controls to keep system losses to reasonable, minimal levels. **Real losses** in water systems are incurred from pipeline leakage, whereas **apparent losses** are incurred when customer water consumption is not properly measured or billed.<sup>7</sup> Both negatively impact the costs and revenues of water services within communities. This survey report focused on **real losses**.

3. American Water Works Association. *Buried No Longer: Confronting America's Water Infrastructure Challenge*. Denver: American Water Works Association, 2012.

4. American Society of Civil Engineers. *Failure to Act: The Economic Impact of Current Investment Trends in Water and Wastewater Treatment Infrastructure*. 2011.

5. "The Carbon Footprint of Water" 2009. <http://www.rivernetwork.org/resource-library/carbon-footprint-water>

6. Source: <http://www.ncsl.org/issues-research/env-res/overviewofthewaterenergyxusinthelus.aspx>

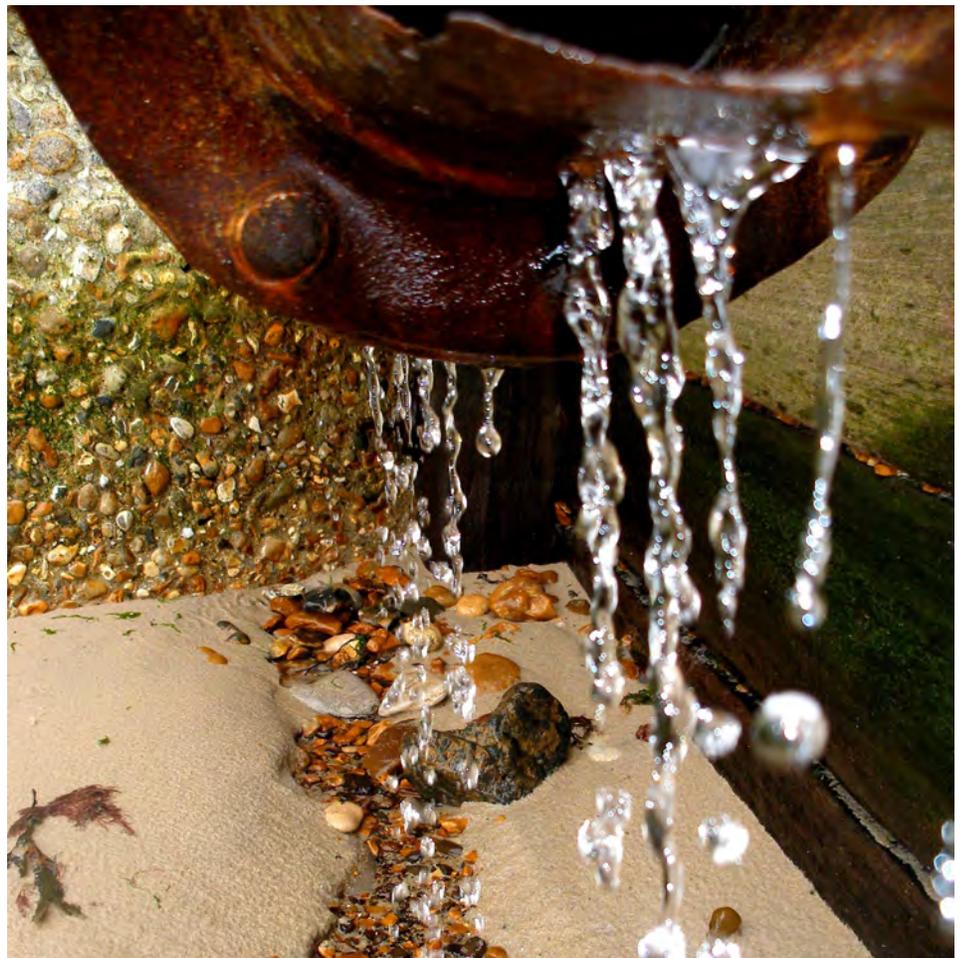
7. Source: <http://www.awwa.org/Resources/WaterLossControl.cfm?ItemNumber=47847>

# Methodology/ Approach

The water loss control survey was drafted and conducted throughout the winter and spring of 2012. Many of the questions were designed based-on a previous national survey report published in 2002.<sup>8</sup> Survey Gizmo was used as the survey host.

The survey sample was established by selecting the ten largest water supply utilities in each of the eight Great Lakes states based on service population numbers from the annual *Consumer Confidence Reports (CCRs)* issued by utilities. A total of 80 utilities received the survey via email. A complete list of survey recipients is included as Appendix A. Calls to establish the appropriate utility contact were conducted as were regular reminder emails and calls to various potential respondents throughout the survey timeframe.

Follow-up phone calls were done to clarify answers that may have been confusing or incomplete. Based on these calls, adjustments to the original data were made and tracked. In the interest of quality data, utilities that completed the survey were ensured confidentiality, thus survey results have been aggregated.



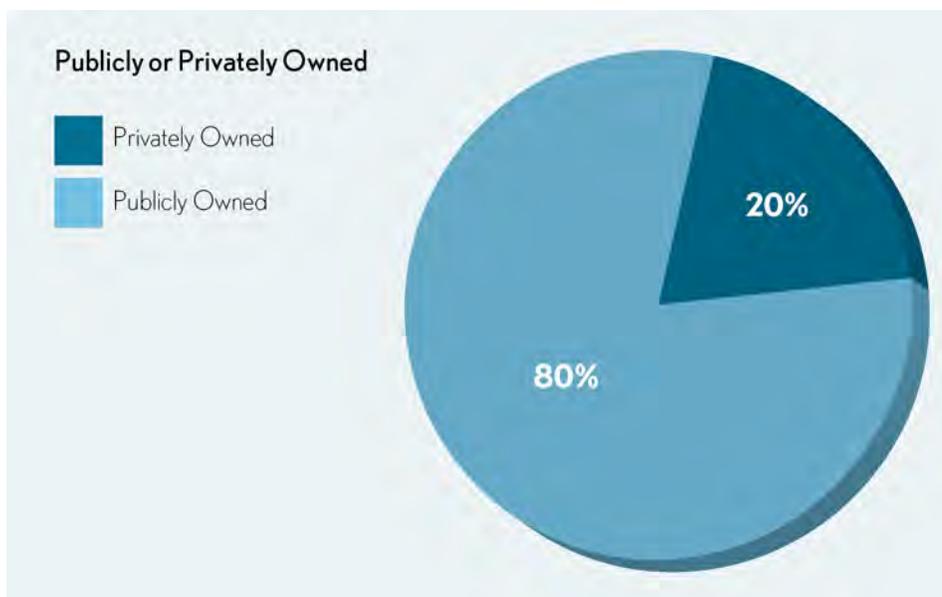
8. Beecher, Janice A. *Survey of State Agency Water Loss Reporting Practices*. Final Report to the American Water Works Association, January 2002.

PHOTO: Flickr/ian boyd, Creative Commons License

# Respondent Information

Fifty-five out of the 80 utilities who received the survey responded, a response rate of over 68%. Based on survey responses, the respondent pool serves almost 500 municipalities within the Great Lakes states, a population of around 9.8 million people and a water supply infrastructure system that includes over 63,000 miles of pipe.

Utilities from all eight states participated in the survey. The largest utility respondent provides water for a population of 5.3 million; the smallest provides water for approximately 28,000 people. Sources of water for utilities divided into almost even thirds: 1) groundwater 2) Great Lakes water and 3) other surface water sources. About 25% of the utilities purchase some portion of their supply from another provider/wholesaler. Below is some additional information about survey respondents.



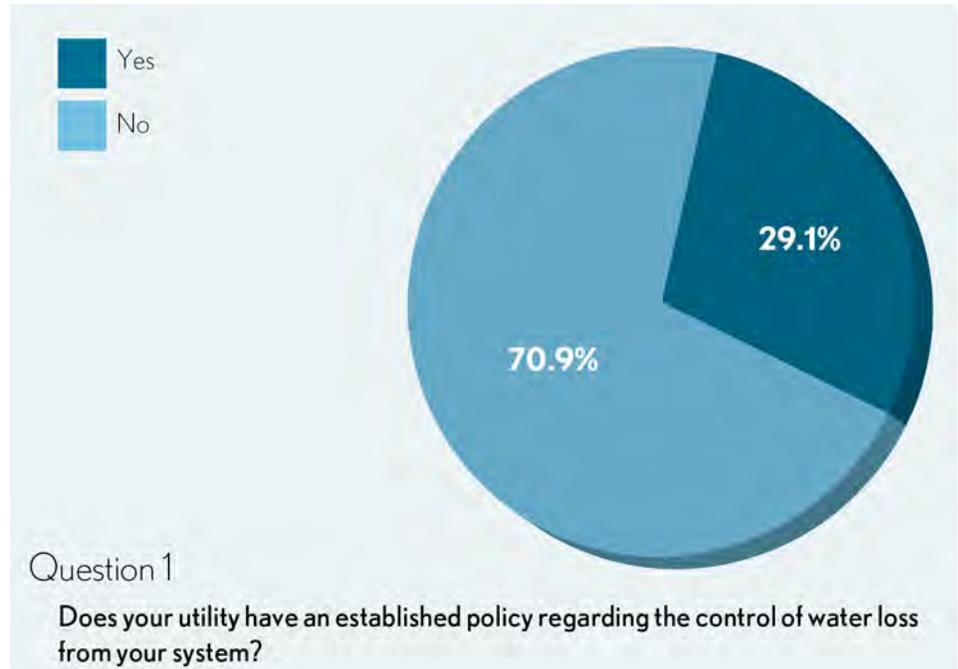
Respondents were asked the number of miles of pipe in their system, the average age of the pipes, and the average number of pipe breaks per year. The range of pipe length varied from over 5,800 miles to 216 miles. Across all respondents the average, estimated age of pipes is 50 years. The average break rate across the whole pool of respondents is approximately 21 breaks per 100 miles of pipe per year.<sup>9</sup> Respondents were also asked to supply an estimated annual volume of water leaked from their system. The total estimated annual volume of leakage per year for all respondents is over 66.5 billion gallons of water.<sup>10</sup>

9. Method of calculation: Average # of pipe breaks per year, per utility divided by estimated miles of pipe (converted to per 100 miles) = average # of breaks per 100 miles per year. Sum of all utilities was aggregated.

10. Survey asked what the estimated annual volume of leakage was in a system (in gallons). Respondents may have added in all water loss, not just leakage into their responses.

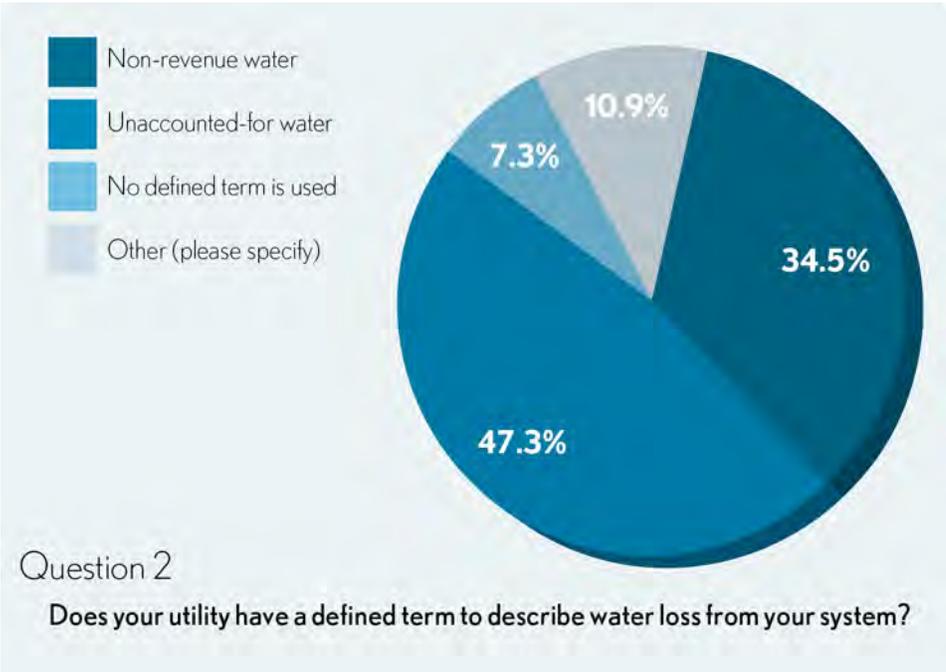
# Summary of Survey Findings

The following section summarizes survey findings for the ten primary questions asked by the survey. These answers were required to be filled out by all respondents to provide some baseline understanding of current water loss policies and practices within water supply utilities in the Great Lakes states.

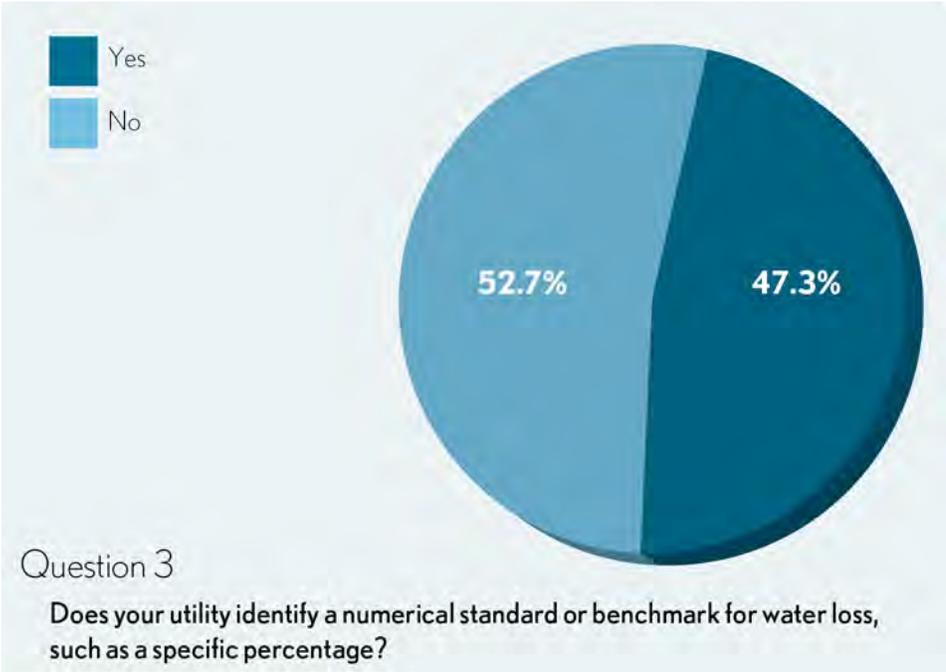


Sixteen utilities reported having a water loss policy of some sort, but a majority of utilities indicated they do not have a stated policy. Survey respondents that do have a policy were asked to provide a link or attachment to the established policy.

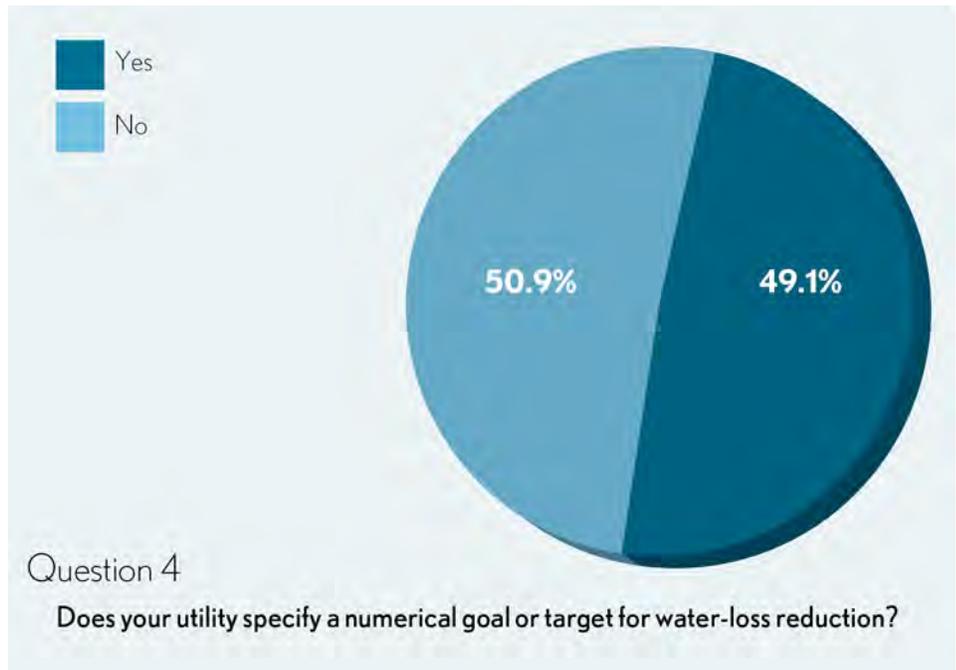
Among those who do have policies, there is a wide range in what is considered to be a policy or policies. Some utilities focus on detecting unauthorized use and subsequent enforcement and fines, while others focus on routine water audits and eliminating leaks. Other utilities do not have their own stated policy, but reference a regulatory requirement (typically by a state agency) to perform regular water audits and reporting. For example, communities in Illinois that have a permit for Lake Michigan water are required to submit a Pumpage Report LMO-2 form, which includes leakage and flow information, to the Illinois Department of Natural Resources annually. Likewise, the State of Wisconsin's Public Service Commission oversees all public and private water suppliers and requires an annual report of infrastructure performance including leaks.



Almost fifty percent of respondents use the term ‘unaccounted-for water’ to describe their water losses. The term has been used historically in the industry, but is now recognized as imprecise and non-preferred terminology. Nineteen utilities (34.5 percent) indicated they use the term ‘non-revenue water’ to define water loss. This term is advocated by the AWWA and other organizations. The remaining 18% of water utilities either do not have a defined term, or use an ‘in-house’ established term.



Respondents are split down the middle in regards to whether or not they identify a numerical standard or benchmark for water loss within their utility. There were 26 utilities who said they use a standard or benchmark. Stated targets fall within the 10-20% range with the majority of them using 15% as their benchmark.



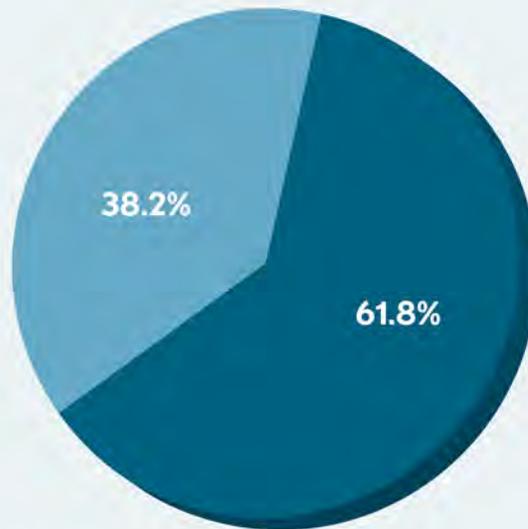
There seems to be an obvious overlap and even some confusion regarding a benchmark or standard (see question #3 above) versus a goal or target. For the purposes of this survey we define a benchmark or standard to be an industry or regulatory indicator, and a goal or target to represent a utility's specifically stated, internal indicator.

As with the question about benchmarks and standards in question #3 above, survey responses indicate a 50/50 split by utilities in whether or not they have established internal goals and targets. Most respondents reported a 10-20% range for a goal and/or target with some utilities having stated goals in the single digit range.

Respondents were asked a subsequent question as to how they determine their goal. There were a range of responses including: goals being based-on system past performance and maintainable levels, a regulatory requirement by a state agency, or wanting to base performance on industry standards and it being "the right thing to do."

Almost half of the respondents who indicated they have a benchmark or standard do not have a set goal or target, and a little over half of those that indicated having a goal or target stated they do not have a set benchmark or standard. Again, this suggests the distinction between these terms is vague and often used interchangeably. Given that, roughly one quarter do not have an identified numerical standard or goal they strive to attain.

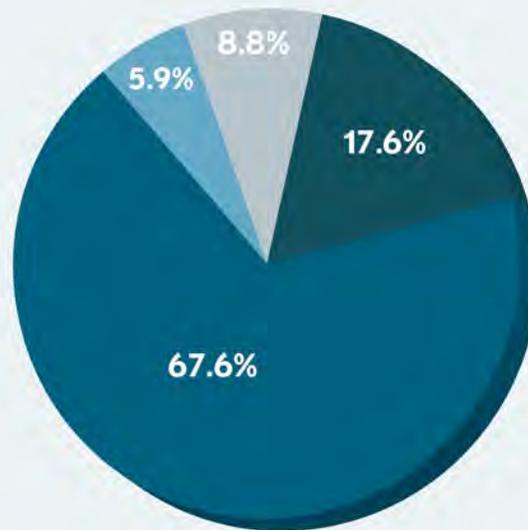
- Yes
- No



Question 5

Does your utility perform regular water audits?

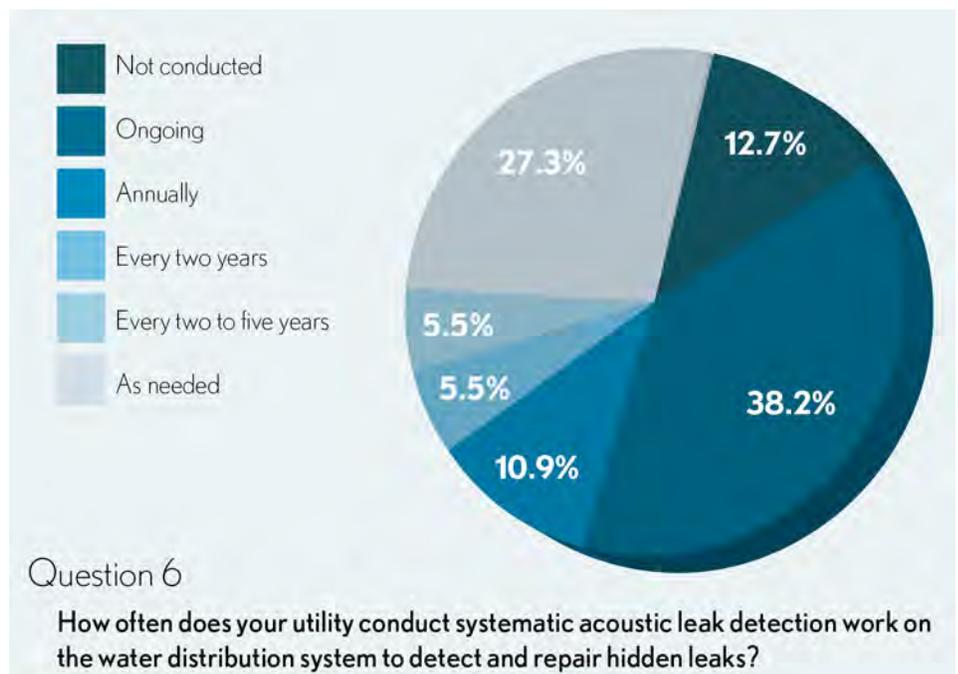
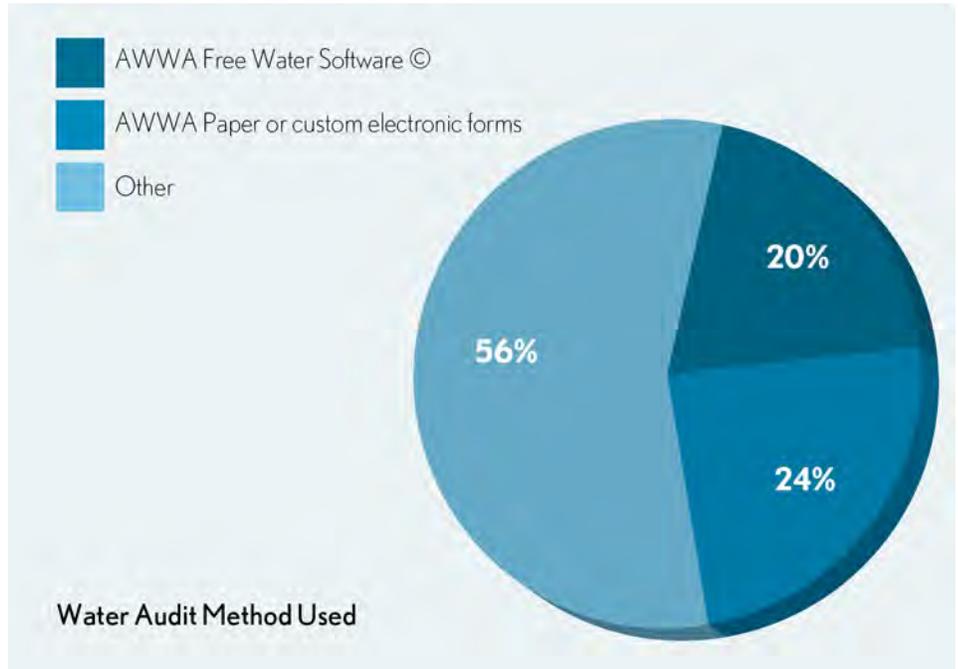
- Ongoing
- Annually
- Every two years (0%)
- Every two to five years
- As needed



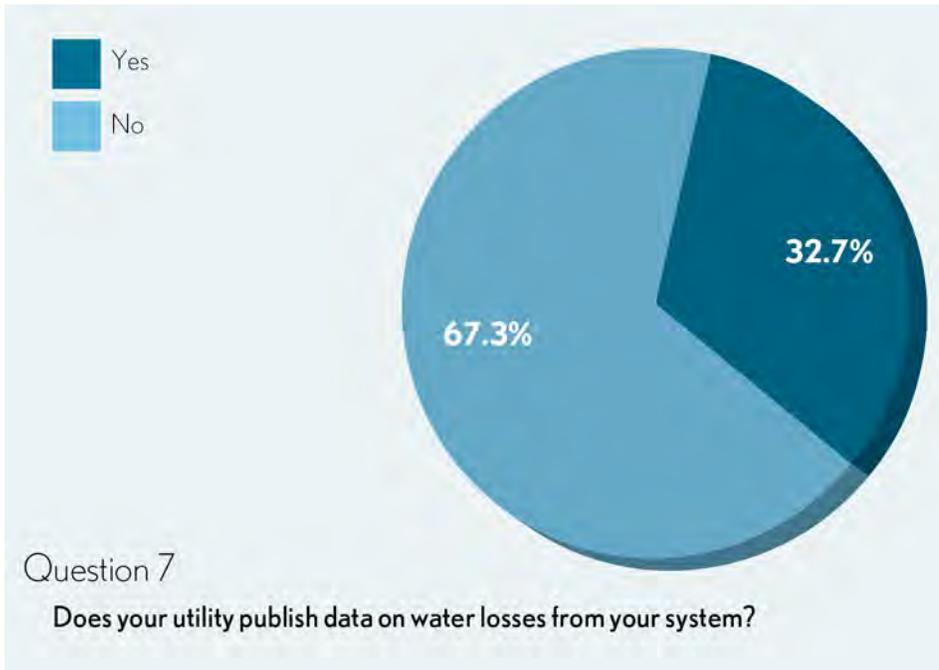
If yes, how often is the audit performed?

Over 60% of utilities indicate they do regular water audits with over 85% of those performing them on an annual or ongoing basis. About 53% of all utilities indicate they perform water audits on an annual or ongoing basis.

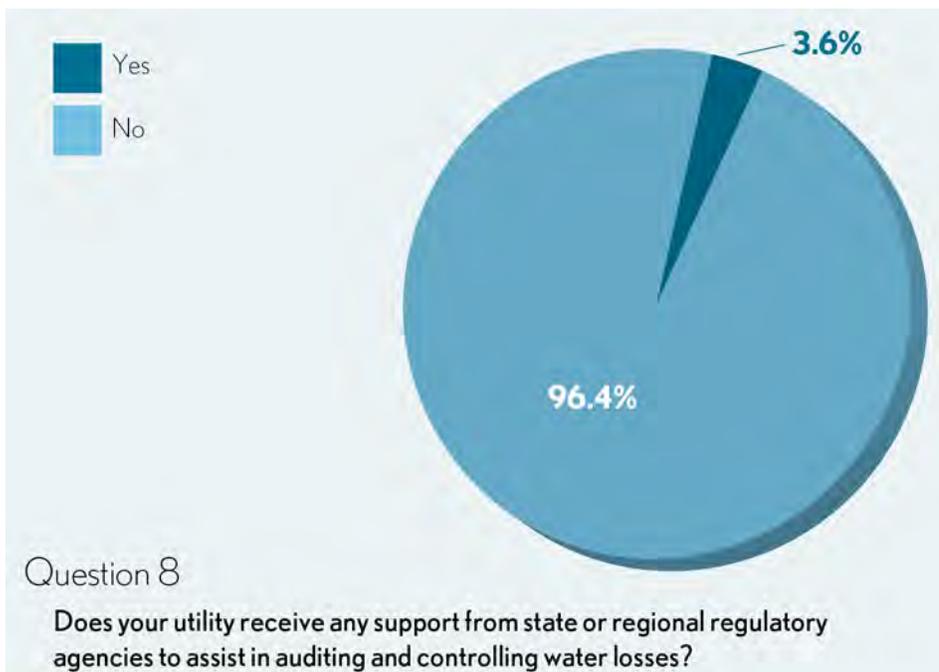
Survey respondents were also asked about the water audit method they use. Twenty-four utilities use the AWWA/IWA (M36) method, 11 of whom use the AWWA Free Water Audit Software© instead of the paper or custom electronic forms. Of the 31 respondents who indicated using a different method, most use some sort of in-house or consultant derived water audit method.



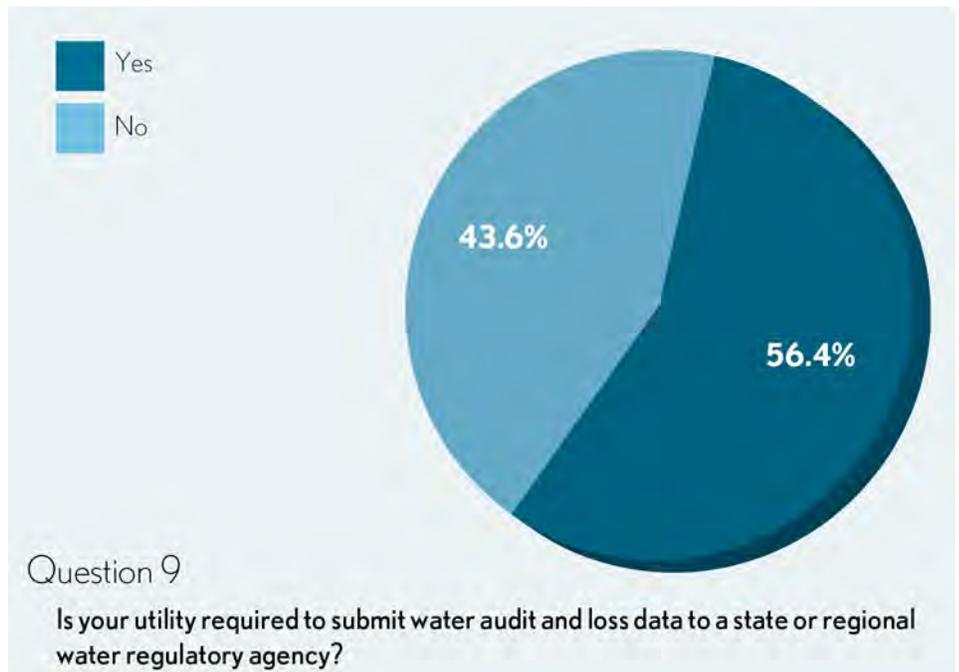
Over 65% of utilities indicated they do acoustic leak detection either ongoing or as needed, while almost 22% stated they perform acoustic leak detection every one to five years.



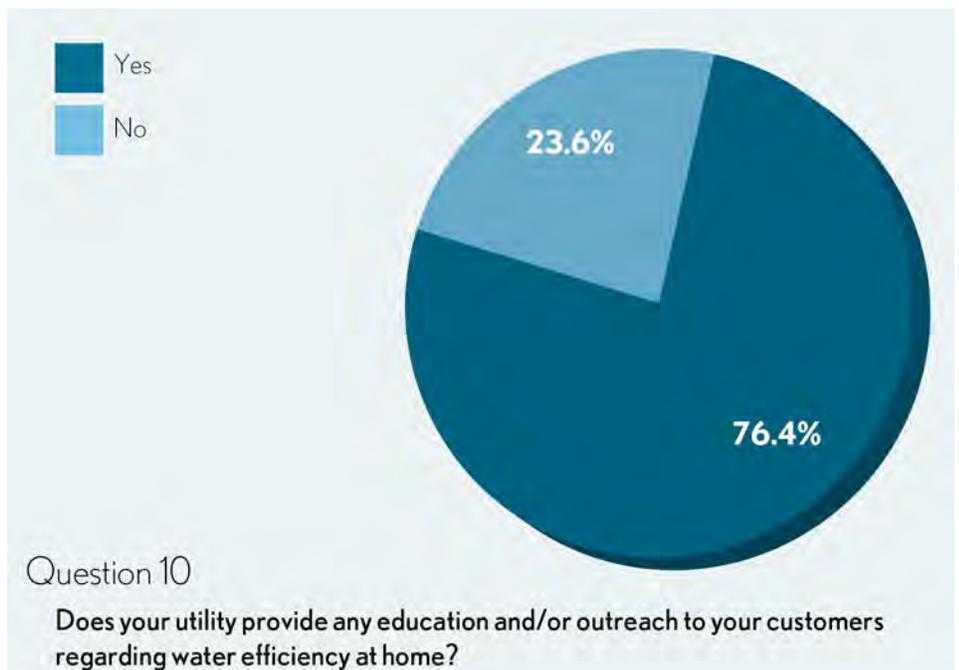
A majority of utilities do not publish or communicate data on water losses to the public. However, about one-third of respondents do report to the public either through a regulatory requirement, voluntarily in an annual water report posted online, or within their Consumer Confidence Reports (CCRs). For example, all Wisconsin water suppliers are required to submit an annual report, which also contains a water audit form, to the Public Service Commission. These reports are then published and publically available online year after year (<http://psc.wi.gov/apps40/annlreport/default.aspx>).



Most utilities do not indicate receiving any support from state or regional regulatory agencies in auditing and controlling water loss. The few utilities who received support cited their Department of Natural Resources office or a utility commission provided them support in the form of template forms or additional data.



Over half of the utilities reported having to submit water audit and loss data to a state or regional water regulatory agency. The type of agency requiring reporting included state utility commissions, state departments of natural resources, state health and budget offices and regional commissions.



Forty-two utilities indicated they provide some form of education or outreach to their customer base regarding water efficiency in the home. The ways these utilities engage with their customer base include: Websites; Newsletters, postcards, brochures & flyers; Utility bill inserts; Media campaigns including print, radio & television; Booths at local community events; School education programs; Rebate programs for various water-saving technologies & appliances; Free home kits for leak detection; Participating in EPA's WaterSense program; Occasional community presentations.

# Observations

The water loss control survey provides insight into current water loss practices and policies within the Great Lakes states today. Although not easy to generalize, some of the findings in the survey are worthy of closer examination.

First, since 2003 the American Water Works Association's Water Loss Control Committee has recommended using the term 'non-revenue water'.<sup>11</sup> One of the main reasons for the best practice change is that the term 'unaccounted-for water' is misleading since all water supplied by a utility can be accounted for either through metering or estimation. Only one-third of survey respondents use the term 'non-revenue water'. As more water utilities and regulatory agencies become educated about the approaches in the AWWA M36 publication, the use of 'unaccounted-for water' is likely to decline.

Similarly, another issue regarding definitions and industry standards for auditing is the use of a water percentage to measure water loss, which is an output versus input ratio measure. While this practice is long referenced by the water industry, it is now considered a limited and misleading indicator. AWWA recommends against the use of the 'unaccounted-for water' percentage and offers an array of performance indicators to track water loss within its 'non-revenue water' definition and M36 manual. The survey reflects that most utilities have yet to put these indicators into use.

Second, while the survey specifically gauges utility practices, other surveys<sup>12</sup> have gathered data on the practices of water regulatory agencies. There is likely a strong correlation between the extent of water auditing requirements in regulatory agencies and the actual compilation of water audit data by water utilities. In doing some cross comparisons between regulated and unregulated utilities, there do seem to be differences in water loss practices. For example, while 43% of regulated utilities have a water loss policy, only 12% of unregulated utilities have a policy, and 73% of regulated utilities do regular water audits, while only 48% of unregulated utilities report doing regular water audits. Similarly 67% of regulated utilities have a set standard or benchmark, while only 24% of unregulated utilities do. The type of audits performed varies between these two groups as well. Responses show that 68% of regulated utilities use the AWWA/IWA (M36) method, while only 36% of unregulated utilities use this method, and while 60% of regulated utilities do distribution system leak detection on an annual or ongoing basis, only 36% of unregulated utilities perform this type of leak detection annually or on an ongoing basis. Finally, based on survey responses, 50% of regulated utilities versus only 12% of unregulated utilities publicly publish data on water losses from their system.



Third, it is important to note that of the 39 utilities with no water loss policy, 24 say they perform regular water audits. At the same time 6 of the 16 utilities who do have a stated water loss policy do not perform regular water audits. It appears that having a stated water loss policy does not necessarily denote a commitment to regular water audits to determine performance.

11. As defined in its third edition of the (M36) *Water Audits and Loss Control Programs* manual. AWWA. 2009.

12. Beecher, Janice A. *Survey of State Agency Water Loss Reporting Practices*. Final Report to the American Water Works Association, January 2002.

PHOTO: Flickr/jronaldee, Creative Commons License

# Conclusion

In an industry where data collection and asset management of infrastructure are more critical than ever to the reliability of water service, the absence of universal standards and defined terms is inefficient and risky. Not only is defining and setting standards important, but establishing a consistent method by which a system's performance is measured and compared is also important for ensuring infrastructure integrity and reducing water waste. Additionally, transparent reporting of system performance is beneficial in providing the public with a better understanding of how their water service operates. This supports utilities in making the improvements needed to provide safe and reliable service now and in the future.

Reducing real losses through regular leak detection and repair can have a huge impact on the costs and revenues of water supply systems. By reducing leaks, utilities can reduce their energy and chemical costs as well as possibly delay or defer the cost of new capital construction - a major savings for communities, not to mention the preservation of fresh water resources.

A final question was asked of survey respondents to gauge their interest in participating in improved collaboration and best practices on water loss control and reporting. Over 60% of survey respondents indicated they are interested in collaborating and participating in improved water loss audit practices and public reporting. There is a desire to come together and solve water loss issues, improve infrastructure conditions and increase public transparency about water services.

This survey is a first step in CNT's initiative to work with communities on solutions to water loss control and to improve public reporting. Along with our partner agencies, we intend to work with utilities to develop new initiatives to address these issues. Identifying barriers to and implementing solutions for improved water loss control and increased public reporting will be a next step. Uncovering the mystery of our buried water infrastructure and giving it the attention and support it deserves will ensure community vitality, economic stability and resource reliability now and for future generations.



# Appendix A

## List of Survey Recipients

### Illinois

American Water - Champaign District  
American Water - East St. Louis  
American Water – Peoria  
City of Aurora  
City of Chicago  
City of Elgin  
City of Joliet  
City of Naperville  
City of Rockford  
City of Springfield

### Indiana

American Water - Johnson County  
American Water – Muncie  
American Water – Northwest  
American Water - Southern Indiana  
City of Bloomington  
City of Evansville  
City of Fort Wayne  
Hammond Water Works  
Indianapolis Water  
South Bend Water Works

### Michigan

City of Ann Arbor  
Village of Clinton  
City of Dearborn  
City of Detroit  
City of Flint  
City of Grand Rapids  
City of Kalamazoo  
Lansing Board of Water & Light  
City of Sterling Heights  
City of Warren

### Minnesota

City of Bloomington  
City of Brooklyn Park  
City of Duluth  
City of Eagan  
City of Eden Prairie  
City of Minneapolis  
City of Plymouth  
City of Rochester  
City of St. Cloud  
City of St. Paul

### New York

American Water - Long Island  
Buffalo Water Authority  
Erie County Water Authority  
Monroe Co Water Authority - Shoremont TWP  
City of New York  
Onondaga County WA – Home  
City of Rochester  
Suffolk County Water Authority  
United Water New York  
City of Yonkers

### Ohio

City of Akron  
City of Canton  
Greater Cincinnati Water Works  
Cleveland Water  
City of Columbus  
City of Dayton  
Del-Co Water Company  
Montgomery County  
City of Toledo  
City of Youngstown

### Pennsylvania

Aqua America  
American Water - Pittsburgh  
American Water - Scranton  
Erie Water Works Authority  
Philadelphia Water Department  
Pittsburgh Water & Sewer Authority  
West View Water Authority  
Westmoreland Co Authority - Sweeney Plant  
Westmoreland Co Authority - Yough Plant  
York Water Company – Gravity

### Wisconsin

Appleton Public Works  
Green Bay Water Utility  
City of Janesville  
Kenosha Water Utility  
Madison Water Utility  
Milwaukee Water Works  
City of Oshkosh  
City of Racine  
Waukesha Water Utility  
West Allis Public Works

**INSIDE COVER**

INTENTIONALLY LEFT BLANK

## ABOUT THE CENTER FOR NEIGHBORHOOD TECHNOLOGY

The Center for Neighborhood Technology (CNT) is an award-winning innovations laboratory for urban sustainability. Since 1978, CNT has been working to show urban communities in Chicago and across the country how to develop more sustainably. CNT promotes the better and more efficient use of the undervalued resources and inherent advantages of the built and natural systems that comprise the urban environment.

As a creative think-and-do tank, we research, promote, and implement innovative solutions to improve the economy and the environment; make good use of existing resources and community assets; restore the health of natural systems and increase the wealth and well-being of people—now and in the future. CNT's unique approach combines cutting edge research and analysis, public policy advocacy, the creation of web-based information tools for transparency and accountability, and the advancement of economic development social ventures to address those problems in innovative ways.

CNT works in four areas: transportation and community development, water, energy and climate. CNT has two affiliates, I-GO™ Car Sharing and CNT Energy.

CNT is a recipient of the 2009 MacArthur Award for Creative and Effective Institutions.

More information about CNT is available at [www.cnt.org](http://www.cnt.org)