



## **NATIONAL CITY WATER SURVEY 2007**

### **The Status of Asset Management Programs in Public Water and Sewer Infrastructure in America's Major Cities**

**September 2007**

**Washington, DC**

# **The United States Conference of Mayors**

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# **The U. S. Conference of Mayors Mayors Water Council**

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### **The Status of Asset Management Programs in Public Water and Sewer Infrastructure in America's Major Cities**

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# Mayors Briefing

Providing public water and sewer, (a government enterprise), is the second highest category of local government spending next to public education. More than \$82 billion was spent in 2005 on water and sewer services and infrastructure, and from 1992 to 2005 total expenditures exceeded \$841 billion. While this effort accrues many non-monetized public benefits (e.g., protecting public health, supporting local and metropolitan economies, protecting ecosystems), public managers are often measured by the simple balance sheet of revenues versus expenditures.

Water and sewer rates, always a politically sensitive subject, are increasing in America's major cities. Annual local government spending may exceed \$110 billion by 2010, and that estimate does not include additional expenses to address climate change impacts on water resources which are currently unknown. Public support for increasing user fees and rates and additional infrastructure investment is critical, but more information is needed in order for ratepayers to better understand the value of public water and sewer in the United States. Public managers are integrating asset management techniques in their water and sewer systems to help close the gap between system revenues and expenditures. The information gained from applying these techniques is also being used to educate the public about the true costs to provide the desired level of service and to explain that their taxes and rate payments are being used effectively and wisely. Asset management programs include a number of practices that can be coordinated and applied to help water and sewer system managers minimize the overall cost of acquiring, operating, maintaining and rehabilitating water and sewer assets through their lifecycle and simultaneously maintain the desired public service levels.

The USCM conducted a survey of America's major cities to determine the status of integrating asset management techniques in public water and sewer services. The survey findings indicate that America's major cities have made much progress, but more work is needed in some critical areas.

## MAJOR FINDINGS

- **Roughly 75 percent of treatment plants providing drinking water and cleaning wastewater (sewage) employ comprehensive or partial asset management practices.**
  - **60 percent of the cities that do not use these practices plan to do so.**
- **22 to 38 percent of cities are already achieving capital cost and operating cost savings from implementation of asset management programs, but 50 to 60 percent expect to achieve savings in the future.**
- **More than 90 percent of cities have conducted full or partial inventories and condition assessments of their water and sewer pipes**
- **More than 70 percent of cities have implemented a full or partial asset management program for their water and sewer pipes.**
- **Water main breaks continue to be a major concern with 45 percent of cities experiencing more than 50 breaks annually; 43 percent of city drinking water pipe system repair and replacement cycles exceed 50 years, 65 percent of city sewer pipe system repair and replacement cycles exceed 200 years.**
- **Most cities support using asset management programs but are opposed to a Congressional mandate that would make it a prerequisite to receive federal financial assistance**
- **Cities that employ asset management practices are gaining the information and knowledge they seek to determine the level of user rates that can lead to system sustainability, but only half of those cities are using that information to educate their customer base.**

# Summary of Findings

## **Above Ground Water and Sewer Plants**

### **How Common are Asset Management Programs?**

- Nearly 40 percent of cities employ asset management programs at their water and sewer treatment plants,
- Another 32 to 36 percent have at least a partial program
- Roughly one-quarter of cities have none
- 60 percent of cities that have no current programs plan on employing one in the future

### **Are Cities Achieving Cost-Savings from These Programs?**

- **Sewer Treatment Plants**
  - 39 percent of cities with asset management programs report capital cost savings
  - 32 percent report operations & maintenance savings
  - Roughly 60 percent of cities expect future savings in their drinking water treatment plants
  - 17 percent of cities employing asset management programs have not achieved, or expect to achieve cost savings from employing asset management programs
- **Water Treatment Plants**
  - 21 percent of city drinking water treatment plants report capital cost savings
  - 22 percent report operations & maintenance savings
  - 51 percent of cities expect future capital cost and operations & maintenance savings sewer treatment plants
  - 16 percent of cities employing asset management programs have not achieved, or expect to achieve cost savings from employing asset management programs

## **Underground Water and Sewer Pipes**

### **How Common are Asset Management Programs?**

- More than 70 percent of cities have implemented a full or partial asset management program for their water and sewer pipes
- More than 90 percent of cities have conducted full or partial inventories and condition assessments of their water and sewer pipes

### **Water Main breaks continue to plague cities**

- 27 percent of cities are experiencing annual decreases in the number of breaks
- 35 percent of cities are experiencing an increased or unchanged number of annual breaks
- 72 percent of cities experience up to 100 breaks per year
- 21 percent of cities experience from 100 to 500 breaks per year
- 7 percent of cities experience over 500 breaks per year
- The repair and replacement cycle of water and sewer pipes is reported to be a “continuous” process that never ends.
  - The cycle for water pipes ranges from 3 years to greater than 300 years, with 56 percent of cities at 50 years or less
  - The cycle for sewer pipes ranges from 2 years to 1,200 years, with half the cities at 40 years or less.
- The cost to repair and replace water and sewer pipes is very high

- Nearly half of the cities report annual spending on water pipe repair and replacement ranging from \$400,000 to \$15 million
- Nearly half of the cities report annual spending on sewer pipe repair and replacement ranging from \$450,000 to \$30 million

### **Policy, Training Opportunities and Education**

- 59 percent of cities oppose a Congressional mandate that would require implementing formal asset management programs as a condition of receiving federal financial assistance
- Cities prefer face-to-face technical training from EPA on asset management over access to an internet information repository
- 63 percent of cities indicate asset management programs have helped them determine a rate structure that could lead to self-sustaining systems
- Half of the cities employing asset management programs have not used information from those programs to educate customers about the cost for services
- 44 percent of cities have used such information to educate customers concerning the true cost of providing high quality service levels

# **The Status of Asset Management Programs in Public Water and Sewer Infrastructure in America's Major Cities**

## **Introduction**

This report is intended to provide information on the status of integrating asset management programs in public water and sewer systems in America's major cities. A survey was conducted in 2007 by The U.S. Conference of Mayors to elicit key information on the subject. Asset management programs, (briefly defined as a set of management practices and techniques that can be applied to the operation, maintenance and replacement of physical assets), provide an opportunity for water and sewer managers to maintain and expand services and simultaneously identify and realize cost savings and system efficiencies. The growing interest in local government to integrate asset management approaches to public infrastructure is consistent with the desire to maximize the prudent application of taxes and revenues raised from rate-payers for these services. This is especially critical in the realm of public water and sewer services because they are the second highest category of local government expenditures in the United States next to education.

Local government has invested a significant amount of resources in public water and sewer infrastructure: \$82 billion in 2004-2005, and \$841 billion between 1991 and 2005 according to the U.S. Bureau of the Census reports on local government finances (1). Estimated increased annual spending by 2010-2011 could be as high as \$109.7 billion, but that figure is likely to underestimate total spending requirements because capital expenditures for drinking water are currently not adequately reported, and increased spending to address climate change impacts on water resources is inevitable yet currently uncertain (2). The substantial amount of public resources devoted to local water and sewer, and the anticipated increased spending argue strongly for integrating smart asset management programs that allow managers to take advantage of opportunities for savings and efficiencies.

Reported spending includes debt service, operations and maintenance (O&M) costs, and some (but not all) capital costs. A 2005 National City Survey conducted by the Conference of Mayors indicates that the highest water resources priority of America's major cities is the rehabilitation of an aging water and sewer infrastructure (3). The print and broadcast media is replete with reports about breaking water mains and the general state of disrepair, if not failure, of high-usage public infrastructure. The U.S. Environmental Protection Agency (EPA) estimates that a range of \$500 to \$600 billion of new investment is needed in public water and sewer in order to comply with existing law over the 20 year period 2000-2019 (4).

Water and sewer infrastructure investment needs will continue to draw significant and constantly increasing levels of public resources. It is natural to inquire if these investments yield public benefits and are prudently managed. Public managers have achieved much success in securing and delivering safe and reliable water and sewer services. A qualitative snap-shot is favorable- the improved state of public health and significant decline in waterborne infectious diseases, the robust and growing metro economies, and the continually increasing efforts to better manage watersheds and protect ecosystems indicates that much success has been achieved and future successes are likely.

Despite the tangible and aesthetic public benefits derived from investment in public water and sewer infrastructure and services, a quantitative snap-shot based on the simple balance sheet is less favorable. Assuming that public health improvements are not quantified, or economic growth with local and regional multipliers are not added to the revenue side, there is, and for many years has been, a gap between water and sewer revenues versus expenditures. The ratio of revenues to expenditures for drinking water infrastructure and services ranged from 78.5 percent in 1991-92, to 81.3 percent in 2004-05, with a high of 88 percent in 1995-96 (2). The ratio of revenues to expenditures for wastewater (sewer) infrastructure and services was more favorable than for drinking water, ranging from 77.4 percent in 1991-92, to 88.5 percent in 2004-05, with a high of 95.2 percent in 2000-01 (2).

The gap between local water and sewer revenues and expenditures has been a focus of concern to EPA for some time. The Agency's Four Pillars strategy articulates the need for adequate pricing of water and sewer services to make the utilities self-sustaining (5). This approach, according to the Agency, would place the full cost of investment and service delivery on system users. It could also take some pressure off of scarce federal financial aid, and allow that aid to achieve greater social utility if diverted to systems where users experience economic hardship in complying with existing law and protecting public health.

The historical trend of increased local government spending on water and sewer infrastructure and services will likely continue. The U.S. Conference of Mayors (USCM) - Mayors Water Council (MWC) has established a forum for local government to share information on their water resources issues, and to promote "Best Practices" that provide innovative, alternative and cost-effective solutions to those problems. Low impact development and "Green Infrastructure" approaches have been promoted by the USCM's Sustainable Cities Task Force. Another Best Practice is the asset management approach to water and sewer system operations and management. Asset management techniques have the potential to help close the gap in system revenues and expenditures. The reality, however, is that the revenue gap can be narrowed, in some cases quite substantially, but increased user rates will likely accompany employment of asset management techniques in order for water and sewer systems to become self-sustaining. Local government strives to achieve public benefits from tax-payer's and rate-payer's money. Employing asset management science to public infrastructure, with the inclusion of life-cycle planning and identifying management decision points that allow cost-efficiencies and savings, can help win the public's support for reinvestment in water and sewer infrastructure.

## **2007 National City Survey**

The USCM conducted a National City Survey of Drinking Water and Wastewater Asset Management in 2007. An objective of the Survey is to examine the extent to which public water and sewer infrastructure managers are integrating asset management programs into their systems. Another objective of the Survey is to generate information on common challenges cities face in managing the physical assets. Thus, questions concerning the above ground as well as the underground water and sewer assets were included.

A survey questionnaire was sent to roughly 1,200 major cities in the United States that have Mayoral forms of government. Mayors were asked to work with their water and sewer departments or public works departments to provide information.

The Survey questionnaire was designed with three categories of information generation in mind. The first category was comprised of questions asking for general information on water and sewer systems including above ground and underground assets. The second category

focused in on the underground infrastructure of drinking water distribution pipes and sewer collection pipes. The third category included questions concerning education, training opportunities and policy.

The Survey response rate was 27.5 percent. Completed questionnaires were received from 330 cities. Judgment and follow-up phone calls were employed to clarify question (item) responses. For example, if a city responded that the pipe rehabilitation cycle was 20 to 30 years, the mid-point (25 years) was used to derive quantitative results (findings). Where no responses were encountered on survey questions a follow-up phone call was made to the survey city to fill-in the correct information.

## **Findings**

### **General Information on Public Water and Sewer Asset Management Programs**

#### **Customer Base for Drinking Water and Wastewater Treatment Facilities**

296 cities out of the 330 cities responding to the survey reported that their drinking water facilities serve a total population of 55.3 million customers. The City drinking water customer base in the responding survey cities ranges from 3,100 to 5.4 million. The average number of customers is 186,671. The majority of cities (63.9 percent) serve 100,000 customers or less, (Table 1). Another 15.5 percent of cities serve between 100,000 and 200,000 customers. Less than 2 percent serve more than 1 million customers.

228 cities reported that their wastewater treatment facilities serve a total population of 32.2 million customers. City wastewater collection systems report number of customers ranging from 11,400 to 2.2 million. The average number of customers is 141,371. The majority of cities (54.0 percent) serve 100,000 customers or less, (Table 2). Another 20.2 percent of cities serve between 100,000 and 200,000 customers. The remaining 15.8 percent of cities report serving over 400,000 to 2.218 million customers.

#### **The Status of Implementing Formal Asset Management Programs in City Water and Sewer Treatment Plants**

The number of cities implementing formal asset management programs at their water and sewer plants is almost identical at 39 percent, (Table 3). Sewer plants are more likely (36.9 percent) to implement at least a partial asset management program than water plants (31.9 percent). Roughly three-quarters of water and sewer plants employ either a comprehensive or partial asset management program. The remaining one-quarter of cities have not implemented any formal asset management program. However, 60.1 percent of cities not currently using asset management programs for their drinking water or wastewater plants plan to do so in the future (Table 4).

#### **Inventories of Above Ground Physical Assets**

The vast majority of cities report having conducted inventories of their water and sewer plants (Table 5). Slightly more than 73 percent of cities have done so. Roughly 20 percent of cities have conducted at least a partial inventory. Only 6.5 percent of cities report not having conducted an inventory of their drinking water plants; and only 5.7 percent report not having conducted an inventory of their wastewater treatment plants.

## **Asset Management Programs and Cost-Savings**

Cities were asked to report if they have achieved cost-savings from implementing asset management programs in two categories: capital costs and operating and maintenance costs (O&M). About a fifth of city water plants reported achieving cost savings in both capital costs and O&M, (Table 6). Roughly another three-fifths of city water plants were optimistic that capital cost and O&M savings are expected in the future as a result of their asset management efforts. Slightly more than 17 percent of city water plants indicate no cost savings were, or are expected to be, achieved.

City wastewater plants were more advanced than the water plants in achieving capital cost and O&M savings. 38.8 percent of city wastewater plants report achieving capital cost savings; and 32.2 percent report achieving O&M cost savings. Slightly more than half of the wastewater treatment plants expect to achieve capital cost (51.1 percent) and O&M (51.3 percent) savings. However, similar to the water plants, the city wastewater plants indicate that 17.1 percent have not or do not expect to achieve capital cost savings; and 16.4 percent indicate they have not, nor expect to, achieve O&M cost savings.

## **Underground Drinking Water and Wastewater Assets**

### **Drinking Water Distribution Pipes**

#### **Miles of Drinking Water Distribution Pipes**

293 cities provided information on the number of miles of drinking water distribution pipes they manage. The responses range from 12.5 to 7,000 miles; and the total number of miles is 186,149. The average number of drinking water distribution pipe miles for a city is 635.

The distribution of city responses provides more detailed information. The median number of city drinking water distribution pipe miles is 330. A small group of cities report having 100 miles of pipes or less (5.8 percent, Table 7). Cities reporting between 101 and 300 miles of drinking water pipes comprise 39.9 percent. Cities reporting 301 to 500 miles of pipe comprise 21.5 percent. Cities with over 500 miles of drinking water pipes comprise 32.8 percent of the survey cities.

#### **The Status of Formal Asset Management Programs for Drinking Water Pipes**

Less than half (41.7 percent) of the survey cities employ a formal asset management program for their drinking water distribution pipes, (Table 3). Another 30.2 percent employ at least a partial asset management program; and 28.1 percent do not employ any formal asset management program.

#### **Estimating the Cost of Comprehensive Asset Management Programs for Drinking Water Pipes**

Only 23.1 percent of the survey cities have estimated the cost of a comprehensive asset management program for their drinking water distribution pipes; while 55.2 percent have not made estimates, (Table 8). The remaining 21.7 percent of survey cities have made at least a partial estimate of the cost of an asset management program.

### **Conducting Inventories of Drinking Water Pipes**

Most cities have conducted an inventory of their drinking water distribution pipes. 72.3 percent have conducted full inventories, and 20.6 percent have conducted partial inventories, (Table 5). Only 7.1 percent of the survey cities report that they have not conducted inventories of the distribution pipes.

Cities that have conducted inventories are beginning to rely on Global Positioning System (GPS) technology: 37.6 percent have used GPS for a full inventory; 31.2 percent have used GPS for a partial inventory; 31.2 have not used GPS at all for this purpose, (Table 9).

### **Assessing the Condition of Drinking Water Pipes**

Cities have a general understanding of the condition of their drinking water distribution pipes. Nearly half (46.1 percent) of the survey cities report that they have fully assessed the condition of their pipes, (Table 10). Nearly half, (46.1 percent) report that they have conducted at least a partial assessment. Only 7.8 percent of the survey cities have not conducted any assessment of the condition of their drinking water pipes.

### **Water Main Breaks, Causes of Drinking Water Pipe Deterioration, and Mitigation Measures**

Roughly a quarter (27.5 percent) of cities report experiencing annual decreases in the number of water main breaks each year (Table 11). About a fifth of cities (19.8 percent) report no change in the number of annual breaks. Breaks are increasing in 16.1 percent of cities; and nearly a third of cities (32.6 percent) are experiencing a mix of increases and decreases from year-to-year.

The magnitude of average annual water main breaks varies considerably. Cities report a range of 1 to over 3,000 water main breaks on an average annual basis. Slightly more than half of the survey cities report an average of 50 water main breaks or less per year: (35.8 percent experience 1 to 25; 19.1 percent experience 26 to 50, (Table 12)). Slightly less than half of the survey cities report greater than 50 water main breaks per year: 16.7 percent report 51 to 100; 14.9 percent report 101 to 200; 6.4 percent report 201 to 500; and, 7.1 percent report greater than 500.

The leading cause of deterioration of drinking water distribution pipes is general wear and tear, (63.3 percent, Table 13). The second most frequently cited cause of deterioration is corrosion, (36.0 percent). Chemical impacts accounted for less than 1 percent.

Cities commonly apply pipe deterioration mitigation measures, often relying on multiple mitigation measures throughout a distribution system. The most commonly used mitigation measures are listed in descending order of frequency (Table 14): protective coatings and linings, 70.3 percent; use non-corrodible materials, 68.2 percent; require corrosion pretreatment of water, 44.8 percent; use cathodic protection, 35.0 percent.

### **Detailed Drinking Water Pipe Characteristics and Performance Evaluation Methods**

Cities are generally very well informed concerning the size (96.0 percent), material composition (93.4 percent) and age (81.3 percent) of drinking water pipes (Table 15). Only 40.3 percent of cities report that they record information on the type of pipe joints used in the distribution system. Cities are more likely to use of number of breaks per unit length (86.2 percent) to evaluate drinking water pipe performance than either amount of leakage per unit length (36.9 percent), or maintenance cost per unit length (38.9 percent), (Table 16).

## **Drinking Water Pipe Rehabilitation Cycles**

Underground assets, such as drinking water distribution pipes, are often ignored unless they break and remedial actions are required to stop leakage and resume normal service. Managers involved with the operation and maintenance of water distribution recognize that older pipe systems may be constructed with multiple materials such as concrete, ductile iron, wood (and even lead), and some of these pipes may be over 125 years old. However, asset management techniques do not rely on the past practice of – if it isn't broken don't fix it. Indeed, previous information presented in this report indicates that cities are inventorying and assessing the condition of buried pipes. As asset management practices gain popularity the information they generate can be used to efficiently replace older pipes constructed with undesirable materials.

Repair and replacement cycles are, in large part, determined by budget allocations. Cities were asked to estimate and report how many years it takes to complete a repair and replacement (rehabilitation) cycle for the pipe systems they operate and maintain at current or projected spending levels. Responses to this question were considerably varied. Some cities provided commentary while others provided quantifiable information.

Those cities that provided commentary rather than quantifiable estimates may have found the question to be somewhat difficult to answer. While inventories and condition assessments are increasing they are not perfect. Some cities suggested that a pipe system rehabilitation cycle is only one way to look at the subject. For example, one city commented that rehabilitation of water pipes would take 2 million years. This response may seem exaggerated but it should not be summarily dismissed. On the other hand, it certainly approaches measurements akin to “geologic time”, and is clearly an impractical time frame for planning public works activities or the historical understanding of the survival of societies. While such an estimate provokes thought, it is not useful for quantifying rehabilitation cycles.

Many cities commented that drinking water pipe system rehabilitation is an “ongoing” or “continuous” process. Other cities commented that the rehabilitation effort is “unknown”, “indefinite” or “depends on funds”. Only one city responded that their drinking water pipe rehabilitation efforts were “current and up to date”.

Quantifiable responses were provided by 131 cities, (Table 17) and they ranged from currently complete to 2 million years until completed. Eliminating the 2 million year response as “outlier data” the average city drinking water distribution pipe rehabilitation period is 90.6 years. The average figure, however, is skewed even when the 2 million year data element is eliminated. The median number of rehabilitation cycle years is 50. The distribution of rehabilitation cycle years provides greater detailed information. A little more than 30 percent of cities (31.3 percent) indicated that their drinking water pipe rehabilitation cycle is 20 years or less. Another 25.1 percent of the survey cities indicated the rehabilitation cycle extended from 21 to 50 years. 43.5 percent of the cities indicated that their rehabilitation cycles were greater than 50 years.

## **Annual Spending on Rehabilitation of Drinking Water Pipes**

Cities were asked to provide information on average annual spending to maintain and rehabilitate their drinking water distribution pipe systems. 235 cities responded with their dollar spending/budgeting information. The average annual spending ranged from \$1,500 to \$15 million; with an average of \$1.4 million. The median expenditure is \$400,000.

The distribution of city expenditures provides greater detailed information, (Table 18). 31.1 percent of the survey cities indicated that their average annual expenditures were \$100,000 or less: about half of those cities are spending \$50,000 or less. Nearly a quarter of the

cities (24.7 percent) are spending between \$100,000 and \$500,000 annually. Cities spending between \$1 million and \$10 million comprise 29.4 percent of the survey cities. Two percent of the survey cities (5 cities) report annual average expenditures of more than \$10 million to as much as \$15 million.

## **Wastewater (Sewer) Collection System Pipes**

### **Miles of Sewer Pipes**

276 cities provided information on the number of miles of wastewater collection system pipes they manage. The responses ranged from 13.5 to 4,300 miles; and the total number of miles is 136,104. The average number of wastewater collection system pipe miles is 493.

The median reported number of wastewater collection pipe miles is 272. The distribution of wastewater pipe miles is as follows (Table 19): 100 miles or less 8.7 percent; 101 to 200 miles 26.1 percent; 201 to 300 miles 20.3 percent; 301 to 500 miles 20.3 percent; 501 to 1,000 miles 14.5 percent; greater than 1,000 miles 10.1 percent.

### **The Status of Formal Asset Management Programs for Sewer Pipes**

Less than half (40.9 percent) of cities have employed a formal asset management program in their wastewater collection systems (Table 3). Another 32.6 percent have at least a partial asset management program. Slightly more than a quarter of the cities (26.5 percent) have no asset management programs in their collection systems.

### **Conducting Inventories of Sewer Pipes**

Regardless of whether cities have instituted formal asset management programs, most of the survey cities (71.7 percent) have conducted an inventory of their wastewater collection systems. 21.5 percent have conducted partial inventories, (Table 5). Only 6.8 percent of the cities report not having conducted collection system inventories.

Cities that have conducted inventories are beginning to rely on Global Positioning System (GPS) technology: 37.5 percent have used GPS for a full inventory; 32.9 percent have used GPS for a partial inventory; 29.6 have not used GPS at all for this purpose, (Table 9).

### **Estimating the Cost of Comprehensive Asset Management Programs for Sewer Pipes**

Only 22.3 percent of the survey cities have estimated the cost of a comprehensive asset management program for their wastewater collection system pipes; while 55.4 percent have not made estimates, (Table 8). The remaining 22.3 percent of survey cities have conducted at least a partial estimate of the cost of an asset management program.

### **Assessing the Condition of Sewer Pipes**

Cities generally have at least a fair understanding of the condition of their wastewater collection system pipes. Some 44.7 percent of the survey cities report that they have fully assessed the condition of their pipes, (Table 10). Another 48.2 percent report that they have conducted at least a partial assessment of the collection system pipes. Only 7.1 percent of the survey cities have not conducted any assessment of the condition of their collection system pipes.

## **Major Cause of Sewer Pipe Deterioration and Mitigation Measures**

The main cause of deterioration in wastewater collection pipes is general wear and tear (82 percent, Table 13). Corrosion is reported as the next most frequent (14.6 percent) cause of deterioration; and chemical attack is a minor cause at 3.4 percent.

The two major mitigation measures applied to wastewater collection pipes include use of non-corrodible materials (79.9 percent, Table 14), and use of protective coatings and linings (67.4 percent). Twenty percent of cities report that they require corrosion pretreatment of water. Less than 10 percent of cities report using cathodic protection measures.

## **Detailed Sewer Pipe Characteristics and Performance Evaluation Methods**

Cities are generally very well informed concerning the size (96.2 percent), material composition (95.4 percent) and age (72.4 percent) of sewer pipes (Table 15). Only 41.8 percent of cities report that they record information on the type of pipe joints used in the distribution system. Cities are more likely to employ the use of number of breaks per unit length (64.9 percent) to evaluate sewer pipe performance than either amount of leakage per unit length (33.7 percent), or maintenance cost per unit length (55.0 percent), (Table 16).

## **Sewer Pipe Rehabilitation Cycles**

108 of the survey cities responded to the question asking them how many years it will take to repair and replace (rehabilitation cycle) their wastewater collection system pipes at current or projected spending levels. Responses ranged from 2 years to over 5 million years: or, two years to 500 hundred years when the one city responding 5 million years is dealt with as an outlier. The average number of years is 77.9, when the 5 million year outlier is not included.

Over half of the survey cities (51.4 percent) indicated that a full cycle of pipe repair/replacement is scheduled to be complete between 2 years and 40 years, (Table 20). About a fifth of the cities (20.6 percent) indicated the repair/replacement cycle ranges from 50 to 95 years. At the extreme end of the range, 24.3 percent of the survey cities indicated a 100 to 400 year cycle; and a small number of cities (4 cities, 3.7 percent) responded that their repair/replacement cycle is 500 years or more.

## **Annual Spending on Rehabilitation of Sewer Pipes**

218 cities reported average annual spending on repair/replacement of wastewater collection pipes. The total amount of spending by these cities exceeded \$374.3 million, and ranged between \$1,500 and \$30 million. Ten cities spend \$10 million or more each year on wastewater collection pipe repair/replacement.

The average annual city spending is \$1.72 million. Half of the survey cities report annual spending of \$400,000 or less, (Table 21). One quarter of the survey cities report annual spending between \$450,000 and \$1.5 million. One quarter of the survey cities report annual spending above \$1.5 million to \$30 million.

## **Preferred Pipe Replacement Construction Method**

The survey cities were asked to comment on their preferred method of replacing buried pipe. No distinctions were made between drinking water and sewer pipes. A majority (55 percent) of cities indicated that they prefer a combination of open trench and trenchless replacement methods, (Table 22). The traditional open trench method was the next most frequently preferred method at 39.6 percent. Only 5.4 percent of the survey cities responded that the trenchless method was their preferred approach.

## **General Information: Policy, Training Opportunities and Education**

### **Congressionally Mandated Asset Management**

Congress has suggested and/or proposed imposing a legislative mandate to require public water and wastewater utilities that seek federal financial aid for infrastructure investment to implement asset management programs as a condition of receiving such aid. Survey cities were asked if Congress should impose such a mandate. The survey cities generally are not favorable (48 percent) to a Congressional mandate linking implementation of an asset management program to receipt of federal financial aid for infrastructure investment, (Table 23). 29 percent of the survey cities support a Congressional mandate; while 18.3 percent expressed no opinion. If cities expressing no opinion either way are removed from the totals, then 59 percent of cities oppose a mandate; 35 percent support a mandate; and, 6 percent report that they don't know.

### **Technical Assistance from the US EPA**

Cities were asked if they would use an Environmental Protection Agency (EPA) sponsored internet-based information repository stored with technical information concerning water and wastewater asset management. More than 57 percent of cities (Table 24) indicated they would use it a lot (18.6 percent) or a little (38.8 percent). More than one-third (35.9 percent) of cities indicated they didn't know if they would use such an internet-based repository; and, about 7 percent indicated they would not use it at all.

Cities were far more favorable to free asset management training sessions that the EPA might offer in major cities in the various EPA Regions. A majority of cities (53.5 percent) preferred this method of technical assistance, (Table 25). Another 38.5 percent of cities indicated they may attend free asset management training sessions sponsored by EPA. Only 8 percent of cities indicated they would not attend such training sessions or did not know if they would attend.

### **Leveraging Information from Implementing Asset Management Programs**

One objective of employing asset management programs is to enable managers to determine customer rate structures that can lead to self-sustaining drinking and wastewater systems. A majority of cities (62.8 percent) reported that they have determined self-sufficient system rate structures (Table 26). Nearly one-quarter of the survey cities using asset management programs indicate they still "don't know" what the appropriate self-sufficient rate structure is; and 12.8 percent of cities indicate that using such programs has not lead them to determining self-sufficient rate structures.

Less than half of the cities (43.8 percent) indicate that they use information gained from asset management programs to educate customers about the true cost of providing the level of drinking water and wastewater services they desire, (Table 27). Half of the cities (50.2 percent) indicate they do not use asset management information to educate consumers. Six percent of cities responding indicated they "don't know" is asset management information if used for customer education.

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# REPORT TABLES

**Table 1: Drinking Water System Population Served**

<b>Range of Population Served</b>	<b>No. of Cities</b>	<b>Percentage of Cities</b>
<b>3,100 – 50,000</b>	<b>77</b>	<b>26.0</b>
<b>&gt; 50,000 – 100,000</b>	<b>112</b>	<b>37.9</b>
<b>&gt; 100,000 – 200,000</b>	<b>46</b>	<b>15.5</b>
<b>&gt; 200,000 – 500,000</b>	<b>37</b>	<b>12.5</b>
<b>&gt; 500,000 – 1.0 mill</b>	<b>19</b>	<b>6.4</b>
<b>&gt; 1.0 mill – 5.4 mill</b>	<b>5</b>	<b>1.7</b>

**Table 2: Wastewater System Population Served**

<b>Range of Population Served</b>	<b>No. of Cities</b>	<b>Percentage of Cities</b>
<b>11,400 – 50,000</b>	<b>66</b>	<b>28.9</b>
<b>&gt; 50,000 – 100,000</b>	<b>80</b>	<b>35.1</b>
<b>&gt; 100,000 – 200,000</b>	<b>46</b>	<b>20.2</b>
<b>&gt; 200,000 – 400,000</b>	<b>20</b>	<b>8.8</b>
<b>&gt; 400,000 – 2.218 mill</b>	<b>16</b>	<b>7</b>

**Table 3: Cities Implementing Formal  
Asset Management Programs, (%)**

<b>Infrastructure Category</b>	<b>Yes</b>	<b>Partial</b>	<b>No</b>
<b>Drinking Water Treatment Plant</b>	<b>39.3</b>	<b>31.9</b>	<b>28.8</b>
<b>Drinking Water Distribution Pipes</b>	<b>41.7</b>	<b>30.2</b>	<b>28.1</b>
<b>Wastewater Treatment Plant</b>	<b>39.0</b>	<b>36.9</b>	<b>24.1</b>
<b>Wastewater Collection Pipes</b>	<b>40.9</b>	<b>32.6</b>	<b>26.5</b>

**Table 4: Cities Not Using Asset Management Programs and Their  
Future Plans to Use Them**

<b>Answer</b>	<b>No. of Cities</b>	<b>Percent of Cities</b>	<b>Percent of Cities*</b>
<b>Yes</b>	<b>101</b>	<b>33.8</b>	<b>60.1</b>
<b>No</b>	<b>6</b>	<b>2.0</b>	<b>3.6</b>
<b>Don't Know</b>	<b>61</b>	<b>20.4</b>	<b>36.3</b>
<b>Not Applicable</b>	<b>131</b>	<b>43.8</b>	<b>NA</b>
<b>Total</b>	<b>299</b>		<b>(168) **</b>

\* If cities responding with Not Applicable were not included in percentages

\*\* Total No. of Cities when Not Applicable cities are removed

**Table 5: Cities that Have Conducted  
Physical Asset Inventories, (%)**

<b>Infrastructure Category</b>	<b>Yes</b>	<b>Partial</b>	<b>No</b>
<b>Water Treatment Plant</b>	<b>73.9</b>	<b>19.6</b>	<b>6.5</b>
<b>Water Distribution Pipes</b>	<b>72.3</b>	<b>20.6</b>	<b>7.1</b>
<b>Wastewater Treatment Plant</b>	<b>73.6</b>	<b>20.7</b>	<b>5.7</b>
<b>Wastewater Collection Pipes</b>	<b>71.7</b>	<b>21.5</b>	<b>6.8</b>

**Table 6: Achieving Cost-Savings from Implementing an Asset  
Management Program, (%)**

<b>Achieved Savings</b>	<b>Water Treatment Plant</b>	<b>Wastewater Treatment Plant</b>
<b>Capital Costs</b>		
<b>Yes</b>	<b>21.2</b>	<b>38.8</b>
<b>No</b>	<b>17.6</b>	<b>17.1</b>
<b>Not yet, Expected To</b>	<b>61.2</b>	<b>51.1</b>
<b>Operations &amp; Maintenance</b>		
<b>Yes</b>	<b>22.5</b>	<b>32.2</b>
<b>No</b>	<b>17.9</b>	<b>16.4</b>
<b>Not yet, Expected To</b>	<b>59.6</b>	<b>51.3</b>

**Table 7: Reported Miles of Drinking Water Distribution System Pipes**

<b>Miles of Pipe</b>	<b>No. of Cities</b>	<b>Percent of Cities</b>
<b>≤ 100</b>	<b>17</b>	<b>5.8</b>
<b>101 ≤ 200</b>	<b>57</b>	<b>19.4</b>
<b>201 ≤ 300</b>	<b>60</b>	<b>20.5</b>
<b>301 ≤ 500</b>	<b>63</b>	<b>21.5</b>
<b>501 ≤ 1,000</b>	<b>48</b>	<b>16.4</b>
<b>&gt;1,000</b>	<b>48</b>	<b>16.4</b>
<b>Total</b>	<b>293</b>	<b>100.0</b>

**Table 8: Cities that Have Estimated the Cost of a Comprehensive Asset Management Program, (%)**

<b>Infrastructure Category</b>	<b>Yes</b>	<b>Partial</b>	<b>No</b>
<b>Water Distribution Pipes</b>	<b>23.1</b>	<b>21.7</b>	<b>55.2</b>
<b>Wastewater Collection Pipes</b>	<b>22.3</b>	<b>22.3</b>	<b>55.4</b>

**Table 9: Cities that Use GPS to Inventory Physical Assets, (%)**

<b>Infrastructure Category</b>	<b>Yes</b>	<b>Partial</b>	<b>No</b>
<b>Water Distribution Pipes</b>	<b>37.6</b>	<b>31.2</b>	<b>31.2</b>
<b>Wastewater Collection Pipes</b>	<b>37.5</b>	<b>32.9</b>	<b>29.6</b>

**Table 10: Cities that Have Assessed the Condition of Physical Assets, (%)**

<b>Infrastructure Category</b>	<b>Yes</b>	<b>Partial</b>	<b>No</b>
<b>Water Distribution Pipes</b>	<b>46.1</b>	<b>46.1</b>	<b>7.8</b>
<b>Wastewater Collection Pipes</b>	<b>44.7</b>	<b>48.2</b>	<b>7.1</b>

**Table 11: The Frequency of Annual Water Main Breaks**

<b>Frequency</b>	<b>Percent of Cities</b>
<b>Increase</b>	<b>16.1</b>
<b>Decrease</b>	<b>27.5</b>
<b>Unchanged</b>	<b>19.8</b>
<b>Mix of Increases And Decreases</b>	<b>32.6</b>
<b>Don't Know</b>	<b>4.0</b>

**Table 12: The Distribution of Reported Annual Water Main Breaks**

<b>Number of Reported Breaks</b>	<b>Number of Cities</b>	<b>Percent of Cities</b>
<b>1-25</b>	<b>101</b>	<b>35.8</b>
<b>26-50</b>	<b>54</b>	<b>19.1</b>
<b>51-100</b>	<b>47</b>	<b>16.7</b>
<b>101-200</b>	<b>42</b>	<b>14.9</b>
<b>201-300</b>	<b>7</b>	<b>2.5</b>
<b>301-500</b>	<b>11</b>	<b>3.9</b>
<b>&gt; 500</b>	<b>20</b>	<b>7.1</b>
<b>Total</b>	<b>282</b>	<b>100.0</b>

**Table 13: Leading Cause of Deterioration in Drinking Water and Wastewater Pipes**

<b>Leading Cause Of Deterioration</b>	<b>Drinking Water Pipes (Percent of Cities)</b>	<b>Wastewater Pipes (Percent of Cities)</b>
<b>Corrosion</b>	<b>36.0</b>	<b>14.6</b>
<b>Chemical Attack</b>	<b>0.7</b>	<b>3.4</b>
<b>General Wear &amp; Tear</b>	<b>63.3</b>	<b>82.0</b>

**Table 14: Mitigation Measures Applied to Preserve Drinking Water Distribution Pipes and Wastewater Collection Pipes**

<b>Mitigation Measures Applied</b>	<b>Drinking Water Pipes (Percent of Cities)</b>	<b>Wastewater Pipes (Percent of Cities)</b>
<b>Use More Non-Corrodible Materials</b>	<b>68.2</b>	<b>79.9</b>
<b>Use Protective Coatings &amp; Linings</b>	<b>70.3</b>	<b>67.4</b>
<b>Use Cathodic Protection</b>	<b>35.0</b>	<b>9.6</b>
<b>Require Corrosion Pretreatment of Water</b>	<b>44.8</b>	<b>20.1</b>

**Table 15: Standard Pipe Information Recording**

<b>Pipe Information</b>	<b>Drinking Water Pipes (Percent of Cities)</b>	<b>Wastewater Pipes (Percent of Cities)</b>
<b>Pipe Size (diameter)</b>	<b>96.0</b>	<b>96.2</b>
<b>Pipe Material</b>	<b>93.4</b>	<b>95.4</b>
<b>Pipe Age</b>	<b>81.3</b>	<b>72.4</b>
<b>Type of Joints</b>	<b>40.3</b>	<b>41.8</b>
<b>Pipe Depth</b>	<b>NA</b>	<b>62.5</b>

**Table 16: Performance Evaluation Method Employed for Drinking Water Distribution Pipes**

<b>Performance Evaluation Method</b>	<b>Drinking Water Pipes (Percent of Cities)</b>	<b>Wastewater Pipes (Percent of Cities)</b>
<b>Number of Breaks per Unit Length</b>	<b>86.2</b>	<b>64.9</b>
<b>Amount of Leakage per Unit Length</b>	<b>36.9</b>	<b>33.7</b>
<b>Maintenance Cost per Unit Length</b>	<b>38.9</b>	<b>55.0</b>

**Table 17: Number of Years to Repair Your City's Drinking Water Distribution Pipes**

<b>Years</b>	<b>No. of Cities</b>	<b>Percent of Cities</b>
<b>3 - 10</b>	<b>18</b>	<b>13.7</b>
<b>11 - 20</b>	<b>23</b>	<b>17.6</b>
<b>21 - 30</b>	<b>9</b>	<b>6.9</b>
<b>31 - 50</b>	<b>24</b>	<b>18.3</b>
<b>51 - 100</b>	<b>30</b>	<b>22.9</b>
<b>101 - 300</b>	<b>21</b>	<b>15.3</b>
<b>&gt; 300</b>	<b>7</b>	<b>5.3</b>
<b>Total</b>	<b>131*</b>	<b>100</b>

\* One city removed from frequency distribution as an outlier.

**Table 18: Average Annual Spending on Drinking Water Distribution System Pipe Repair/Replacement**

<b>Average Annual Spending Range (\$)</b>	<b>Percent of Cities</b>
<b>1,500 – 100,000</b>	<b>31.1</b>
<b>&gt; 100,000 – 400,000</b>	<b>19.6</b>
<b>&gt; 400,000 – 1.5 Mill</b>	<b>23.8</b>
<b>&gt; 1.5 Mill – 15 Mill</b>	<b>25.5</b>

**Table 19: Reported Miles of Wastewater Collection System Pipes**

<b>Miles of Pipe</b>	<b>No. of Cities</b>	<b>Percent of Cities</b>
<b>≤ 100</b>	<b>24</b>	<b>8.7</b>
<b>101 ≤ 200</b>	<b>72</b>	<b>26.1</b>
<b>201 ≤ 300</b>	<b>56</b>	<b>20.3</b>
<b>301 ≤ 500</b>	<b>56</b>	<b>20.3</b>
<b>501 ≤ 1,000</b>	<b>40</b>	<b>14.5</b>
<b>&gt;1,000</b>	<b>28</b>	<b>10.1</b>
<b>Total</b>	<b>276</b>	<b>100.0</b>

**Table 20: Number of Years to Repair Your City’s Wastewater Collection Pipes**

<b>Years</b>	<b>No. of Cities</b>	<b>Percent of Cities</b>
<b>2-19</b>	<b>28</b>	<b>26.2</b>
<b>20-40</b>	<b>27</b>	<b>25.2</b>
<b>50-95</b>	<b>22</b>	<b>20.6</b>
<b>100-400</b>	<b>26</b>	<b>24.3</b>
<b>500 +</b>	<b>4</b>	<b>3.7</b>
<b>Total</b>	<b>107</b>	<b>100</b>

**Table 21: Average Annual Spending on Wastewater Collection System Pipe Repair/Replacement**

<b>Average Annual Spending Range (in \$)</b>	<b>Percent of Cities</b>
<b>1,500 – 90,730</b>	<b>25</b>
<b>100,000 – 400,000</b>	<b>25</b>
<b>450,000 – 1.5 Mill</b>	<b>25</b>
<b>&gt; 1.5 Mill – 30 Mill</b>	<b>25</b>

**Table 22: What is Your City’s Preferred Buried Pipe Replacement Method**

<b>Preferred Buried Pipe Replacement Method</b>	<b>Percent of Cities</b>
<b>Open Trench</b>	<b>39.6</b>
<b>Trenchless Method</b>	<b>5.4</b>
<b>Combination (Open Trench And Trenchless Methods)</b>	<b>55.0</b>

**Table 23: Does Your City Support or Oppose a Congressional Mandate to Use Asset Management Programs**

<b>Response</b>	<b>No. of Cities</b>	<b>Percent of Cities</b>	<b>Percent of Cities*</b>
<b>Support</b>	<b>90</b>	<b>28.9</b>	<b>35.4</b>
<b>Oppose</b>	<b>149</b>	<b>47.9</b>	<b>58.7</b>
<b>No Opinion</b>	<b>57</b>	<b>18.3</b>	<b>NA</b>
<b>Don’t Know</b>	<b>15</b>	<b>4.8</b>	<b>5.9</b>
<b>Total</b>	<b>311</b>		<b>(254) **</b>

**\* If cities responding with No Opinion were not included in percentages**

**\*\* Total No. of Cities when No Opinion cities are removed**

**Table 24: Cities Favoring EPA Internet Information Repository**

<b>Response</b>	<b>No. of Cities</b>	<b>Percent of Cities</b>
<b>A Lot</b>	<b>58</b>	<b>18.6</b>
<b>A Little</b>	<b>121</b>	<b>38.8</b>
<b>Not At All</b>	<b>21</b>	<b>6.7</b>
<b>Don't Know</b>	<b>112</b>	<b>35.9</b>
<b>Total</b>	<b>312</b>	

**Table 25: Cities Favoring Free EPA Training Session**

<b>Response</b>	<b>No. of Cities</b>	<b>Percent of Cities</b>
<b>Definitely</b>	<b>167</b>	<b>53.5</b>
<b>Maybe</b>	<b>120</b>	<b>38.5</b>
<b>Not At All</b>	<b>5</b>	<b>1.6</b>
<b>Don't Know</b>	<b>20</b>	<b>6.4</b>
<b>Total</b>	<b>312</b>	

**Table 26: Has Using an Asset Management Program Helped Determine an Adequate Rate Structure**

<b>Response</b>	<b>No. of Cities</b>	<b>Percent of Cities</b>	<b>Percent of Cities*</b>
<b>Yes</b>	<b>118</b>	<b>37.9</b>	<b>62.8</b>
<b>No</b>	<b>24</b>	<b>7.7</b>	<b>12.8</b>
<b>Don't Know</b>	<b>46</b>	<b>14.8</b>	<b>24.4</b>
<b>Not Applicable</b>	<b>123</b>	<b>39.6</b>	<b>NA</b>
<b>Total</b>	<b>311</b>		<b>(188) **</b>

**\* If cities responding with Not Applicable were not included in percentages**

**\*\* Total No. of Cities when Not Applicable cities are removed**

**Table 27: Have Used Information from Asset Management Program to Educate Consumers on True Cost for the Service Levels they Desire**

<b>Response</b>	<b>No. of Cities</b>	<b>Percent of Cities</b>	<b>Percent of Cities*</b>
<b>Yes</b>	<b>88</b>	<b>28.2</b>	<b>43.8</b>
<b>No</b>	<b>101</b>	<b>32.3</b>	<b>50.2</b>
<b>Don't Know</b>	<b>12</b>	<b>3.9</b>	<b>6.0</b>
<b>Not Applicable</b>	<b>111</b>	<b>35.6</b>	<b>NA</b>
<b>Total</b>	<b>312</b>		<b>(201) **</b>

**\* If cities responding with Not Applicable were not included in percentages**

**\*\* Total No. of Cities when Not Applicable cities are removed**



## **The U.S. Conference of Mayors**

### **Mayors Water Council**

#### **The Mayors Water Council**

#### **A Task Force of The U.S. Conference of Mayors**

The MWC is open to all Mayors, and functions like a USCM task force. It provides Mayors with a forum for discussion of issues impacting how cities provide and protect water and wastewater services to the community. Some of the issues that the MWC focuses on include: watershed management; water supply planning; water infrastructure financing; rehabilitation of surface and sub-surface water infrastructure; water conservation; wetlands construction and education programs; water system program management and asset management; etc.

The MWC will continue to develop local government positions on Federal legislation, regulations and policy. The MWC acts through the USCM Environment Committee, and other Committees, as appropriate, to propose and adopt resolutions on water related matters that benefits the nation's cities.

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