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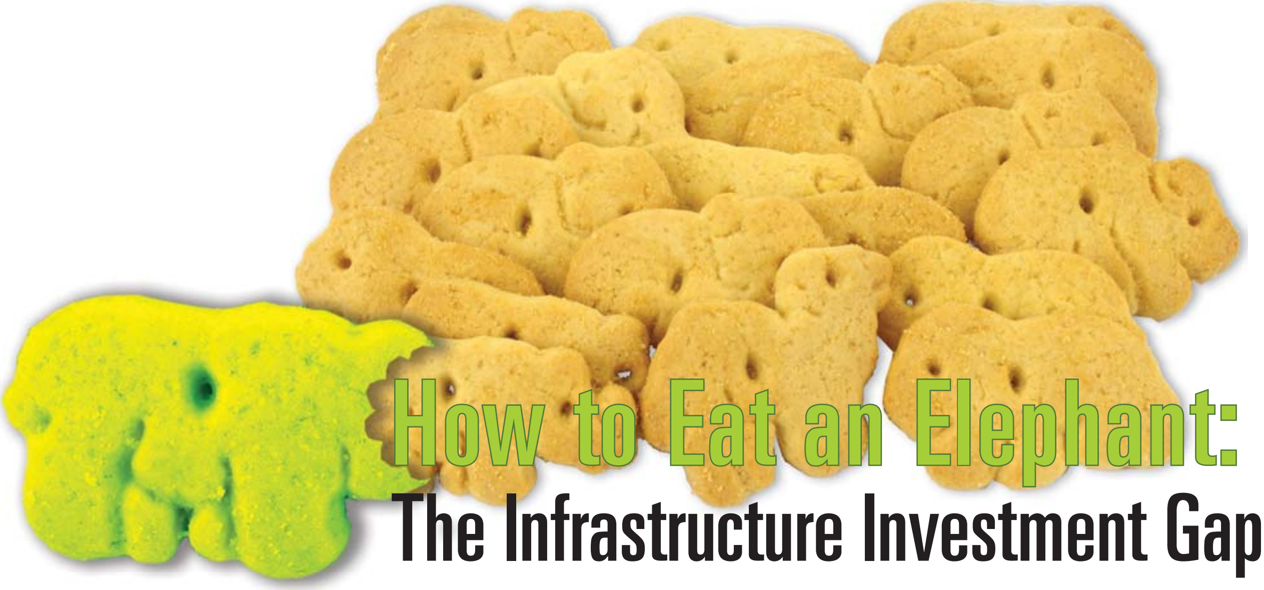

How to Eat an Elephant: The Infrastructure Investment Gap

It has taken modern society many generations to build today's water infrastructure. The older that infrastructure gets, though, the faster maintenance and replacement costs rise. Plus, if the required level of funding has not kept pace with replacement timing and costs, the gap in the necessary level of investment increases at an alarming rate.

A long-term infrastructure investment gap is like an enormous elephant standing in the path of sustainability. This "elephant" issue has been deliberated by policy-makers, but because of the sheer size and complexity of the problem, mutually agreed-on solutions have not been reached. Over the past decade, organizations with different agendas and interests have produced elaborate infrastructure studies that have estimated the potential investment gaps in public infrastructure funding. It is important to understand both the estimated gaps and the purpose of the studies, while remembering that because of all of the assumptions and the uncertainties, these projections are subject to significant variability. The intelligent approach to addressing infrastructure investment gaps is to break the issue down into manageable pieces.

INFRASTRUCTURE INVESTMENT GAP STUDIES

Starting with the global issue. The World Economic Forum's Global Risks 2010 report highlights underinvestment in critical infrastructure as one of the biggest threats facing the world today (WEF, 2010). The World Bank says global infrastructure investment needs will be $35 trillion over the next 20 years (HSNW, 2010). In the United States, the American Society of Civil Engineers (ASCE) estimates that $2.2 trillion will be needed over the next five years for public infrastructure (HSNW, 2010). A portion of this $2.2 trillion estimate includes critical water and wastewater infrastructure.

Focusing on the United States. In the United States, there are differing estimates for the 20-year need for investment in water and wastewater infrastructure. Each study follows some basic methodology, such as a "bottom-up" approach from surveys or an analysis of finance or resource costs. Most estimates target the needs gap, i.e., the investment that will be needed over and above annual spending to comply with existing conditions.

The main studies include a US Environmental Protection Agency (USEPA) needs assessment every four years, analysis from the Congressional Budget Office (CBO), the Water Infrastructure Network (WIN) report, and the Mayor's Water Council Study.

Under the 1996 Amendments to the Safe Drinking Water Act, USEPA is required to conduct an infrastructure needs assessment every four years. The purpose of this gap analysis is to estimate the funding gap between projected infrastructure needs and spending for the water industry. USEPA conducted the analysis to develop a solid foundation for understanding the magnitude of the potential funding gaps facing water systems. The analysis covers a 20-year period from 2000 to 2019 and includes estimates of the funding gap for both capital and operations and maintenance (O&M) costs. The scope of the report was limited to a discussion of the methods for calculating the capital and O&M gaps and did not address the policy implications of the results (USEPA, 2002).

USEPA has completed four reports that estimate capital investment needs that will be required for compliance with existing law over a 20-year period: the 1995 assessment set the estimate at $200.5 billion, the 1999 assessment was $198.2 billion, the 2003 assessment was $331.4 billion, and the 2007 assessment was $334.8 billion, adjusted to 2007 dollars (USEPA, 2009, 2005, 2001, 1997). The latest report, based on extrapolations from a statistically designed 2007 survey of community water systems, includes investment in pipes, plants, storage tanks, and other assets.

Another study by the CBO (2007) provides comparable high- and low-cost estimate scenarios concerning future needed investments in drinking water and wastewater infrastructure. CBO qualifies the nature of the estimates, stating ". . . the estimates are intended to represent the minimum amount that water systems must spend (given the scenario's specific assumptions) to maintain desired levels of service to customers, meet standards for water quality, and maintain and replace their assets cost effectively." The CBO estimates cover the years from 2000 to 2019 in an effort to be comparable to other organization's estimates (Anderson, 2010).

Water Infrastructure Network (WIN), a consortium of industry, municipal, and nonprofit associations, published a report (WIN, 2000) that relied on a "bottom-up" analysis of the infrastructure investment needs for the 20-year period 2000–19. The analysis benefited from the extensive practical and professional water and wastewater experience of the coalition of public and private organizations involved. The report estimated that additional capital investments (the funding gap) of $23 billion a year over current spending is necessary to comply with existing laws and expected levels of service. This figure is extrapolated to $460 billion (in nominal dollars) over the 20-year period involved and is sometimes rounded up to $500 billion (Anderson, 2010). When both capital investment needs and the cost of financing (e.g., interest paid on 30-year bonds) were considered, WIN estimated that up to $1 trillion would be needed over a 20-year period to sustain US water and wastewater systems (WIN, 2000).

The US Conference of Mayors (USCM)—Mayors Water Council report "Trends in Local Government Expenditures on Public Water and Wastewater Services and Infrastructure: Past, Present and Future" was presented this year in Washington, D.C. (Anderson, 2010). The purpose of the report is to examine trends in local government spending on public water and wastewater services and infrastructure to determine the level of resources devoted to these functions and to project what the likely spending requirements will be over the next 20 years (i.e., 2009 to 2028). The report also reviews how various federal government agencies provide financial assistance for public water and wastewater systems and suggests some broad goals for renewing the intergovernmental commitment to sustainable water and wastewater services and infrastructure. The goal of the report is to create a national action agenda to petition Congress for additional funding.

One of the main areas in which this report differs from other studies is that it includes new infrastructure costs required for growth over the next 20 years versus just the replacement of existing infrastructure and costs associated with meeting regulatory requirements. The USCM report has projected that spending by local governments on public water and wastewater from 2009 to 2028 will fall in the range of $2.5 trillion to $4.3 trillion. (The mid-range estimate is $3.3 trillion.) These projections do not include the $500 billion over 20 years ($25 billion/year) associated with the needs gap from the USEPA. The overall projections increase across the board to spending ranges of $4.8 trillion (high), $3.8 trillion (mid-range), and $3 trillion (low; Anderson, 2010).

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HOW TO EAT AN ELEPHANT

These estimates are overwhelming when tallied at the global or even national level and, as a result, decision-makers at all levels of government hesitate to tackle the issue of infrastructure funding. To address the complex nature of the problem, we could apply the African proverb that asks: How does one eat an elephant? The well-known answer is "One bite at a time." This means the best way to solve the problem is to break it down and solve it bit by bit. Investment gaps, therefore, need to be estimated at national, state, regional, and local levels.

Investment gaps will occur in different communities across the United States. The main hot spots for water and wastewater infrastructure failures will be in the industrialized population growth centers established after World War II. Each community will have a different investment gap based on the current condition of the infrastructure and the historical amount of investment already made.

Identification of physical assets is needed. The number of assets in the national network is tremendous. There are approximately 155,000 public drinking water systems in the United States, with only 52,000 community water systems and another 21,400 noncommunity water systems as the main providers for the majority of Americans (USEPA, 2008). Community water systems include more than 1.8 million miles of network pipes (USEPA, 2002). The nationwide system of wastewater infrastructure includes 16,000 publicly owned wastewater treatment plants, 100,000 major pumping stations, 600,000 miles of sanitary sewers, and 200,000 miles of storm sewers (Anderson, 2010). Although there is not an actual inventory of the total amount of pipe associated with wastewater collection systems in the United States, ASCE has estimated that there are 21 feet of sewer pipe per person (ASCE, 1999).

States need to understand the risks of failure as a requirement of good public policy. States and local governments must identify and inventory their critical assets and perform condition assessments to determine the risks of failure. Unless the United States undertakes a concerted effort to replace and repair infrastructure during the next two decades, studies (Barkin, 2009) predict more pipe breaks and water shortages and a return to the pollution levels seen before enactment of the Clean Water Act in 1972—when rivers were catching fire and swimming holes were closed because of excessive bacteria. Without these investments, experts foresee a future of ruptured pipes and sinkholes, tainted drinking water, and sewage-saturated rivers and lakes (Barkin, 2009).

If a utility chooses to ignore the infrastructure problem or continues to defer capital replacement projects to avoid basic rate increases, the investment gap will rise significantly, and the costs of the projects will increase, creating a larger future liability for ratepayers. Establishing a multiyear condition-assessment program as part of the capital plan budget and methodically and annually conducting condition analysis are the only ways an organization can understand its risks and adjust its capital replacement plans cost-effectively. Remember, a needs assessment is different from a condition assessment. The condition assessment is critical to knowing what the risks are and making a strategic investment to actually reduce the identified risks.

For example, the Colorado section of ASCE conducted the first Colorado Infrastructure Report Card in 2003 and updated it in 2008, making projections to 2010 for both drinking water and wastewater treatment. Colorado has 2,084 public water systems serving 4.1 million people (ASCE, 2008). In Colorado, $4.3 billion in projects have been identified as part of the funding gap.

Across New York state there are more than 600 wastewater treatment facilities that serve 1,610 municipalities. The facilities range in size from New York City's vast system that processes 1.3 mgd of wastewater through 14 facilities to small village systems that process less than 100,000 gpd. These facilities provide wastewater treatment for more than 15 million people across the state. The conservative cost estimate of repairing, replacing, and updating New York's municipal wastewater infrastructure is $36.2 billion over the next 20 years (NYSDEC, 2008).

The critical need is at the local level. All of the national- and state-level studies are based on survey sampling and extrapolated projections from many data sources. Breaking the issue down into smaller parts at the local level identifies the true gaps and risks. If a water main breaks, it affects the services provided to the homes and businesses on that street, and the ratepayers from the community's utility will pay all of the costs. These smaller parts are more controllable—and therefore solvable—with known costs, benefits, and impacts. The accuracy of any of the gap estimates will only be improved as local communities conduct individual need assessments. The first level of analysis will include useful-life data based on asset and accounting depreciation schedules.

The second level of analysis is demonstrated in "Dawn of the Replacement Era" (AWWA, 2001), which contains 20 water utility infrastructure expenditure curves in the appendix. The studies include a forecast of water main and other asset repair and replacement expenditure requirements based on how those assets wear out over the course of their economic life. The curves do not take into account new assets to support growth or future regulatory changes. This type of work demonstrates the minimum amount of effort each utility needs to expend.

The third level of analysis is where the rubber really meets the road, and the curves are updated based on real data obtained from conducting a condition assessment. At this point, budgeting for and implementing a condition assessment program sets a utility on a better path. By budgeting each year for an ongoing condition assessment program, priority repair work can be planned for in advance of any pressing need caused by failure of a pipeline. This shifts the focus to controlling risks versus crisis management. It is much more cost-effective (in both political dollars and real dollars) to repair pipes with the highest risk of failure on a schedule instead of reacting to an emergency situation (Baird, 2010)

Pipes represent the largest replacement costs. Physical assets can be further broken down into asset classes or categories. In every assessment conducted to date, transmission and distribution projects have represented the largest category of need (i.e., 60%) of repair and replacement costs. This result is consistent with the fact that transmission and distribution mains account for most of the drinking water infrastructure in the United States. The other categories include treatment, storage, source of supply, and miscellaneous.

The underground infrastructure was constructed in three main time periods because of population growth in the 1800s, 1900–45, and post-1945. Pipes constructed in each of these three eras will all start to fail at nearly the same time over the next couple of decades for a number of reasons that range from age, weather, inadequate design, soil condition, and poor installation. Additionally, the lifespan of the materials used has become shorter with each new investment cycle (WIN, 2002). Focusing on this major asset class first creates an early win for ratepayers by reducing the risk of water infrastructure failure and by better allocating the investment of capital to replace only what needs to be replaced (i.e., the right pipe at the right time.)

FINDING THE SOLUTION

New studies will continue to add to the already growing estimates of the infrastructure investment gap by including the costs of climate change and the preservation of all natural waterways and other related resources. All of these studies will be used as petitions to request federal and state government funding. A second African proverb can be applied here: A roaring lion kills no game. An organization cannot gain anything by sitting around talking. Each of us must find the right motivation and do our part to work toward a solution. Self-reliance is still an American value. The first place of accountability is ultimately at the local level where the benefit of water and wastewater service is received. At the local level, each community is empowered with the ability to increase funding to address the local infrastructure investment gap. A "fix" at any other level produces a redistribution of not only wealth (rates and taxes), but also of accountability and responsibility. The CBO communicated to Congress that "society as a whole pays for 100 percent of the costs of water services, whether through ratepayers' bills or through federal, state, or local taxes." Federal subsidies are merely redistributive tools that allow government to intervene in the market to shift the burden of water costs from some households to others (CBO, 2002).

Setting of rates and fees for adequate revenue recovery for both operational costs and capital costs falls first to the local governing authority. As the local authority assumes this attitude of responsibility, additional steps will be taken to understand and reduce the overall costs. These additional steps, like the bite-size pieces of an elephant, are manageable tasks and include offering ratepayer outreach and education, completing cost-of-service analyses, inventorying critical assets, conducting ongoing condition assessments, and updating capital improvement plans.

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Journal AWWA welcomes comments and feedback at journal@awwa.org.

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